Installation Technical Manual

Technical data

MIQ System

Version 1.2 I 11.2016

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.

Data version 1.2 I Date 11.2016

Content and overview of this manual

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

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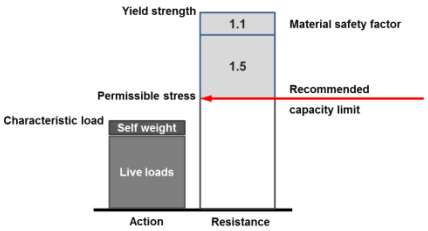
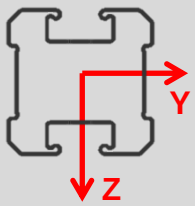
MIQ System - Girders (Channels)

Designation	Item number
MIQ-90-3m	**2119866**
MIQ-90-6m	**2119867**



Technical data			**MIQ-90**
For girder MI / cross section including torsion			
Cross-sectional area	A	[mm²]	1093.51
Channel weight		[kg/m]	8.58
Wall thickness		[mm]	2.5
Material			
yield strength	$f_{y,k}$	[N/mm²]	275
permissible stress*	σ_{rec}	[N/mm²]	178.6
E-module		[N/mm²]	210000
Shear-modulus		[N/mm²]	81000
Surface			
hot dip galvanized		[µm]	65
Cross-section values Y-axis			
Axis of gravity A	e_1	[mm]	45
Axis of gravity B	e_2	[mm]	45
moment of inertia	I_y	[cm⁴]	121.65
Section modulus A	W_{y1}	[cm³]	27.03
Section modulus B	W_{y2}	[cm³]	27.03
Radius of gyration	i_y	[cm]	3.34
Permissible moment	M_y	[Nm]	4.83
Cross-section values Z-axis			
moment of inertia	I_z	[cm⁴]	101.29
Section modulus	W_z	[cm³]	22.51
Radius of gyration	i_z	[cm]	3.04
Data to the torsion			
torsional moment of inertia	It	[mm⁴]	54.35
torsional section modulus	W_t	[mm³]	9.1

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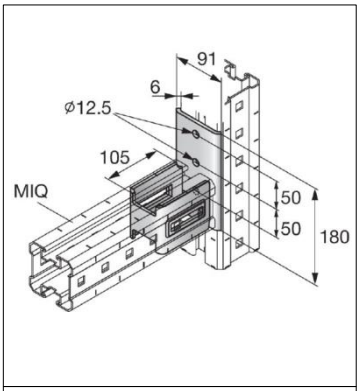
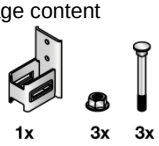
MIQC-90-HS angle connector

Designation	Item number
MIQC-90-HS	**2123880**



Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

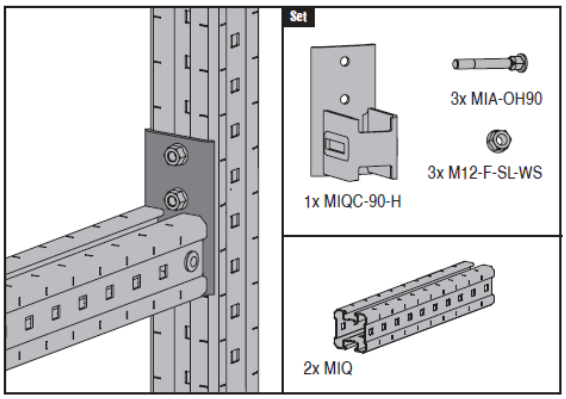
Weight:
1457.1g connector (1802g incl. accessories)

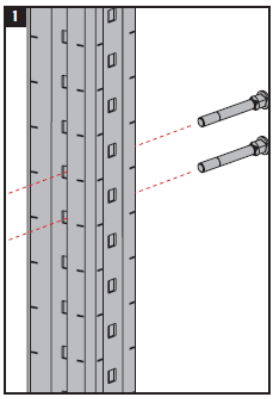
Submittal text:
Hilti angle, 90°, MIQ system, MIQC-90-HS, Hot dipped galvanized , angle typically used for connection of two perpendicular Hilti MIQ girders, angle connector with two hole base plate fitted for connection on surface of other MIQ girder through bolted by two MIA-OH 90 (included in the pack) from back side of the girder and secured by two self locking nuts. The connected girder is stuck on connectivity part of the angle and through bolted by 3 pieces of MIA-OH and self locking nut in the first hole closest to the end of the girder, material weight 1802 grams incl. all connectivity material.

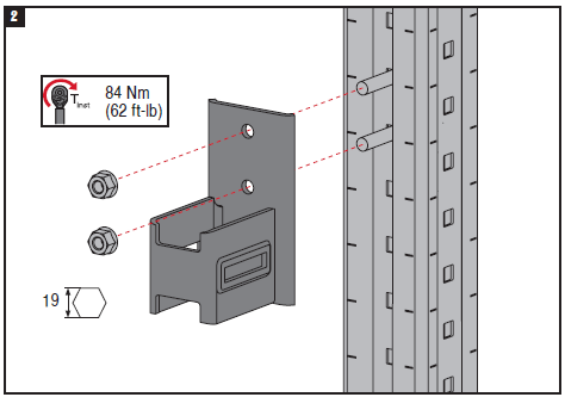
Material properties:

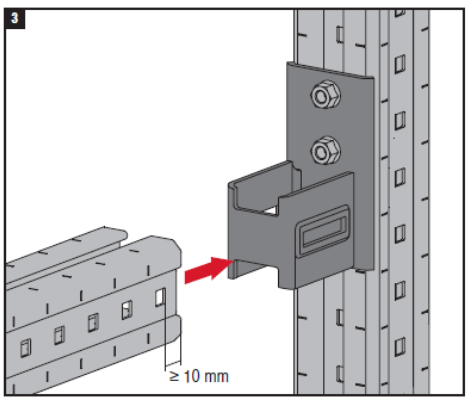
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

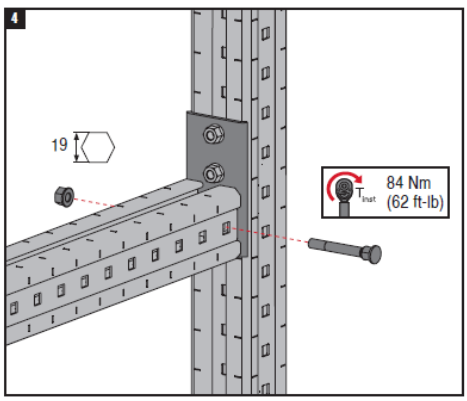
Instruction For Use:

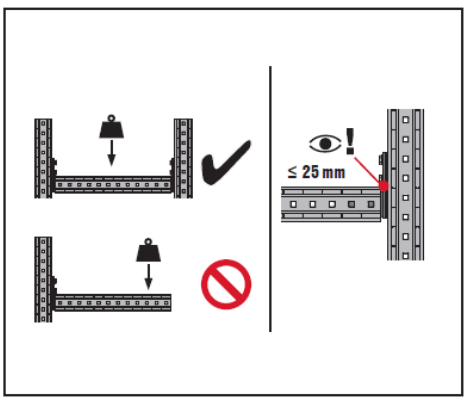












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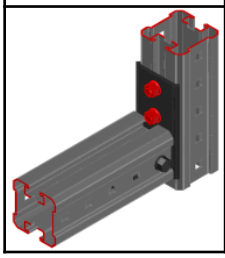
MIQC-90-HS angle connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

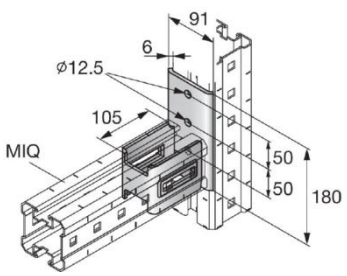
Standards and codes:

• 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:



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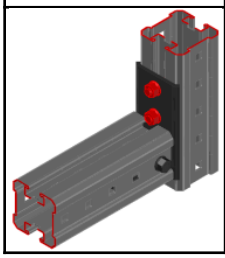
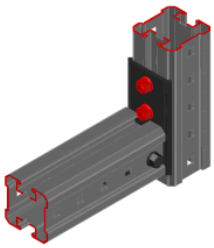
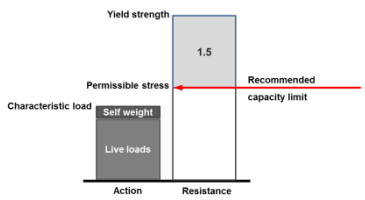
MIQC-90-HS angle connector

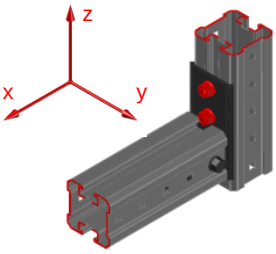
Standard		
		

Loading case: Standard	Combinations covered by loading case
BOM: Angle incl. all connectivity material **1x MIQC-90-HS** **2123880**	Connector used for fixing H-MIQ girder on grooved section of V-MIQ girder 

Recommended loading capacity - simplified for most common applications

Method



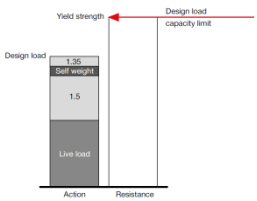


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
0.7	5.4	+10.2 -18.7

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

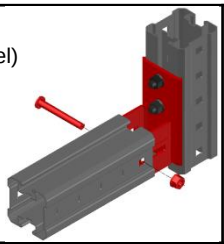
Design loading capacity - 3D 1/2

Method

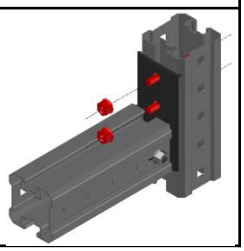


Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-90-H
(taken into account bolt on horizontal channel)



2. 2x Bolt MIA-OH90 on vertical channel



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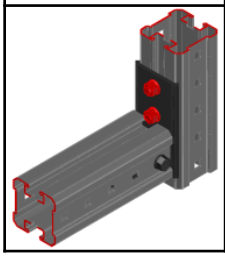
MIQC-90-HS angle connector

Conditions of the loading capacity tables:

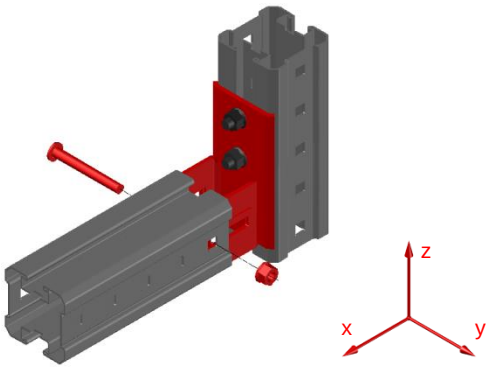
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

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. Steel connector MIQC-90-H (taken into account bolt on horizontal channel and welds)

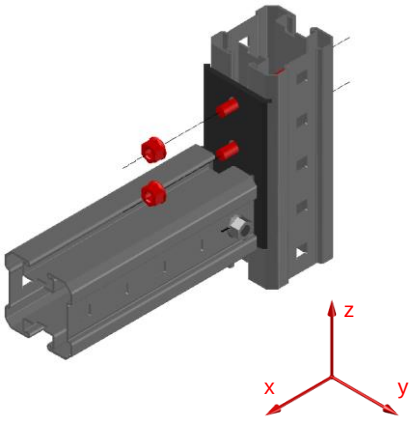


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.06	1.06	8.12	8.12	15.36	33.38
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.10	1.10	1.57	0.24	0.27	0.27

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. 2x Bolt MIA-OH90 on vertical channel (NOTE: interaction is not necessary)



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
*	*	*	*	28.0	28.0
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.55	0.55	*	*	*	*

* not decisive

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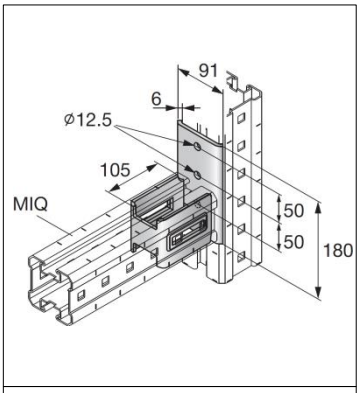
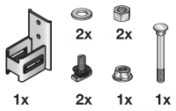
MIQC-90-HT angle connector

Designation	Item number
MIQC-90-HT angle connector	**2123881**



Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

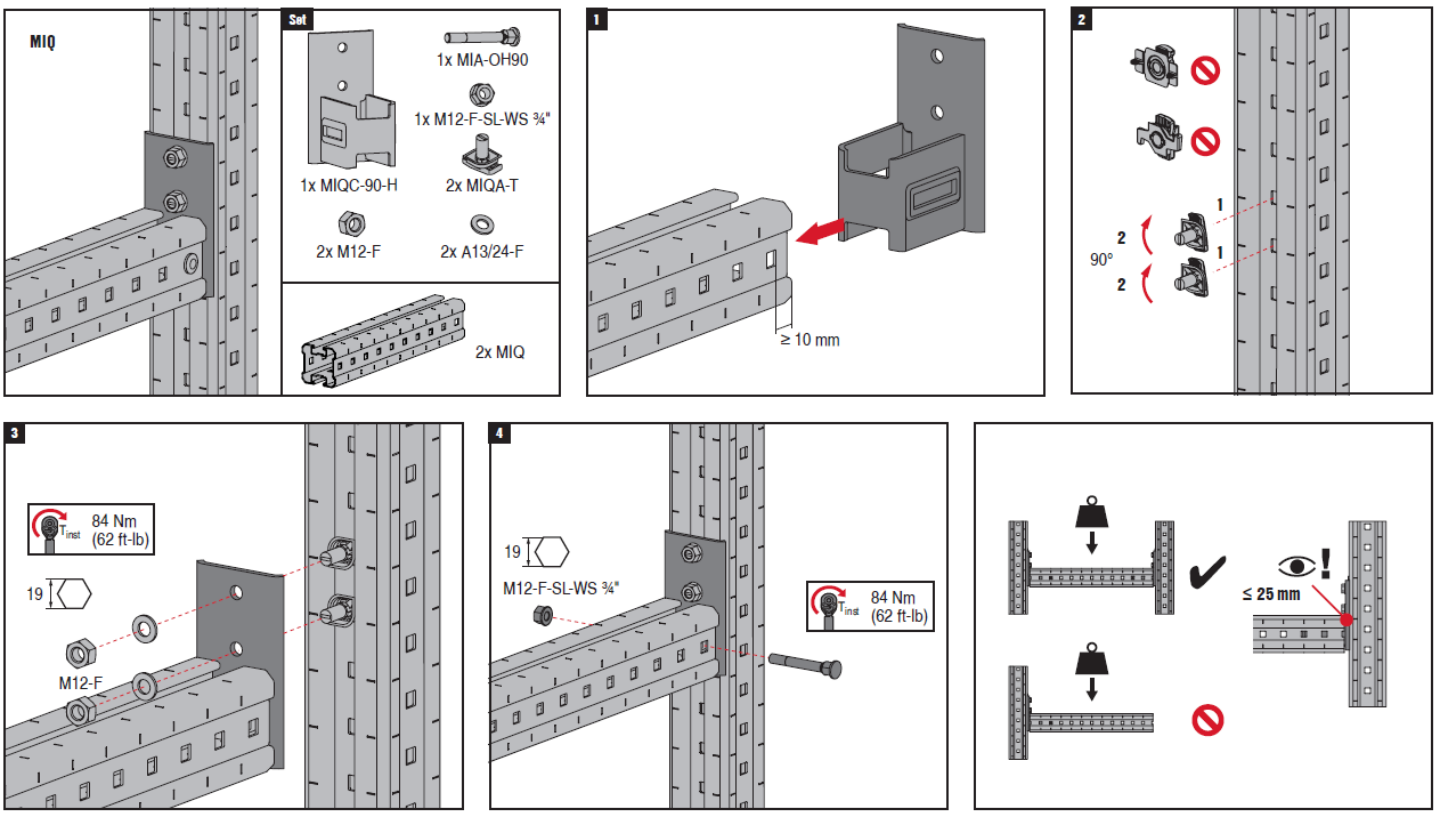
Weight:
1457.1g connector (1732g incl. accessories)

Submittal text:
Hilti angle, 90°, MIQ system, MIQC-90-HT, hot dipped galvanized, angle typically used for connection of two perpendicular Hilti MIQ girders, angle connector with two hole base plate fitted for connection in groove of other MIQ girder with two t-bolts and self locking nuts (both included in the pack). The connected girder is slid onto connection interface of the angle and through bolted by 1 piece of MIA-OH and self locking nut (both included in the pack) in the first hole closest to the end of the gir der, material weight 1732 grams incl. all connectivity material.

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:



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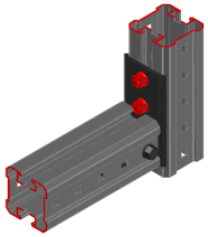
MIQC-90-HT angle connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

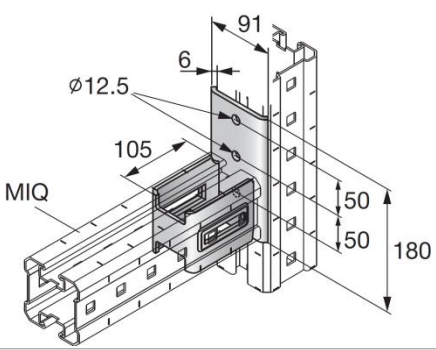
Standards and codes:

• 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:



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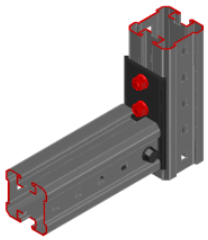
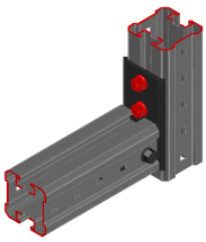
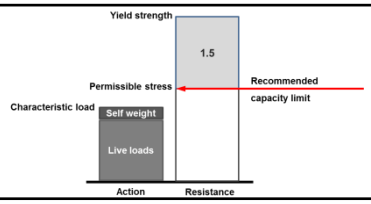
MIQC-90-HT angle connector

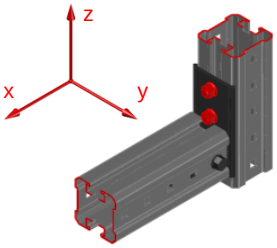
Possible loading cases		
Standard		
		

Loading case: Standard	Combinations covered by loading case
BOM: Angle incl. all connectivity material **1x MIQC-90-HT** **2123881**	Connector used for fixing H-MIQ girder on grooved section of V-MIQ girder 

Recommended loading capacity - simplified for most common applications

Method



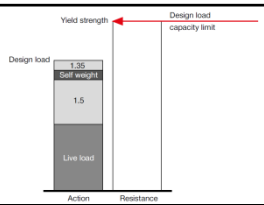


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
0.7	5.4	-12.4 +10.2

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

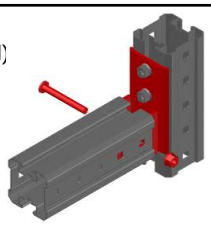
Design loading capacity - 3D 1/2

Method

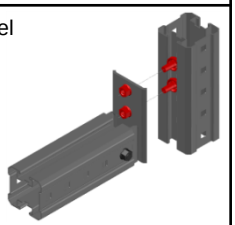


Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-90-H
(taken into account bolt on horizontal channel)



2. HT set with 2x MIQA-T on vertical channel

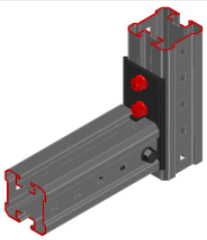


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-HT angle connector

Conditions of the loading capacity tables:

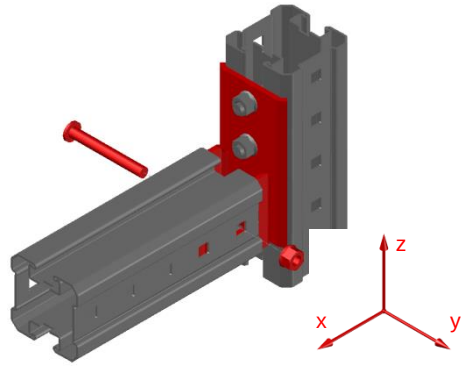
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

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 MIQC-90-H (taken into account bolt on horizontal channel and welds)

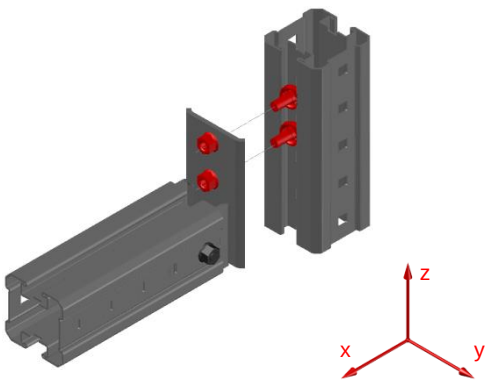


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.06	1.06	8.12	8.12	15.36	33.38
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.10	1.10	1.57	0.24	0.27	0.27

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. HT set with 2x MIQA-T on vertical channel (NOTE: interaction is not necessary)

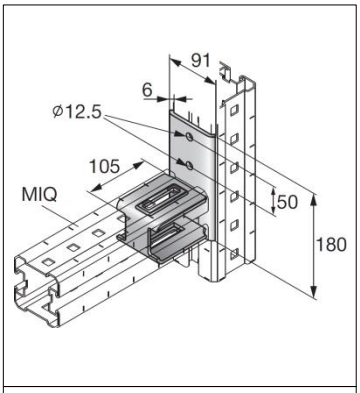


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
*	*	*	*	18.58	18.58
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
*	*	*	*	*	*

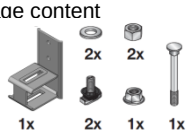
Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-HT-V angle connector

Designation	Item number
MIQC-90-HT-V angle connector	**2134818**



Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

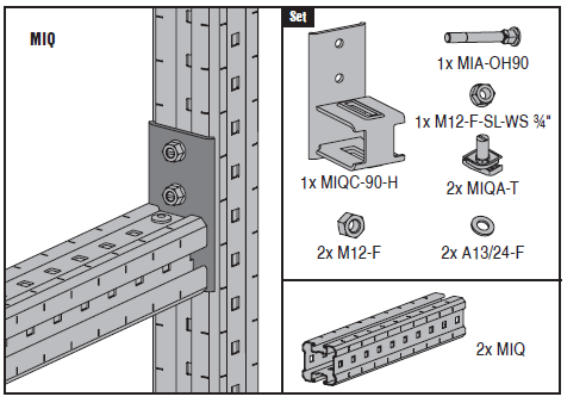
Weight:
1730g

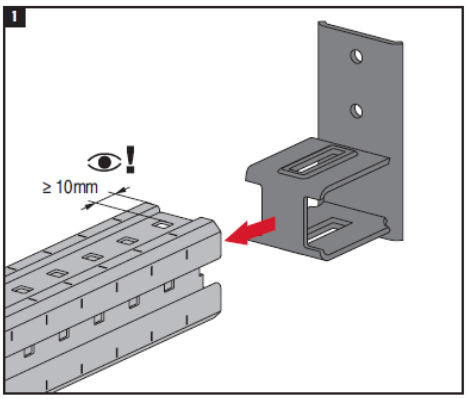
Submittal text:
Hilti angle, 90°, MIQ system, MIQC-90-HT-V, hot dipped galvanized, angle typically used for connection of two perpendicular Hilti MIQ girders, angle connector with two hole base plate fitted for connection in groove of other MIQ girder with two t-bolts and self locking nuts (both included in the pack). The connected girder is slid onto connection interface of the angle and through bolted by 1 piece of MIA-OH and self locking nut (both included in the pack) in the first hole closest to the end of the girder, material weight 1732 grams incl. all connectivity material.

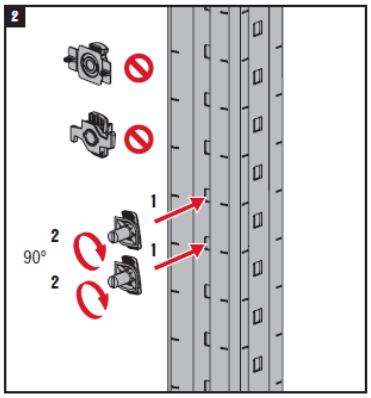
Material properties:

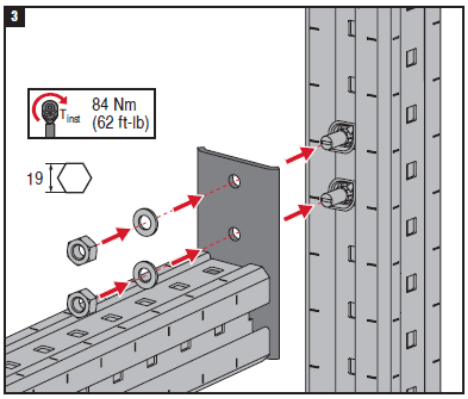
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

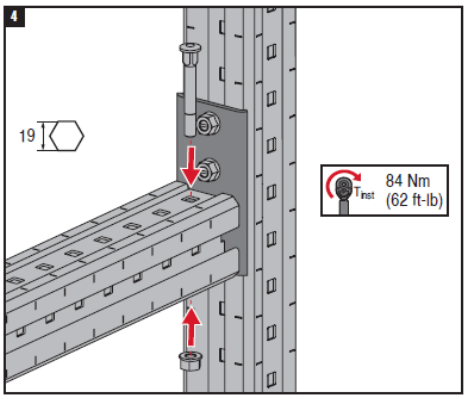
Instruction For Use:

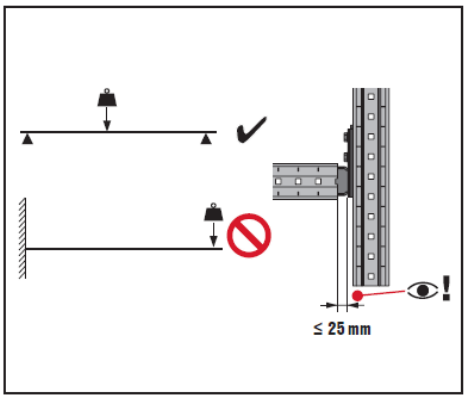






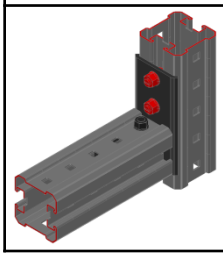






Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-HT-V angle connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

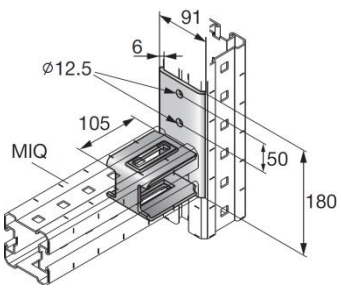
Standards and codes:

• 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

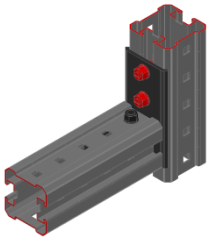
Environmental conditions:
- static loads
- no fatigue loads

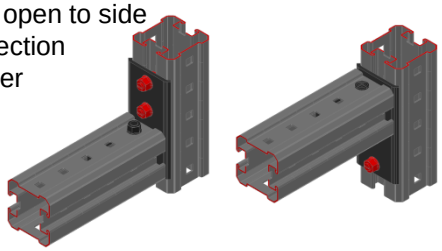
Simplified drawing:



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

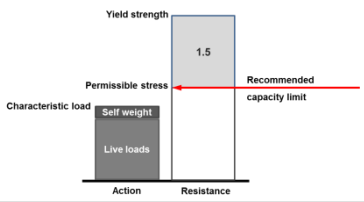
MIQC-90-HT-V angle connector

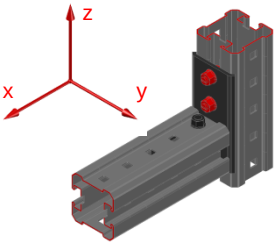
Standard		
		

Loading case: Standard	Combinations covered by loading case
BOM: Angle incl. all connectivity material **MIQC-90-HT-V** **2134818**	Connector used for fixing H-MIQ girder open to side on grooved section of V-MIQ girder 

Recommended loading capacity - simplified for most common applications

Method



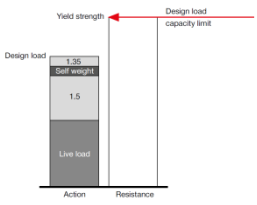


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
0.7	5.5	5.4

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

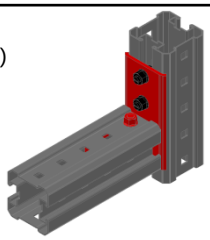
Design loading capacity - 3D 1/2

Method

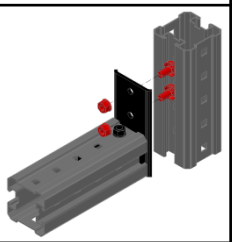


Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-90-HT-V
(taken into account bolt on horizontal channel)



2. set with 2x MIQA-T on vertical channel

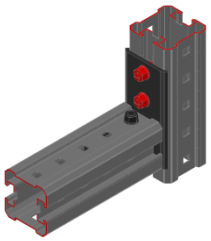


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-HT-V angle connector

Conditions of the loading capacity tables:

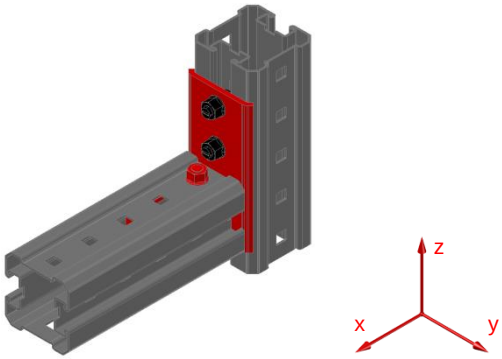
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

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. Steel connector MIQC-90-HT-V (taken into account bolt on horizontal channel)

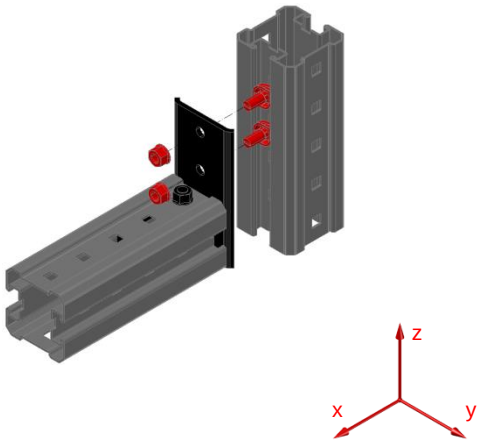


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.06	1.06	8.25	8.25	8.13	8.13
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.10	1.10	0.22	0.12	0.24	0.24

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. Set with 2x MIQA-T on vertical channel (NOTE: interaction is not necessary)



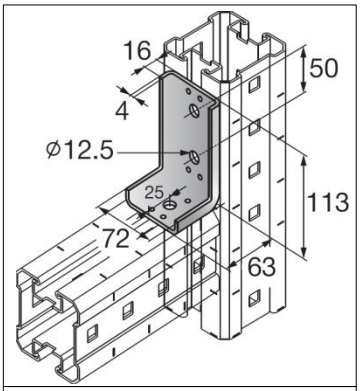
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
*	*	*	*	18.58	18.58
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
*	*	*	*	*	*

* not decisive

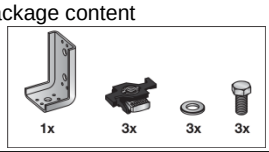
Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-L angle connector

Designation	Item number
MIQC-90-L angle connector	**2119868**



Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

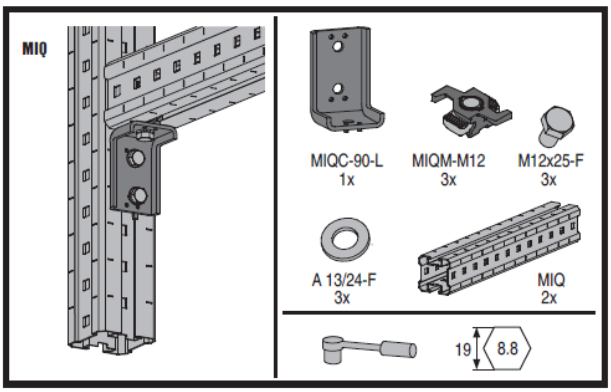
Weight:
450g connector (648g incl. accessories)

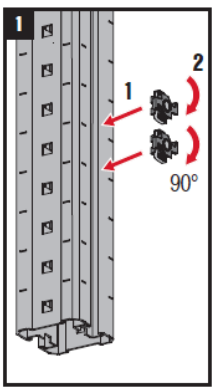
Submittal text:
Hilti angle, 90°, MIQ system, MIQC-90-L, Hot dipped galvanized, angle typically used for connection of two perpendicular Hilti MIQ girders, angle connector with two hole base plate fitted for connection in groove of other MIQ girder with two wing nuts, washers and self locking nuts (both included in the pack) on one side and with one hole fixed the same way on the other side, material weight 648 grams incl. all connectivity material.

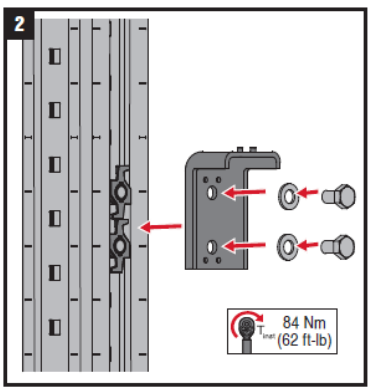
Material properties:

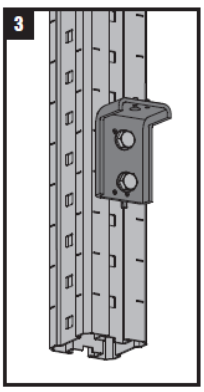
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

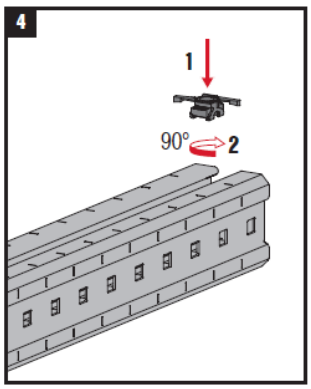
Instruction For Use:

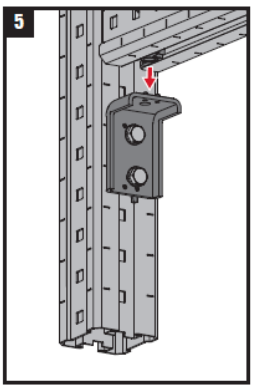


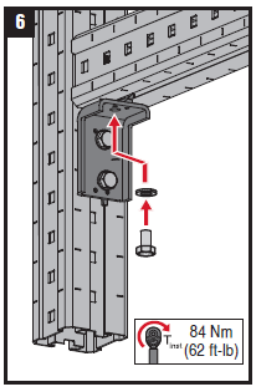


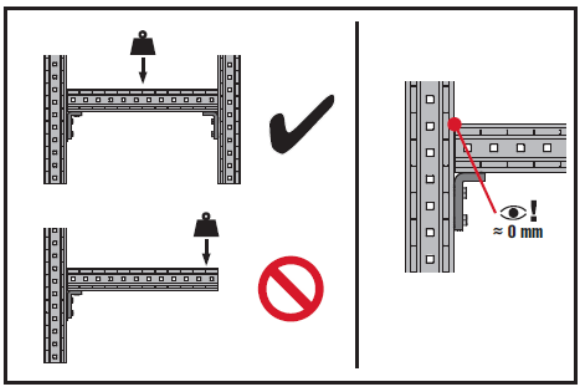






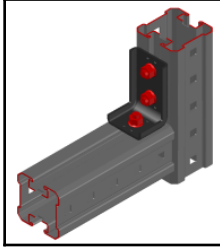






Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-L angle connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

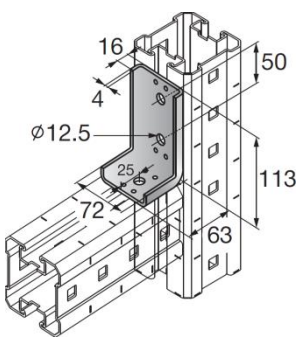
Standards and codes:

• 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

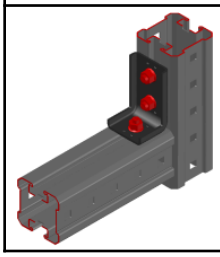
Software:
- Ansys 16.0
- Microsoft Excel

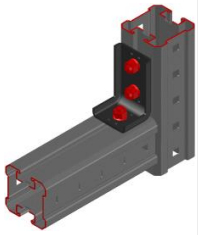
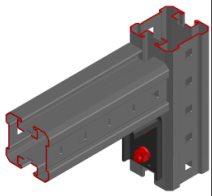
Environmental conditions:
- static loads
- no fatigue loads

Simplified drawing:



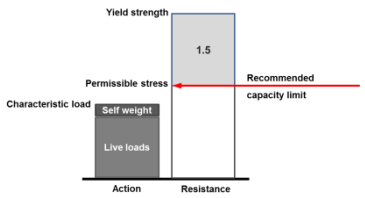
MIQC-90-L angle connector

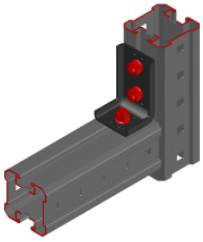
Possible loading cases		
Standard		
		

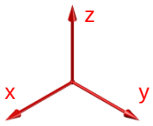
Loading case: Standard	Combinations covered by loading case	
BOM: Angle incl. all connectivity material **1x MIQC-90-L** **2119868**	Connector used for fixing H-MIQ girder on grooved section of V-MIQ girder from top 	Connector used for fixing H-MIQ girder on grooved section of V-MIQ girder from bottom 

Recommended loading capacity - simplified for most common applications

Method





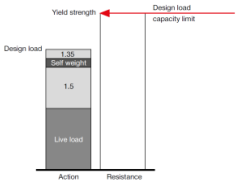


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
3.5	3.5	6.2

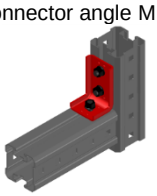
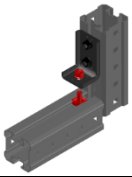
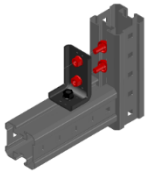
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

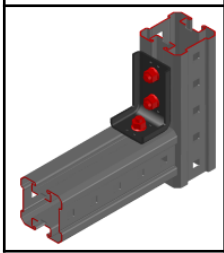
1. Steel connector angle MIQC-90-L	2. Wing nut on horizontal channel	3. Wing nuts on vertical channel
		

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

MIQC-90-L angle connector

Conditions of the loading capacity tables:

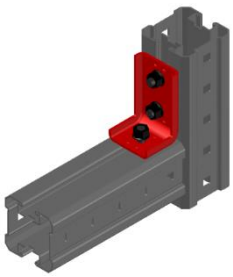
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

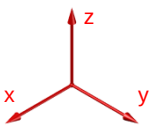
Possible loading cases		
Standard		
		

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 angle MIQC-90-L



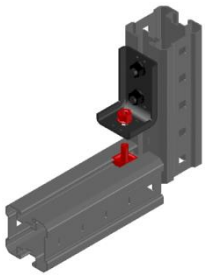


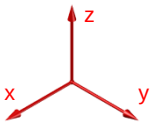
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
10.72	14.85	5.75	5.75	14.07	9.32
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.3	0.3	0.19	0.18	0.08	0.08

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. Wing nut on horizontal channel (Note: Interaction is not necessary.)

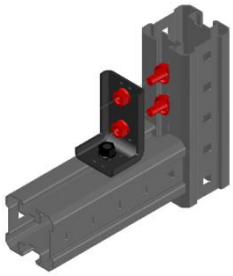




+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
5.21	5.21	5.20	5.20	*	12.89
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
*	*	*	*	*	*

* not decisive

3. Wing nuts on vertical channel (Note: Interaction is not necessary.)



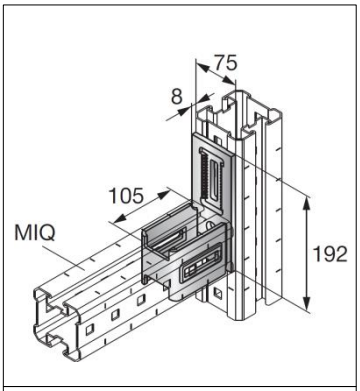
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
6.52	*	*	*	9.93	9.93
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
*	*	*	*	*	*

* not decisive

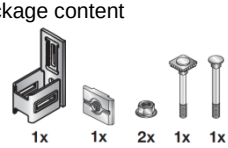
Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-MI angle connector

Designation	Item number
MIQC-90-MI angle connector	**2140257**



Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

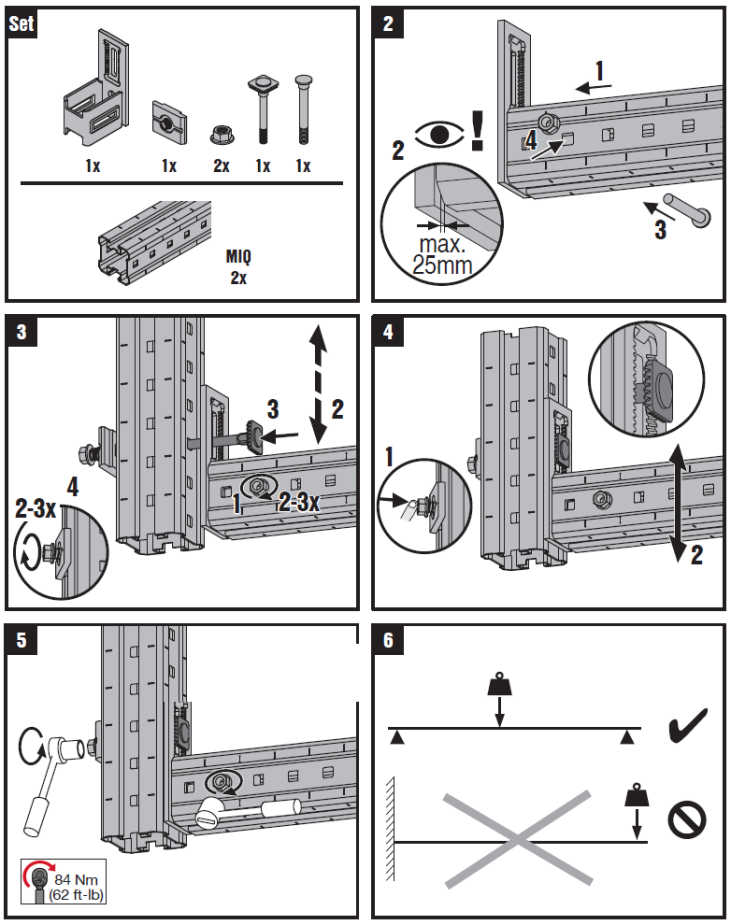
Weight:
2060 g

Submittal text:
Hilti angle, 90°, MIQ system, MIQC-90-MI, Hot dipped galvanized, angle typically used for connection of one MIQ and one MI perpendicular girders, angle connector with oblong serrated holed base plate fitted for connection on MI girder with MIA-EH easy hand screw, back plate and self locking nut (all included in the pack) on one side and the other side of the angle is shaped to accommodate MIQ girder,
material weight 2060 grams incl. all connectivity material.

Material properties:

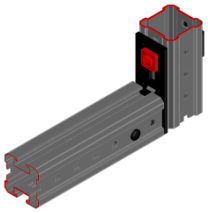
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:



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

MIQC-90-MI angle connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

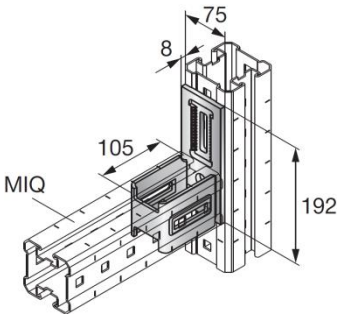
Standards and codes:

• 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
- Mathcad 15

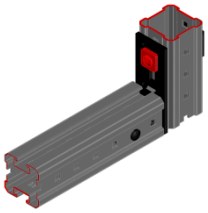
Environmental conditions:
- static loads
- no fatigue loads

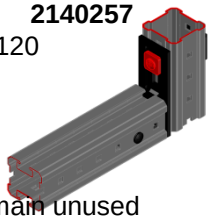
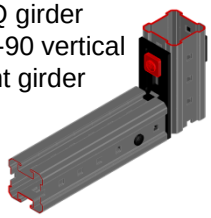
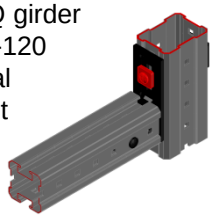
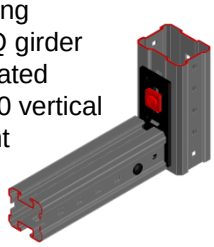
Simplified drawing:



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

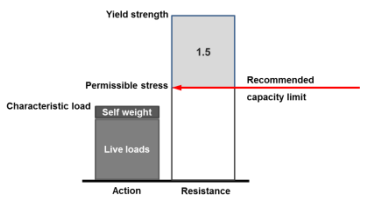
MIQC-90-MI angle connector

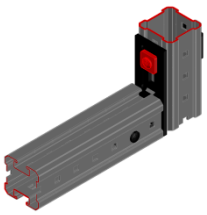
Possible loading cases		
Standard		
		

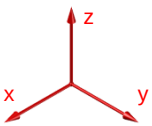
Loading case: Standard	Combinations covered by loading case		
BOM: Angle incl. all connectivity material **1x MIQC-90-MI 2140257** For fixation on MI-120 **1x MIQC-90-MI 2140257** **1x MIA-EH120 304888** The MIA-EH90 remain unused 	Connector used for fixing H-MIQ girder on MI-90 vertical upright girder 	Connector used for fixing H-MIQ girder on MI-120 vertical upright girder 	Connector used for fixing H-MIQ girder on rotated MI-120 vertical upright girder 

Recommended loading capacity - simplified for most common applications

Method







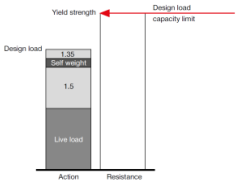
±Fx,rec. [kN]	±Fy,rec. [kN]	+Fz,rec. [kN]
0.7	5.0	10.2

−Fz,rec. [kN]
12.0

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

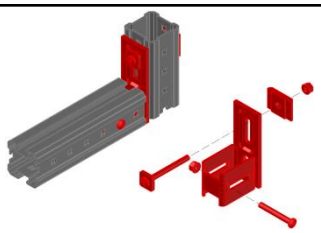
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

1. Steel connector angle MIQC-90-MI incl. bolts, welds

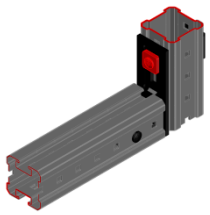


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-MI angle connector

Conditions of the loading capacity tables:

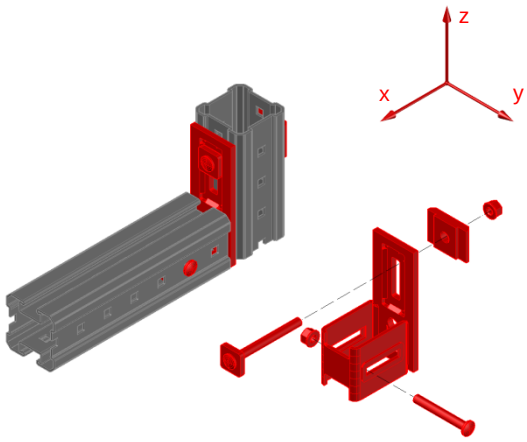
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

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 angle MIQC-90-MI incl. bolts, welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.06	1.06	7.50	7.50	15.30	18.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.90	0.90	0.00	0.00	0.00	0.00

Interaction:

Interaction for +Fz if FyEd ≤ 0.6 kN and Mx ≤ 0.07 kNm :

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{y,Ed}}{F_{y,Rd}} + \frac{F_{z,Ed}}{F_{z,Rd}} + \frac{M_{xEd}}{M_{xRd}} \le 1$$

Interaction for +Fz if FyEd > 0.6 kN and Mx > 0.07 kNm:

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{y,Ed}}{F_{y,Rd}} + \frac{F_{z,Ed}}{\frac{F_{z,Rd}}{1.672}} + \frac{M_{xEd}}{M_{xRd}} \le 1$$

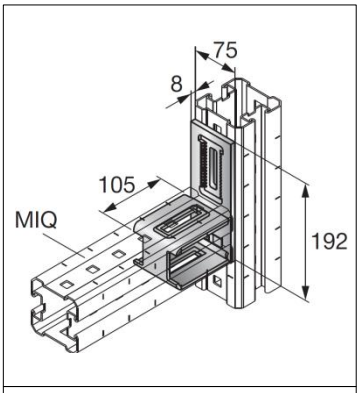
Interaction for -Fz:

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{y,Ed}}{F_{y,Rd}} + \frac{\left|-F_{z,Ed}\right|}{\left|-F_{z,Rd}\right|} + \frac{M_{xEd}}{M_{xRd}} \le 1$$

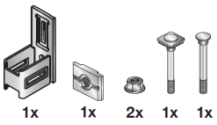
Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-MI-V angle connector

Designation	Item number
MIQC-90-MI-V angle connector	**2140258**



Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

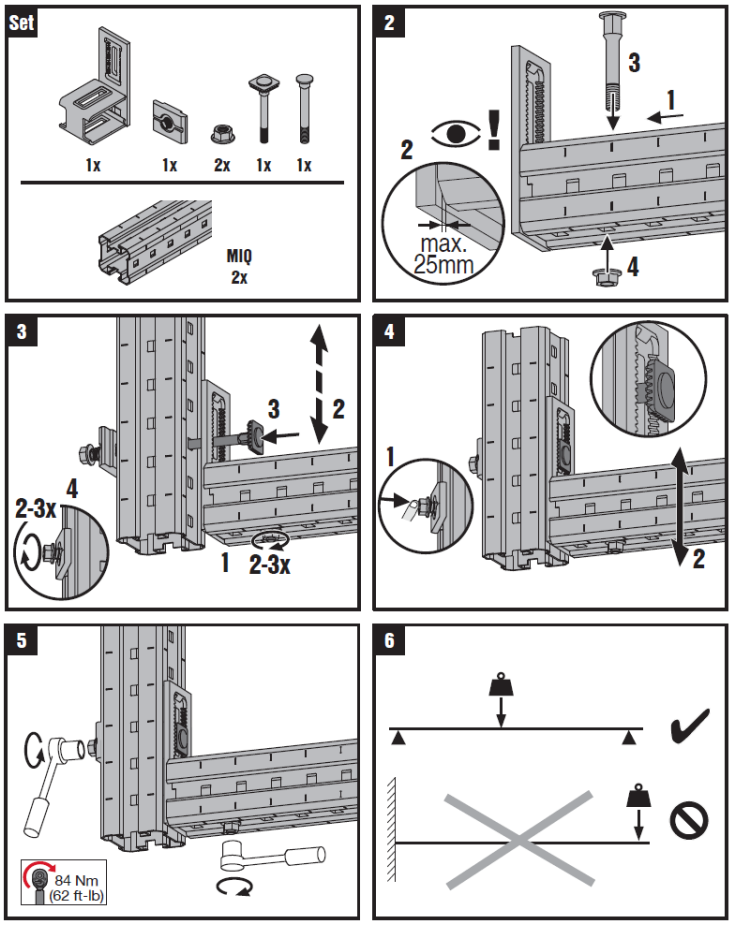
Weight:
2060 g

Submittal text:
Hilti angle, 90°, MIQ system, MIQC-90-MI-V, Hot dipped galvanized, angle typically used for connection of one MIQ and one MI perpendicular girders, angle connector with oblong serrated holed base plate fitted for connection on MI girder with MIA-EH easy hand screw, back plate and self locking nut (all included in the pack) on one side and the other side of the angle is shaped to accommodate rotated MIQ girder, material weight 2060 grams incl. all connectivity material.

Material properties:

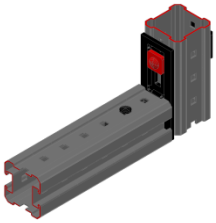
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:



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

MIQC-90-MI-V angle connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

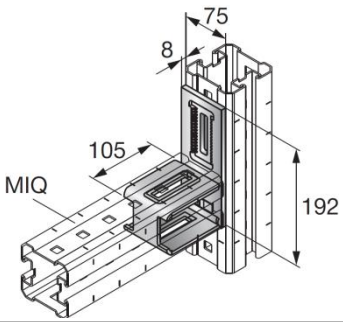
Standards and codes:

• 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
- Mathcad 15

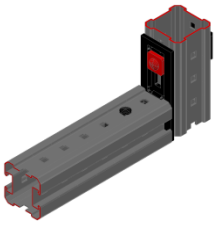
Environmental conditions:
- static loads
- no fatigue loads

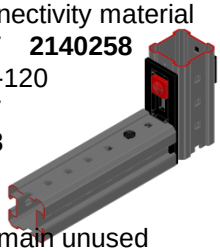
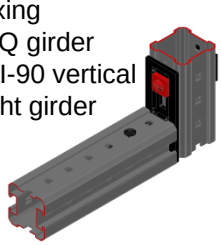
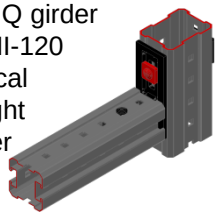
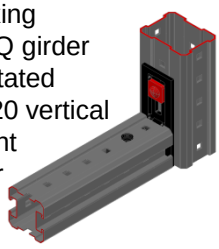
Simplified drawing:



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

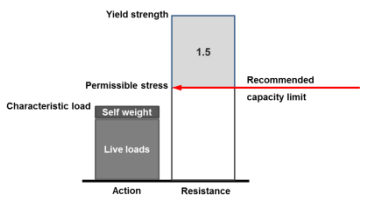
MIQC-90-MI-V angle connector

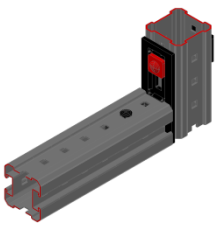
Possible loading cases		
Standard		
		

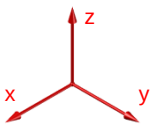
Loading case: Standard	Combinations covered by loading case		
BOM: Angle incl. all connectivity material **1x MIQC-90-MI-V 2140258** For fixation on MI-120 **1x MIQC-90-MI-V 2140258** **1x MIA-EH120 304888** The MIA-EH90 remain unused 	Connector used for fixing H-MIQ girder on MI-90 vertical upright girder 	Connector used for fixing H-MIQ girder on MI-120 vertical upright girder 	Connector used for fixing H-MIQ girder on rotated MI-120 vertical upright girder 

Recommended loading capacity - simplified for most common applications

Method





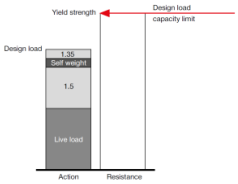


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
0.70	9.00	5.40

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

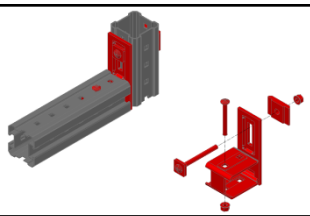
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

1. Steel connector angle MIQC-90-MI-V incl. bolts, welds

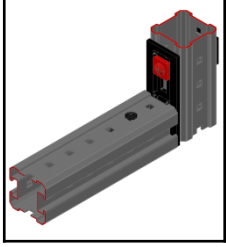


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-MI-V angle connector

Conditions of the loading capacity tables:

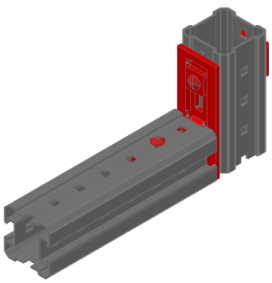
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

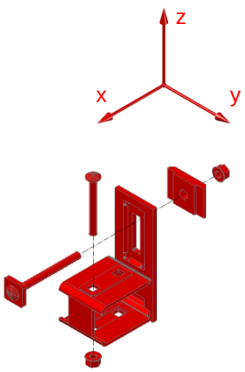
Possible loading cases		
Standard		
		

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 angle MIQC-90-MI-V incl. bolts, welds





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.06	1.06	13.50	13.50	8.10	8.10
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.90	0.90	0.00	0.00	0.00	0.00

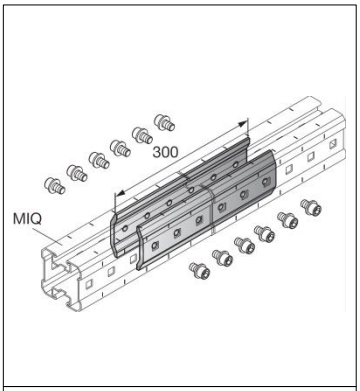
Interaction:

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

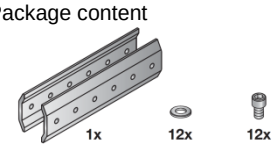
Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-E girder extension connector

Designation	Item number
MIQC-90-E girder extension connector	**2140259**



Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

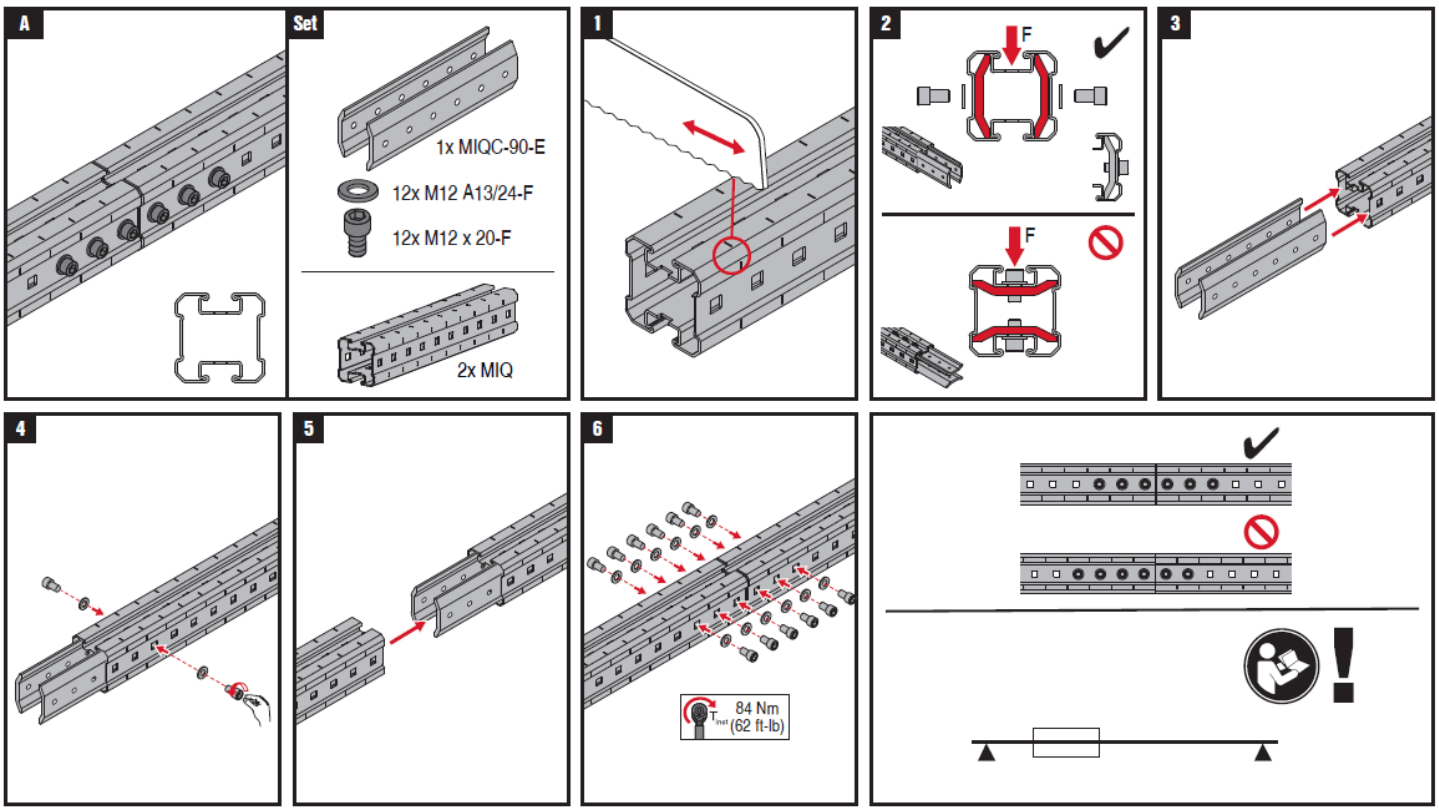
Weight:
3476 g

Submittal text:
Hilti girder extension connector, MIQ system, MIQC-90-E, Hot dipped galvanized, angle typically used for extension of Hilti MIQ girder, Extension either connected to MI side of the girder or to MIQ grove of the MIQ girder. Both through bolting the girder to inner placed extension with 12 screws and washers (included in the packaging).
material weight 3476 grams incl. all connectivity material.

Material properties:

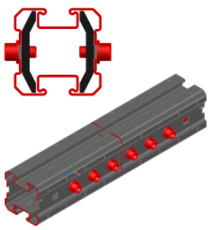
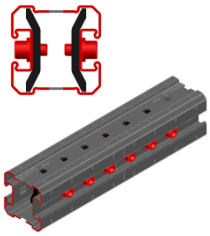
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:



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

MIQC-90-E girder extension connector

Possible loading cases		
Open up	Open to the side	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

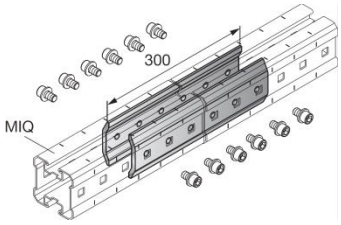
Standards and codes:

• 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

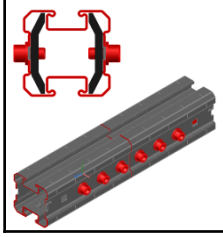
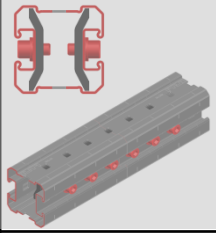
Environmental conditions:
- static loads
- no fatigue loads

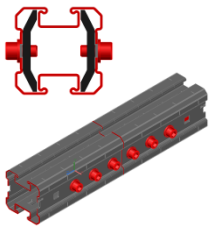
Simplified drawing:



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

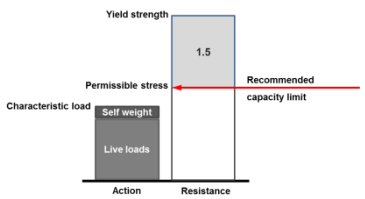
MIQC-90-E girder extension connector

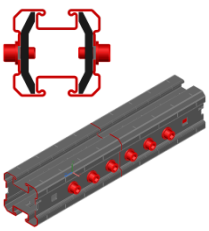
Possible loading cases		
Open up	Open to the side	
		

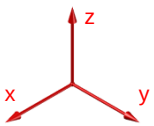
Loading case: Open up	Combinations covered by loading case
BOM: Angle incl. all connectivity material **1x MIQC-90-E** **2140259**	

Recommended loading capacity - simplified for most common applications

Method







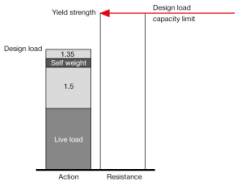
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
34.67	3.33	14.67

±My,rec. [kNm]
1.2

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

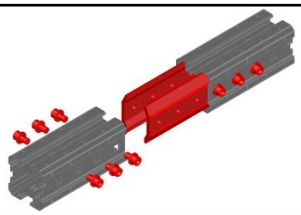
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-90-E incl. all screws

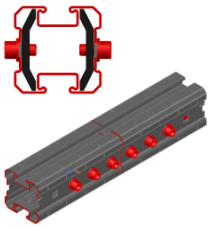
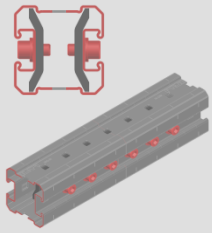


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-E girder extension connector

Conditions of the loading capacity tables:

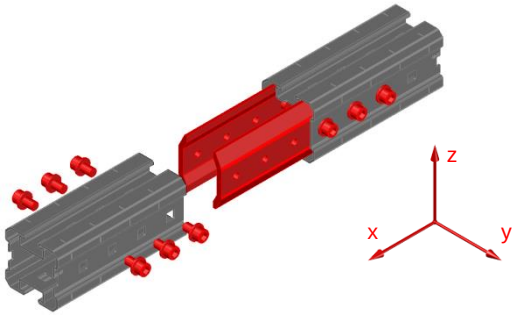
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Open up	Open to the side	
		

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 MIQC-90-E incl. all screws (MIQ girder open up)



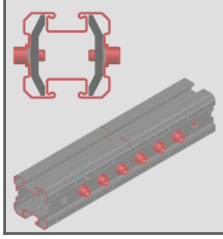
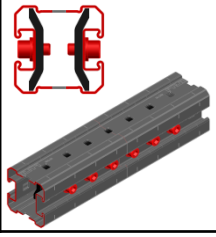
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
52.00	52.00	5.00	5.00	22.00	22.00
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.80	0.80	1.80	1.80	2.00	2.00

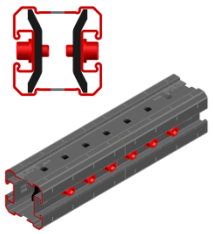
Interaction:

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

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

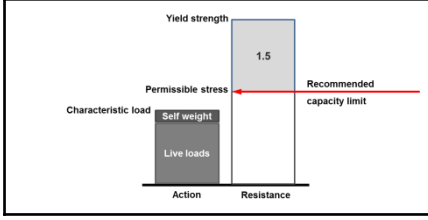
MIQC-90-E girder extension connector

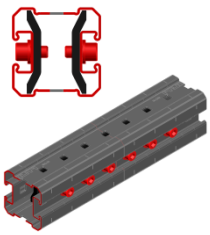
Possible loading cases		
Open up	Open to the side	
		

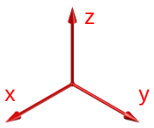
Loading case: Open to the side	Combinations covered by loading case
BOM: Angle incl. all connectivity material **1x MIQC-90-E** **2140259**	

Recommended loading capacity - simplified for most common applications

Method







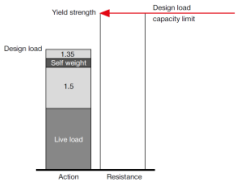
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
34.67	5.0	13.33

±My,rec. [kNm]
1.2

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

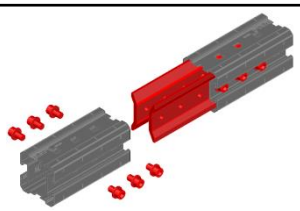
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-90-E incl. all screws (MIQ girder open to side)

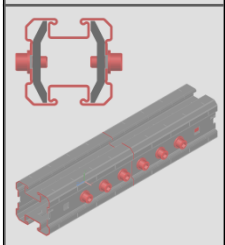
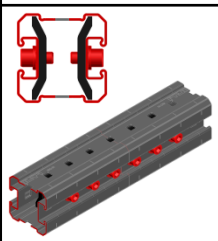


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-90-E girder extension connector

Conditions of the loading capacity tables:

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

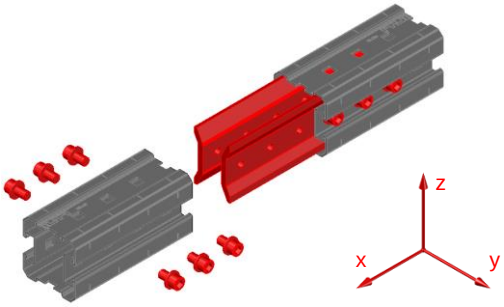
Possible loading cases		
Open up	Open to the side	
		

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 MIQC-90-E incl. all screws (MIQ girder open to side)



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
52.00	52.00	7.50	7.50	20.00	20.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.60	0.60	1.80	1.80	1.60	1.60

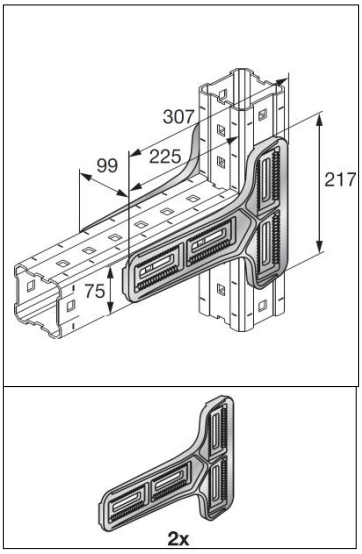
Interaction:

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

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

MIC-90-LH Connector

Designation	Item number
MIC-90-LH	**2048107**



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

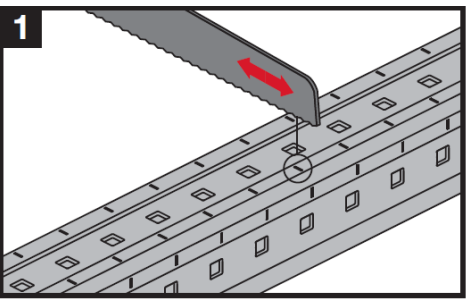
Weight:
3800 g

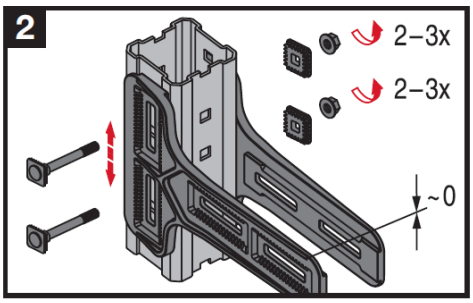
Submittal text:
Hot dipped galvanized, 90° Hilti MI angle connector, typically used for connecting two perpendicular MI or MIQ girders, where the horizontal girder is connected to the side of the vertical girder. Oblong holes enable fine adjustment and are serrated to improve holding and load values. Connector is used on the sides of the girders. Suitable for cantilever applications.

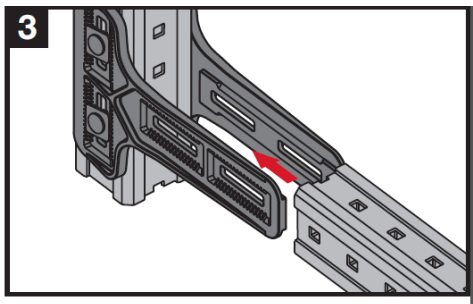
Material properties:

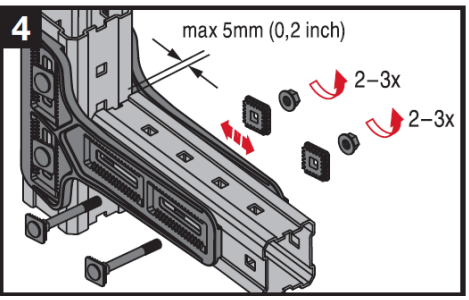
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
Connector: C30-1.0528	$F_y = 250 \frac{N}{mm^2}$	$F_u = 480 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Toothed plate: S235 - EN 10250-2	$F_y = 235 \frac{N}{mm^2}$	$F_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

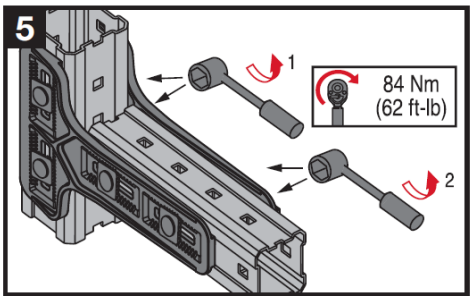
Instruction For Use:

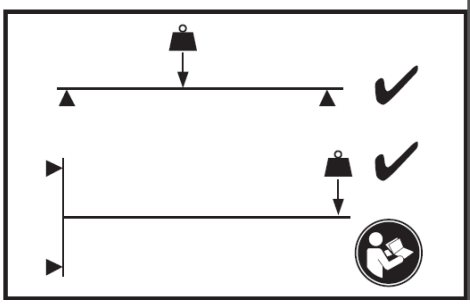








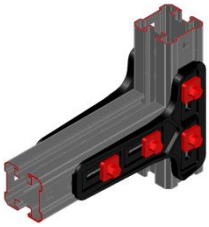




The same assembly principles and torque moments should be applied for MIQ girders

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

MIC-90-LH Connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation

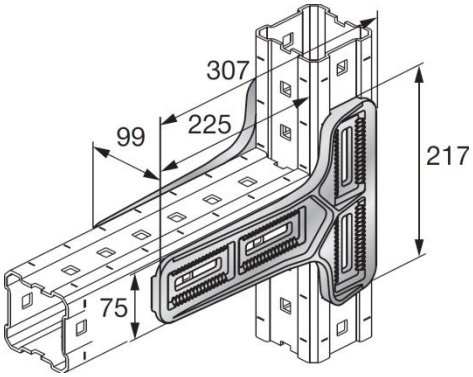
Standards and codes:

• 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

Software:
- Mathcad 15.0
- Microsoft Excel

Environmental conditions:
- indoors, outdoors
- static loads
- no fatigue loads

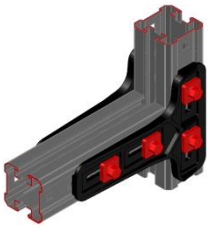
Simplified drawing:



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

MIC-90-LH Connector

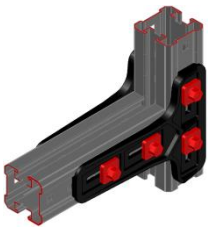
Standard



Loading case: Standard

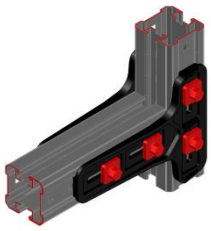
BOM:

Angle does not include all components
1x MIC-90-LH connector 2048107
Connectivity material ordered separately
4x MIA-EH90 easy hand screw 304887
4x MIA-TP serrated plate 305707
M12-F-SL-WS ¾'' lock nut 382897



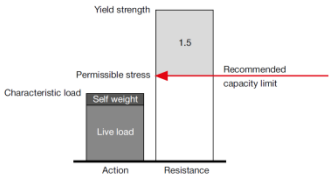
Combinations covered by loading case

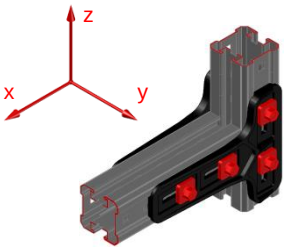
Connector used for perpendicular connections of two MIQ-90 girders, to enable a cantilever arm



Recommended loading capacity - simplified for most common applications

Method





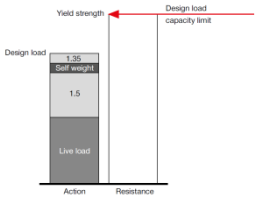
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
24.4	9.7	24.4

±My,rec. [kNm]
3.83

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

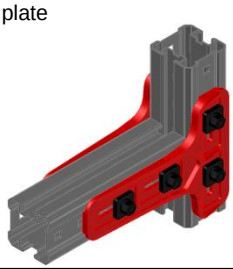
Design loading capacity - 3D 1/3

Method

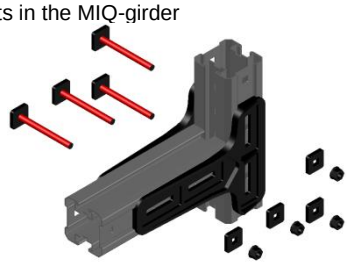


Limiting components of capacity evaluated in following tables:

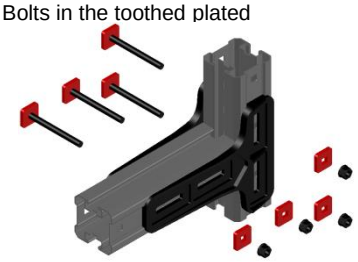
1. Connector steel plate



2. Bolts in the MIQ-girder



3. Bolts in the toothed plated

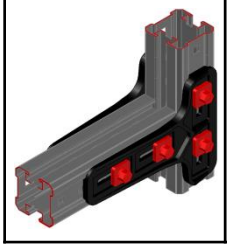


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIC-90-LH Connector

Conditions of the loading capacity tables:

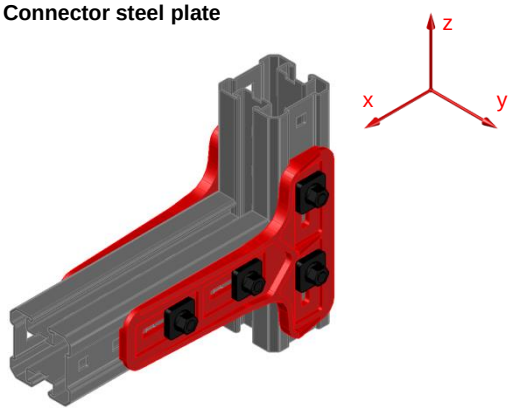
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Standard		
		

Design loading capacity - 3D 2/3

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. Connector steel plate

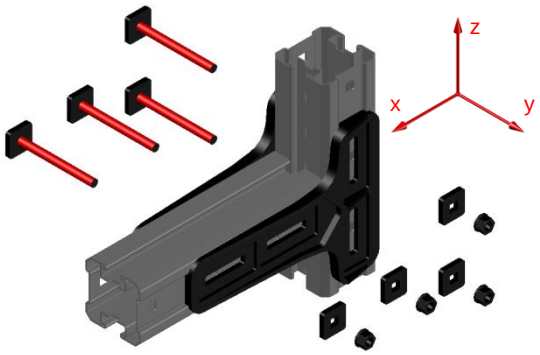


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
112.0	112.0	14.50	14.50	72.00	72.00
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.75	1.75	5.75	5.75	1.73	1.73

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. Bolts in the MIQ-girder



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
36.64	36.64	Not decisive	Not decisive	36.64	36.64
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
Not decisive	Not decisive	Not decisive	Not decisive	Not decisive	Not decisive

Interaction:

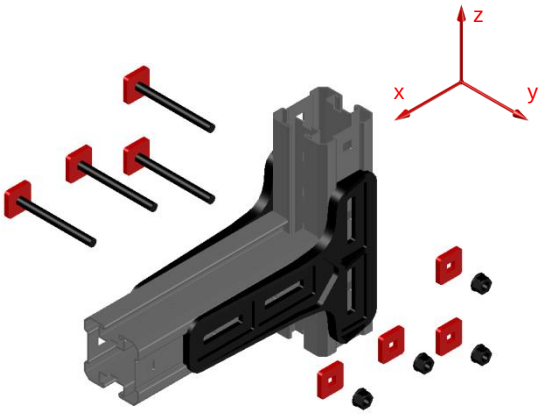
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} \le 1$$

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

MIC-90-LH Connector

Design loading capacity - 3D 3/3

3. Bolts in the toothed plated



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
113.0	113.0	Not decisive	Not decisive	113.0	113.0
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
Not decisive	Not decisive	Not decisive	Not decisive	Not decisive	Not decisive

Interaction:

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

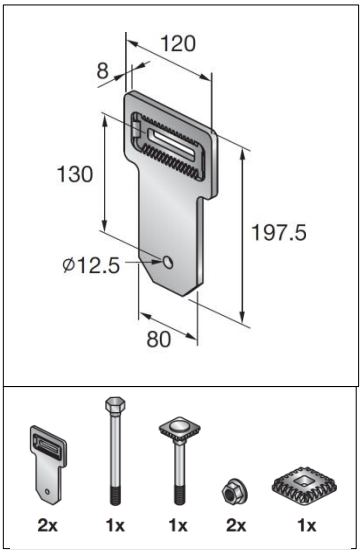
Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

Data version 1.2 I Date 11.2016

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

MIC-U-MA Connector

Designation	Item number
MIC-U-MA	**304806**



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

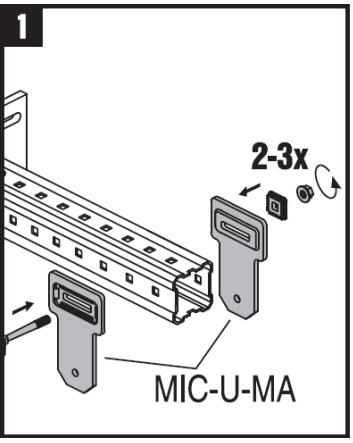
Weight:
2630 g incl. components

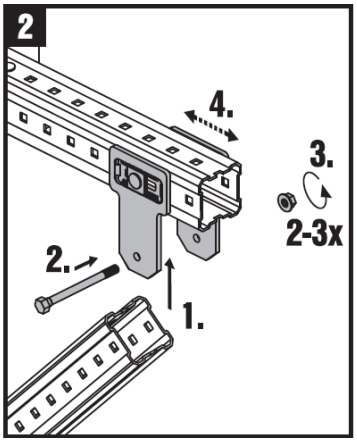
Submittal text:
Hot dipped galvanized Hilti MI connector, typically used for connecting two MI or MIQ girders, where one girder is braced / supported by the other in an angle, to improve total load capacity of the structure. One oblong hole enables fine adjustment and is serrated to improve holding. Connector is used on the sides of the girders.

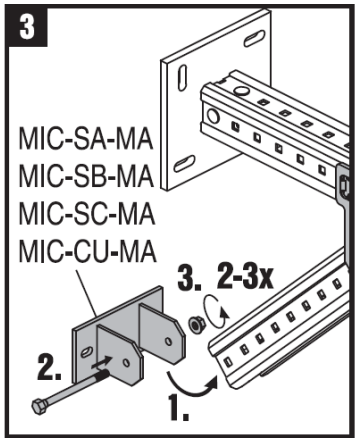
Material properties:

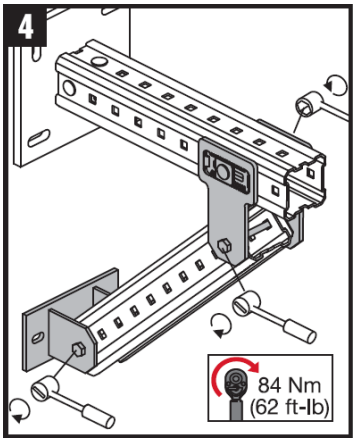
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:









The same assembly principles and torque moments should be applied for MIQ girders

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

MIC-U-MA Connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation

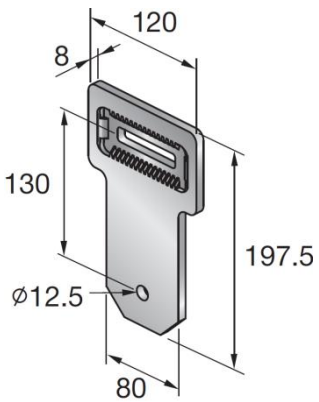
Standards and codes:

• 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

Software:
- Mathcad 15.0
- Microsoft Excel

Environmental conditions:
- indoors, outdoors
- static loads
- no fatigue loads

Simplified drawing:



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

MIC-U-MA Connector

Standard

Loading case: Standard

BOM:

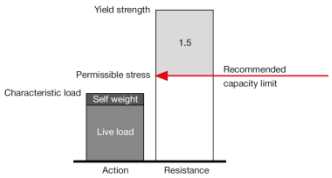
Angle incl. all components
1x MIC-U-MA **304806**

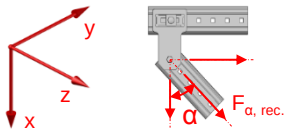
Combinations covered by loading case

Connector used for an angular connection of two MI-90 Or MIQ-90 girders (bracket brace)

Recommended loading capacity - simplified for most common applications

Method





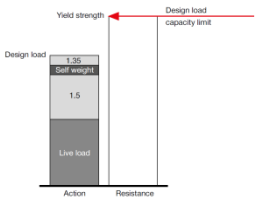
±Fy,rec. [kN]
1.4

α	0°	30°	45°	60°	90°
$±F_{α,rec.}$ [kN]	18.31	11.63	9.77	8.95	9.30

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

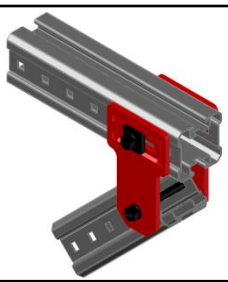
Design loading capacity - 3D 1/3

Method

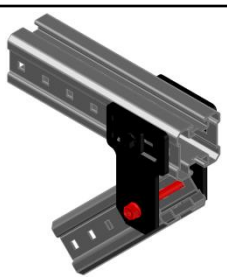


Limiting components of capacity evaluated in following tables:

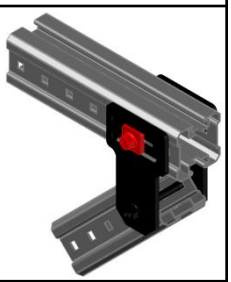
1. Steel connector



2. Hexagon bolt on MIQ-girder



3. Easy hand screw on MIQ-girder



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

MIC-U-MA Connector

Conditions of the loading capacity tables:

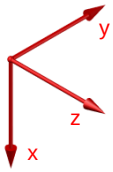
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

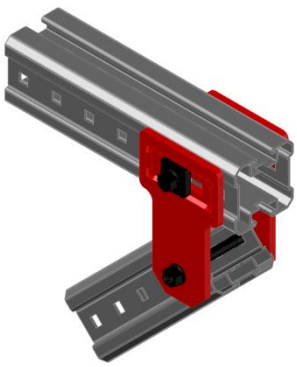
Standard		
		

Design loading capacity - 3D 2/3

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

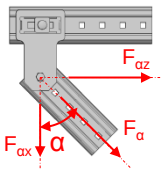




+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
40.32	40.32	2.11	2.11	13.96	13.96
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.63	0.63	0.00	0.00	0.00	0.00

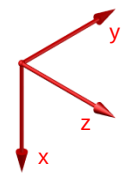
includes cross section resistance of steel plate and contact pressure
Interaction for a general force F_α with a certain inclination α:

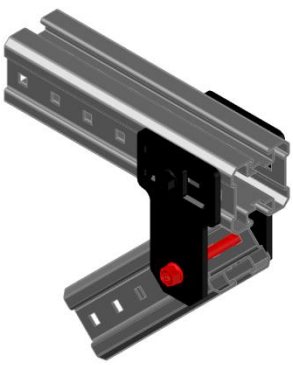
$F_{\alpha xEd}=F_\alpha*\cos\alpha$ and $F_{\alpha zEd}=F_\alpha*\sin\alpha$



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

2. Hexagon bolt on MIQ-girder





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
27.47	27.47	Not decisive	Not decisive	27.47	27.47
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.24	1.24	0.00	0.00	0.00	0.00

$F_{\alpha Rd} = F_{xRd} = F_{zRd}$
includes shear and bending of the bolt, bearing resistance connector plate and channel MIQ-90
The resistance $F_{\alpha Rd}$ of the hexagon bolt is the same for each angle α in plane x/z, therefore no interaction.
The normal force $F_{\alpha Ed}$ in the inclined strut has to be compared with the resistance value $F_{\alpha Rd}$.
Interaction:

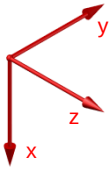
$$\frac{F_{\alpha.Ed}}{F_{\alpha.Rd}}+\frac{M_{x.Ed}}{M_{x.Rd}}\le 1$$

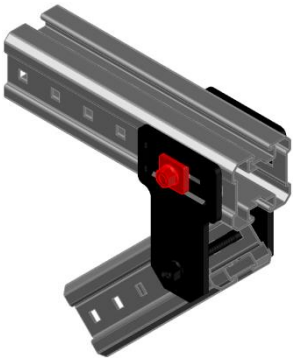
Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIC-U-MA Connector

Design loading capacity - 3D 3/3

3. 3. Easy hand screw on MIQ-girder





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
Not decisive	Not decisive	16.87	16.87	27.40	27.40
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.23	1.23	0.00	0.00	0.00	0.00

includes shear, tension and bending of the bolt, bearing resistance channel MIQ90 and tooth plate

Interaction:

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

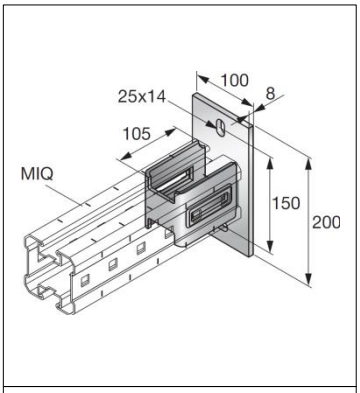
Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

Data version 1.2 I Date 11.2016

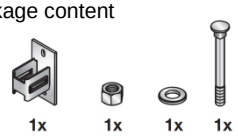
Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-C90-U base material connector

Designation	Item number
MIQC-C90-U base material connector	**2134819**



Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

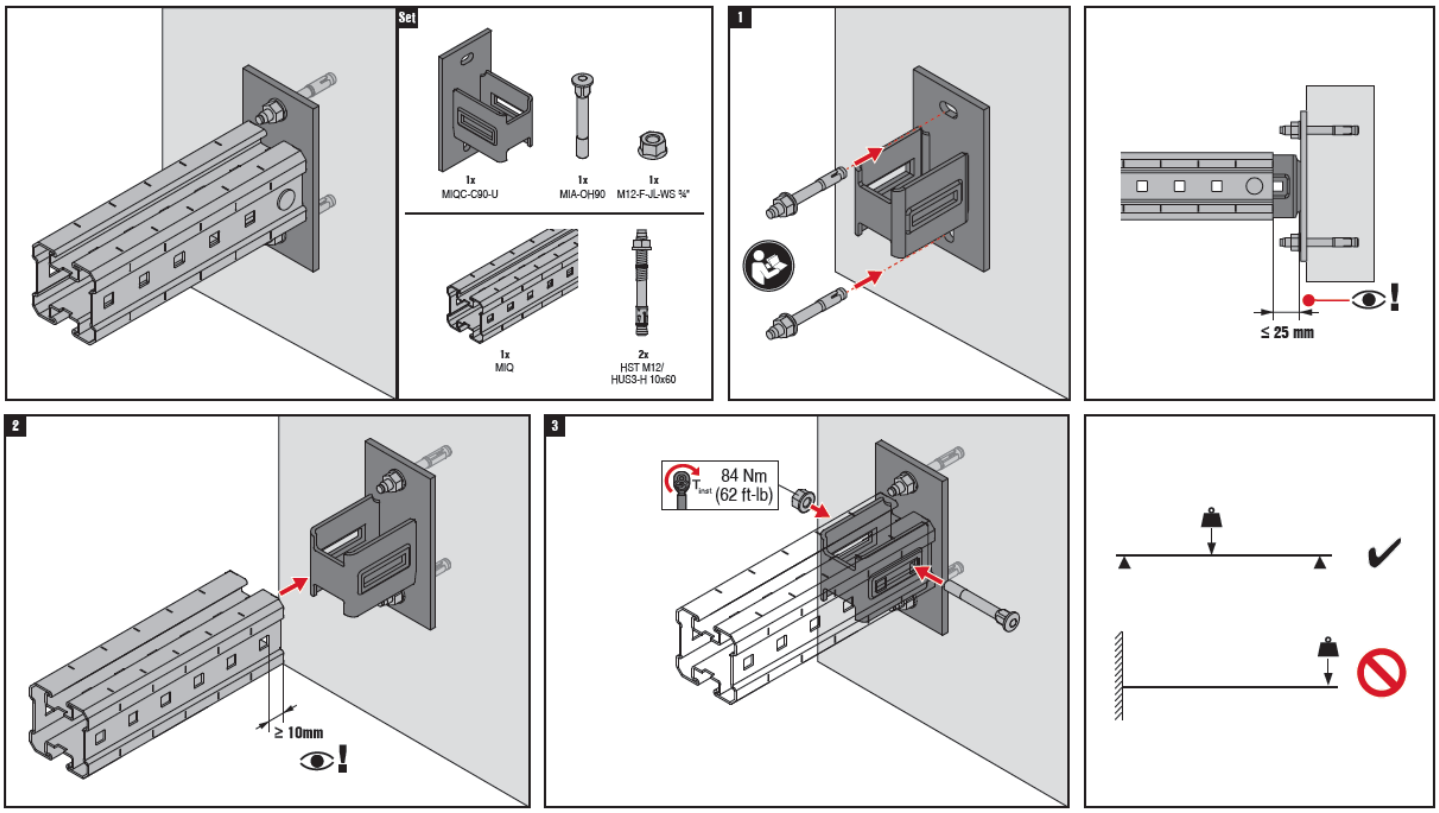
Weight:
2015 g

Submittal text:
Hilti angle, 90°, MIQ system, MIQC-C90-U, Hot dipped galvanized, concrete base material connector typically used for perpendicular of perpendicular Hilti MIQ girder to concrete, base plate with two holes fitting to two M12 sized anchors. Connection part accommodating MIQ girder through bolted by MIA-OH90 screw with washer and lock nut (included in the pack) material weight 2015 grams incl. all connectivity material.

Material properties:

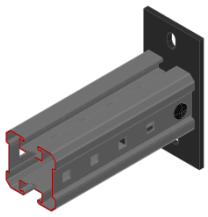
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:



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

MIQC-C90-U base material connector

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

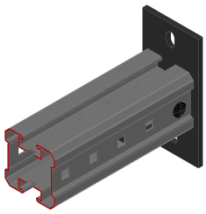
Software:
- Ansys 16.0
- Microsoft Excel

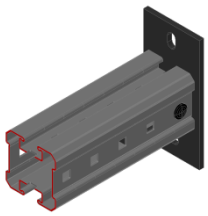
Environmental conditions:
- static loads
- no fatigue loads

Simplified drawing:

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

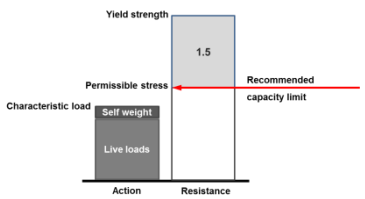
MIQC-C90-U base material connector

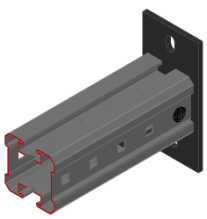
Possible loading cases		
Standard		
		

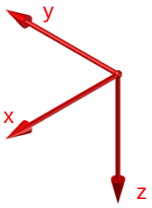
Loading case: Standard	Combinations covered by loading case
BOM: Angle incl. all connectivity material **1x MIQC-C90-U base material connector 2134819**	Connector used for fixing perpendicular MIQ girder on base material- concrete 

Recommended loading capacity - simplified for most common applications

Method





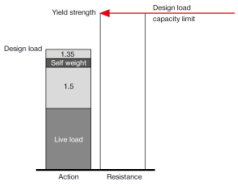


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
0.71	5.43	20.17

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

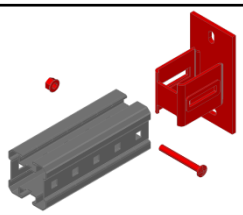
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

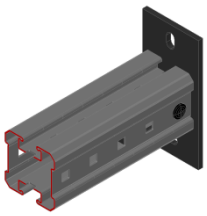
1. **Steel connector MIQC-C90-U**



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

MIQC-C90-U base material connector

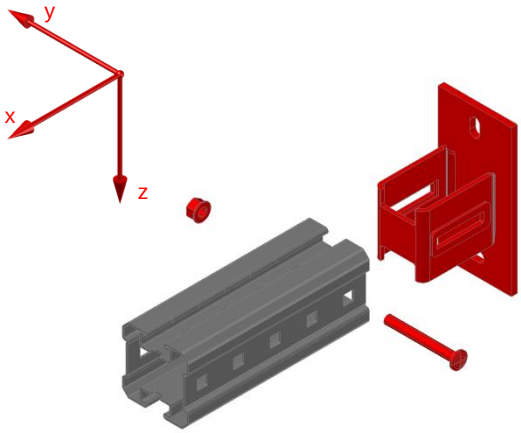
Conditions of the loading capacity tables:
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

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 angle MIQC-90-L



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.06	1.06	8.14	8.14	30.25	30.25
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.90	0.90	0.56*	1.56*	0.24*	0.24*

* the bending resistances are only valid with installation tolerance almost 0 mm

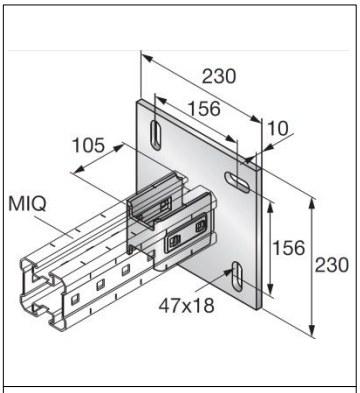
Interaction:

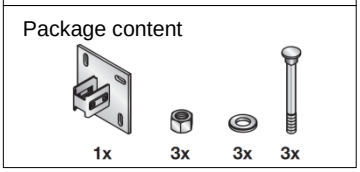
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$$

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

MIQC-C90 base material connector

Designation	Item number
MIQC-C90 base material connector	**2120144**





Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 micr ons

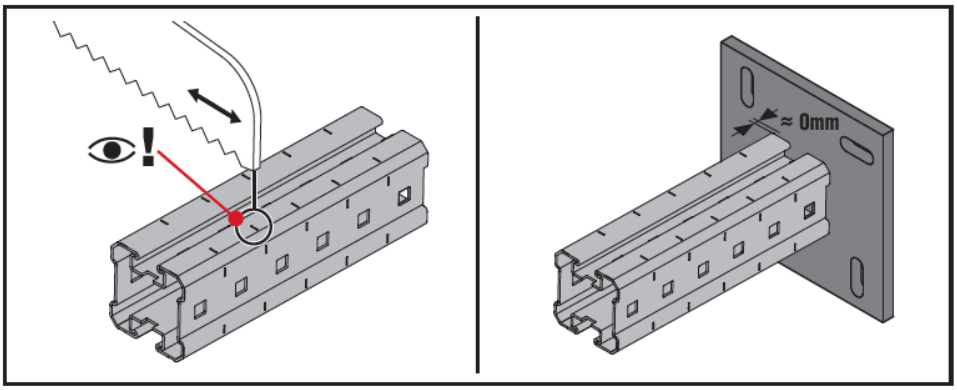
Weight:
4698g connector (4928g incl. accessories)

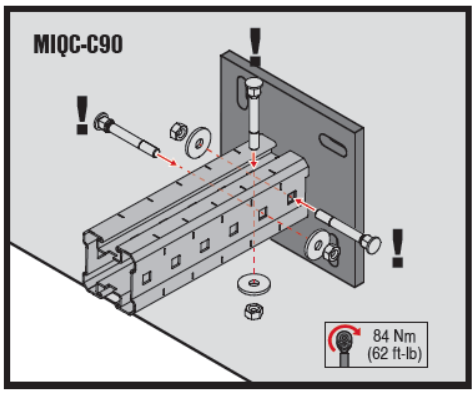
Submittal text:
Hilti base material connector, 90°, MIQ system, MIQC-C90, Hot dipped galvanized, base material connector typically used for connection of perpendicular Hilti MIQ girder to concrete, The connected girder is slid onto connection interface of the connector and through bolted by 2 pieces of MIA-OH and self locking nut (both included in the pack) in the first and second hole closest to the end of the girder, the base plate is connected to concrete by Hilti anchor 4x HST M16 (not in pack) material weight 4928 grams incl. all connectivity material.

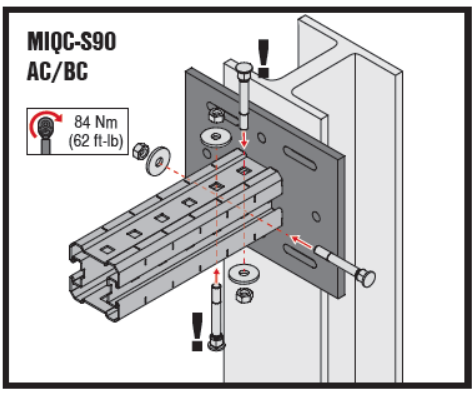
Material properties:

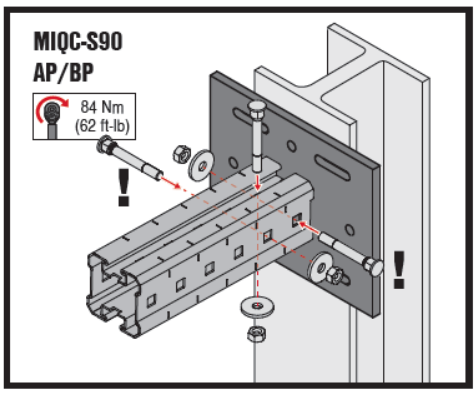
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

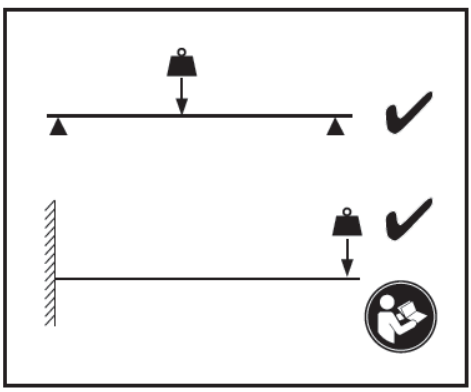
Instruction For Use:





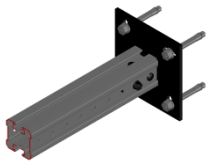






Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-C90 base material connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

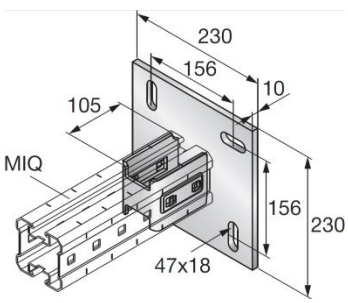
Standards and codes:

• 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

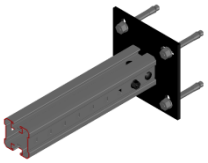
Environmental conditions:
- static loads
- no fatigue loads

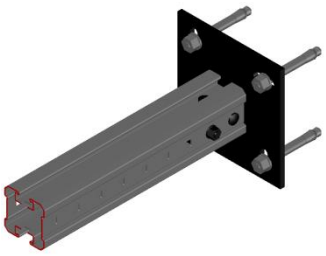
Simplified drawing:



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

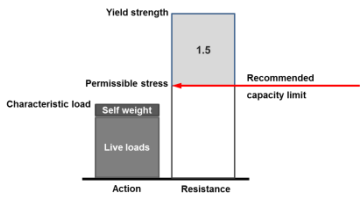
MIQC-C90 base material connector

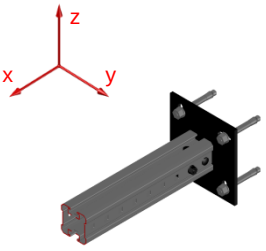
Possible loading cases		
Standard		
		

Loading case: Standard	Combinations covered by loading case
BOM: Angle incl. all connectivity material **1x MIQC-C90** **2120144** **4x HST-R M16x130/10** **2085454**	Connector used for fixing H-MIQ girder, perpendicularly to concrete 

Recommended loading capacity - simplified for most common applications

Method



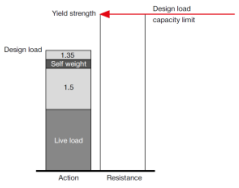


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
24.4	8.8	38.9

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

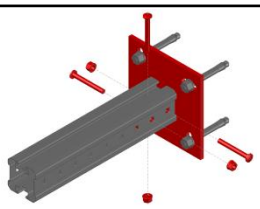
Design loading capacity - 3D

Method

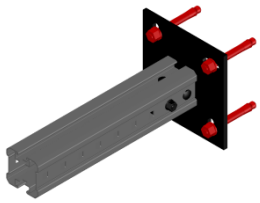


Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-C90



2. Anchors 4x HST M16

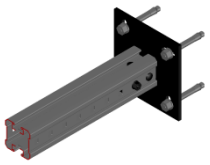


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-C90 base material connector

Conditions of the loading capacity tables:

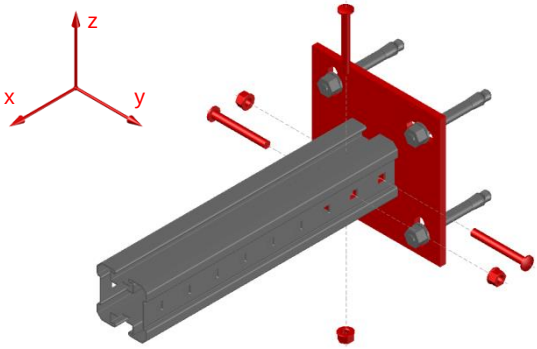
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

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 MIQC-C90 (Including screws MIA-OH90 connecting channel and connector and welds)

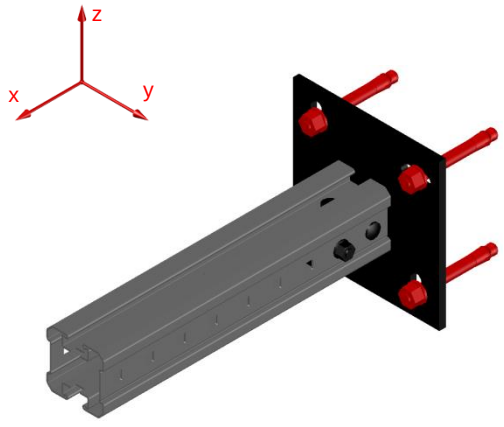


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
36.64	36.64	13.18	13.18	58.37	58.37
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.55	1.55	1.67	1.67	1.08	1.08

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. Anchors 4x HST M16



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
47.50	*	66.00	66.00	66.00	66.00
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
7.30	7.30	4.70	4.70	4.70	4.70

Interaction:

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

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

$$\beta_N + \beta_V \leq 1.2$$

* not decisive

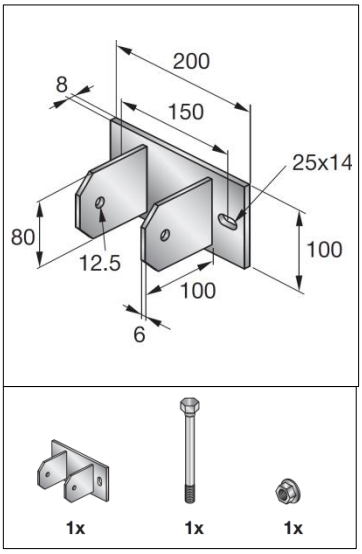
Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIC-CU-MA Base Material Connector - Concrete

Designation	Item number
MIC-CU-MA	**304828**

Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

Weight:
2210 g incl. components

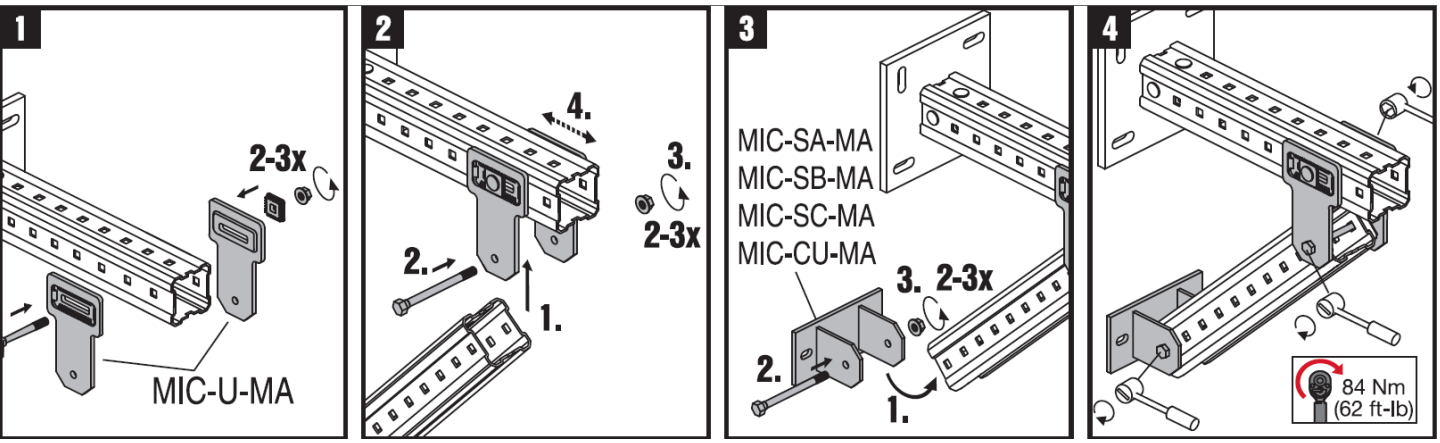


Submittal text:
Hilti Hot-dipped galvanized baseplate connector, typically used for anchoring an MI-90 and MIQ girder to concrete in an angle, usually when it's used as a brace for another girder. Two oblong anchor holes in perpendicular positions enable fine tuning of baseplate position, and girder is connected using one bolt through a hole, which enables various angles.

Material properties:

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

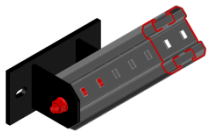
Instruction For Use:



The same assembly principles and torque moments should be applied for MIQ girders

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

MIC-CU-MA Base Material Connector - Concrete

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation

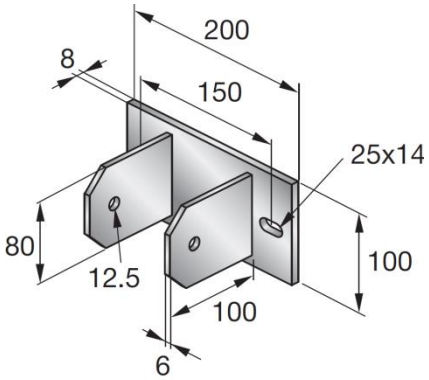
Standards and codes:

• 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

Software:
- Mathcad 15.0
- Microsoft Excel

Environmental conditions:
- indoors, outdoors
- static loads
- no fatigue loads

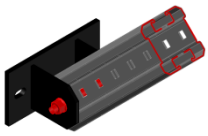
Simplified drawing:

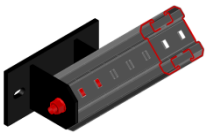
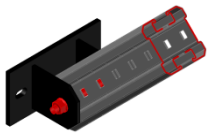


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIC-CU-MA Base Material Connector - Concrete

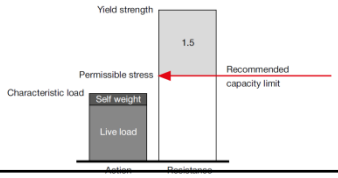
Standard

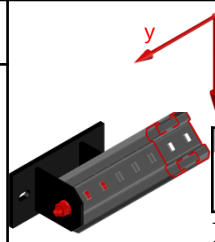


Loading case: Standard	Combinations covered by loading case
BOM: Angle incl. all components **1x MIC-CU-MA** **304828** Associated anchors* for cracked concrete **2x HST3 M12x105 30/10** **2105718** **HST2 M12x105/10** **2107848** *Anchors not incl. in capacity limits 	Baseplate connector used for an angled connection of an MIQ-90 girder to concrete (bracing) 

Recommended loading capacity - simplified for most common applications

Method





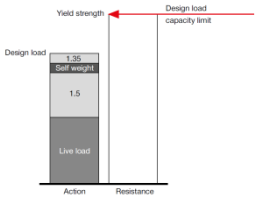
±Fy,rec. [kN]
2.1

α	0°	30°	45°	60°	90°
$\pm F_{\alpha,rec.}$ [kN]	16.93	8.76	7.64	7.21	7.93

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

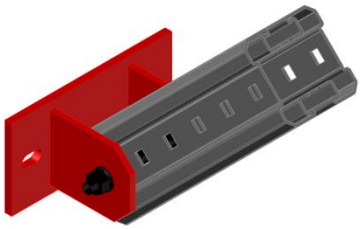
Design loading capacity - 3D 1/3

Method

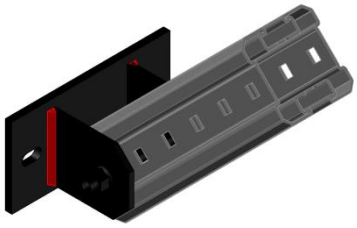


Limiting components of capacity evaluated in following tables:

1. Steel connector



2. Welds



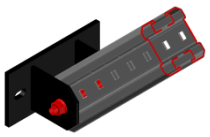
3. bolt in MIQ-girder

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

MIC-CU-MA Base Material Connector - Concrete

Conditions of the loading capacity tables:

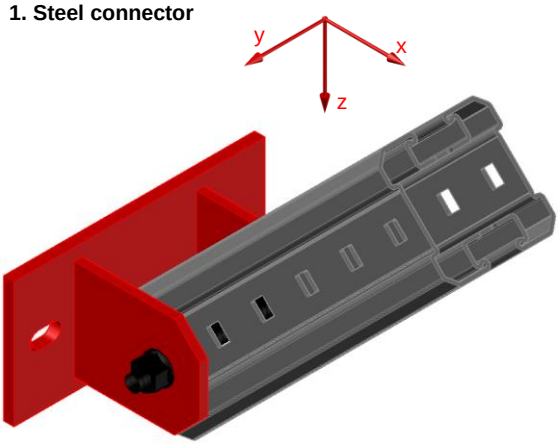
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Standard		
		

Design loading capacity - 3D 2/3

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

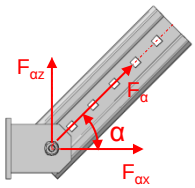


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
25.39	104.01	3.22	3.22	11.90	11.90
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.58	0.58	0.00	0.00	0.00	0.00

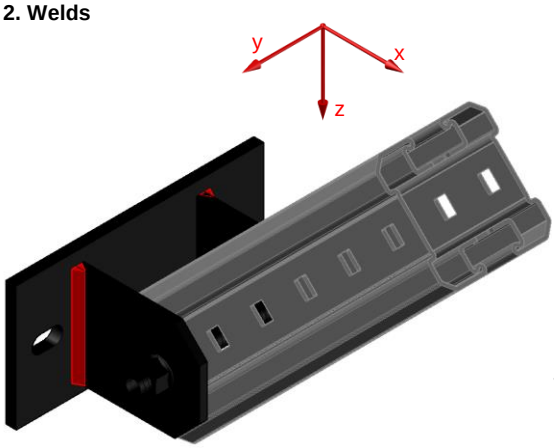
Interaction:

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

with $F_{x.Ed.\alpha}=F_\alpha{}^*\cos\alpha$ $F_{z.Ed.\alpha}=F_\alpha{}^*\sin\alpha$



2. Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
325.83	325.83	266.04	266.04	266.04	266.04
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
12.90	12.90	4.34	4.34	15.80	15.80

Interaction:

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

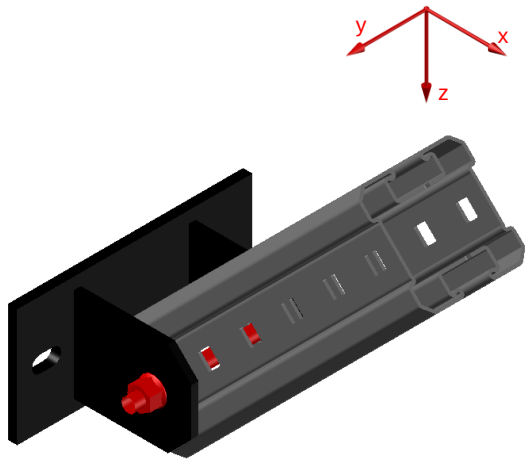
with
ex=0.07m
$F_{x.Ed.\alpha}=F_\alpha{}^*\cos\alpha$
$F_{z.Ed.\alpha}=F_\alpha{}^*\sin\alpha$ --> $M_{y.Ed.\alpha}=F_{z.Ed.\alpha}{}^*e_x$
$M_{z.Ed}=F_{y.Ed}{}^*e_x$

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

MIC-CU-MA Base Material Connector - Concrete

Design loading capacity - 3D 3/3

3. bolt in MIQ-girder



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
27.45	27.45	Not decisive	Not decisive	27.45	27.45
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.33	1.33	0.00	0.00	0.00	0.00

Interaction:
$F_{\alpha Rd} = F_{xRd} = F_{zRd}$

The resistance $F_{\alpha Rd}$ of the hexagon bolt is the same for each angle α in plane x/z, therefore no interaction between F_x and F_z.
The normal force $F_{\alpha Ed}$ in the inclined strut has to be compared with the resistance value $F_{\alpha Rd}$.

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

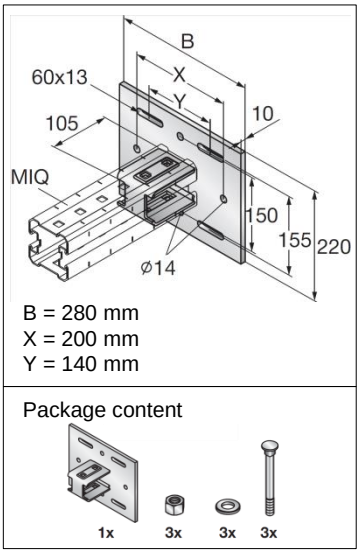
Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

Data version 1.2 I Date 11.2016

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

MIQC-S90-AC base material connector

Designation	Item number
MIQC-S90-AC base material connector	**2120270**



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

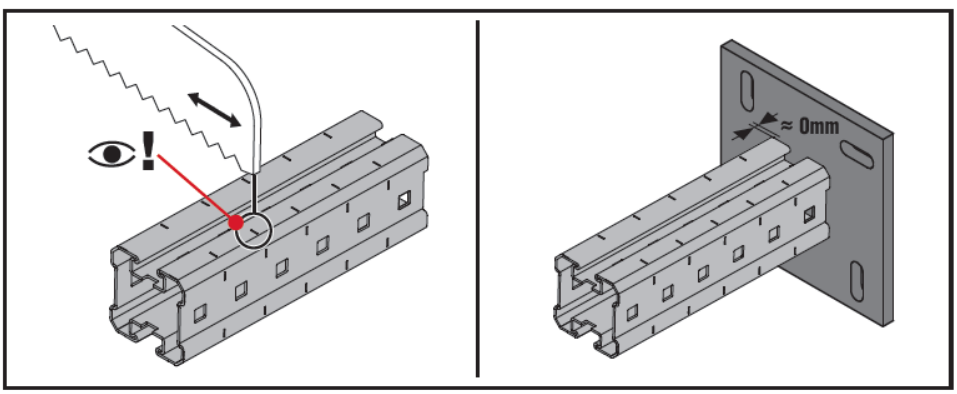
Weight:
5343g connector (5573g incl. accessories)

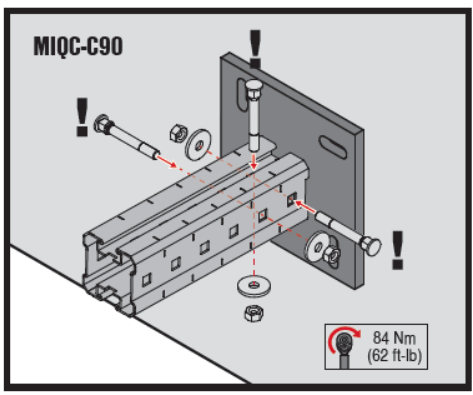
Submittal text:
Hilti base material connector, 90°, MIQ system, MIQC-S90-AC, Hot dipped galvanized, base material connector typically used for connection of perpendicular Hilti MIQ girder to structural steel with open section perpendicular to structural steel beam, The connected girder is slid onto connection interface of the connector and through bolted by 2 pieces of MIA-OH and self locking nut (both included in the pack) in the first and second hole closest to the end of the girder, the connection to structural steel could be done either by 4 pcs of Hilti MI-SGC M12(not in pack) beam clamps to flange (width 75-165mm width) of I-beam or by boxing any structural steel profile (width 75-165mm) using Hilti backing plate MIQB-SA (not in pack) and 4x M12 Hilti threaded rods and 4x M12-F-SL WS3/4 self locking nuts (both not in pack) material weight 5573 grams incl. all connectivity material.

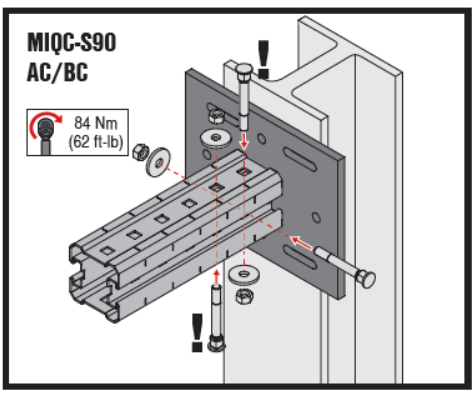
Material properties:

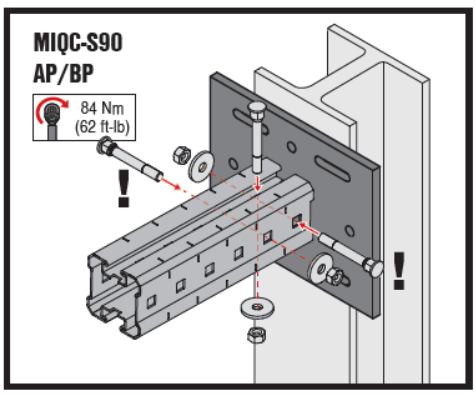
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

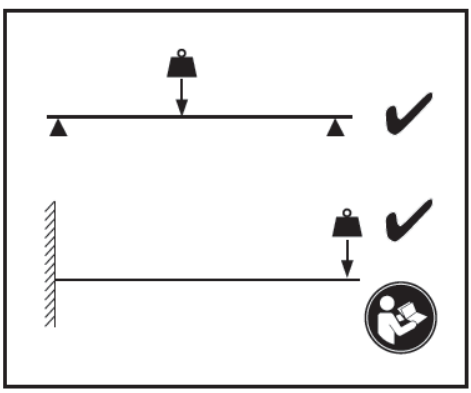
Instruction For Use:





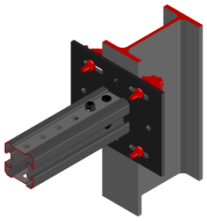
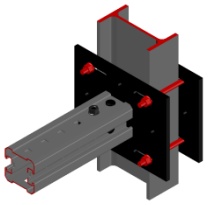






Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-AC base material connector

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

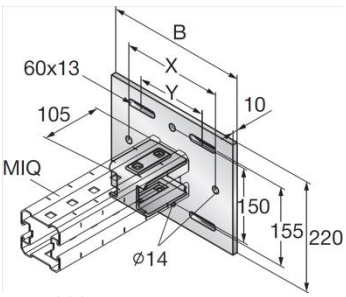
Standards and codes:

• 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

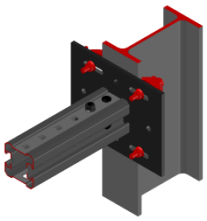
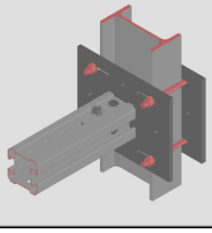
Simplified drawing:

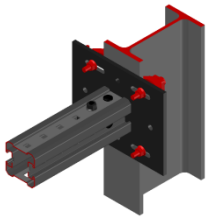


B = 280 mm
X = 200 mm
Y = 140 mm

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

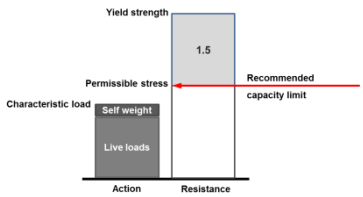
MIQC-S90-AC base material connector

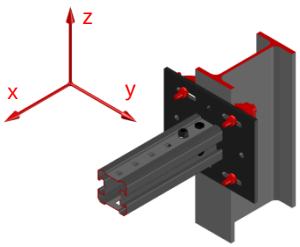
Possible loading cases		
Clamped	Boxed	
		

Loading case: Clamped	Combinations covered by loading case
BOM: Base material connector incl. all connectivity material **1x MIQC-S90-AC** **2120270** Beam clamp **4x MI-SGC M12** **233859**	MIQ girder, perpendicularly to flange (width of 75-165mm) of structural steel open section, perpendicularly to structural steel beam 

Recommended loading capacity - simplified for most common applications

Method



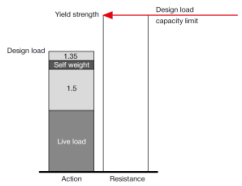


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
23.2	6.0	6.0

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

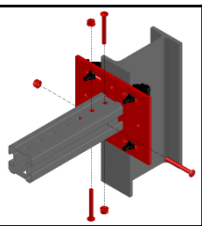
Design loading capacity - 3D 1/2

Method

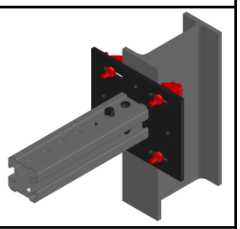


Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-S90-AC



2. Beam clamps 4x MI-SGC M12

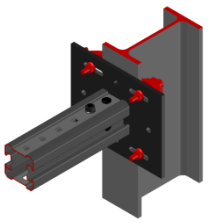
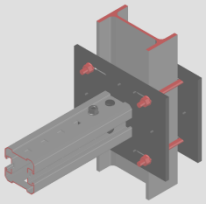


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-AC base material connector

Conditions of the loading capacity tables:

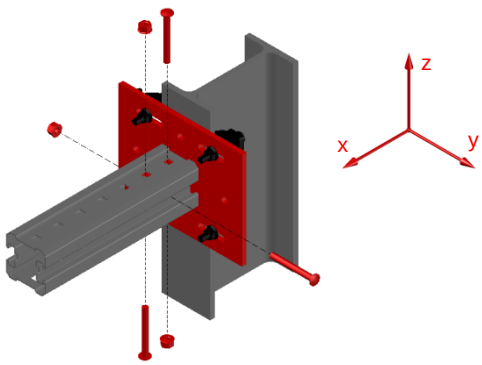
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Clamped	Boxed	
		

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 MIQC-S90-AC (Including screws MIA-OH90 connecting channel and connector and welds)

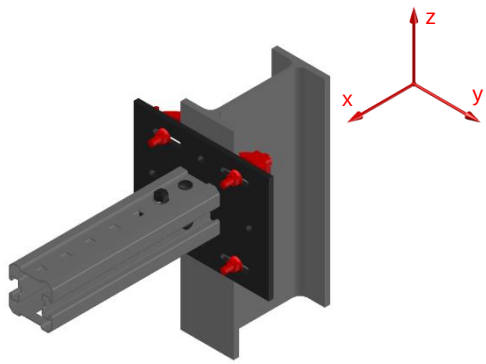


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
36.64	36.64	57.03	57.03	13.18	13.18
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.37	1.37	0.84	0.84	0.70	0.70

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. Clamps 4x MI-SGC M12



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
34.80	*	9.00	9.00	9.00	9.00
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.81	0.81	2.09	2.09	1.39	1.39

Interaction:

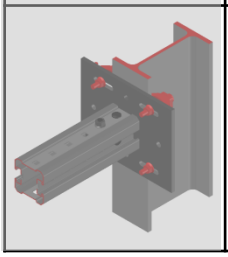
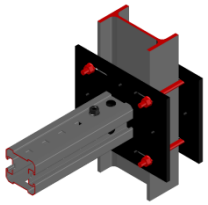
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$$

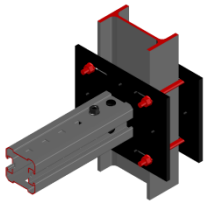
* not decisive

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

MIQC-S90-AC base material connector

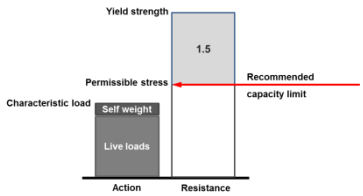
Possible loading cases

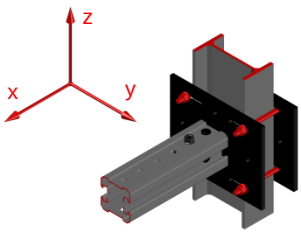
Clamped	Boxed	
		

Loading case: Boxed	Combinations covered by loading case
BOM: Base material connector incl. all connectivity material **1x MIQC-S90-AC** **2120270** Back (base) plate **1x MIQB-SA** **2123565** Threaded rods **4x AM12x1000 8.8 HDG…m** **419103** Self-locking nut **8x M12-F-SL WS3/4** **382897**	Connector used for fixing MIQ girder, perpendicularly to flange (width of 75-165mm) of structural steel open section, perpendicularly to structural steel beam 

Recommended loading capacity - simplified for most common applications

Method



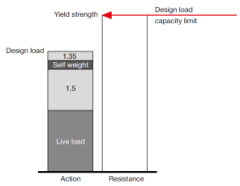


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
24.00	5.0	5.0

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

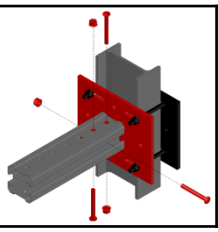
Design loading capacity - 3D 1/2

Method

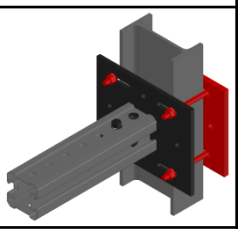


Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-S90-AC



2. Threated rods M12 / 8.8 in connection with MIQB-SA plate

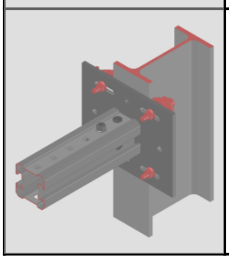
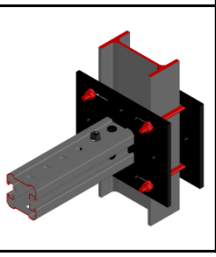


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-AC base material connector

Conditions of the loading capacity tables:

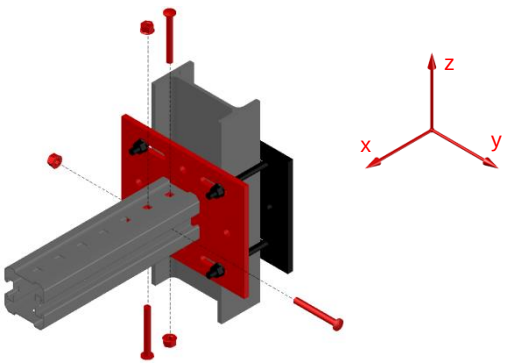
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Clamped	Boxed	
		

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 MIQC-S90-AC (Including screws MIA-OH90 connecting channel and connector and welds)

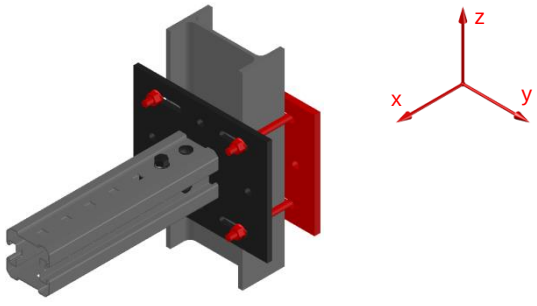


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
36.64	36.64	57.03	57.03	13.18	13.18
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.37	1.37	0.84	0.84	0.70	0.70

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. Threated rods M12 / 8.8 in connection with MIQB-SA plate



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
194.23	35.97	7.42	7.42	7.42	7.42
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.67	0.67	11.65	11.65	7.77	7.77

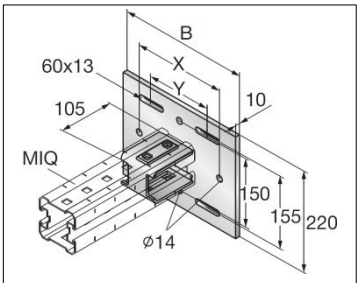
Interaction:

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

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

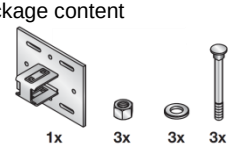
MIQC-S90-BC base material connector

Designation	Item number
MIQC-S90-BC base material connector	**2120272**



B = 350 mm
X = 300 mm
Y = 210 mm

Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

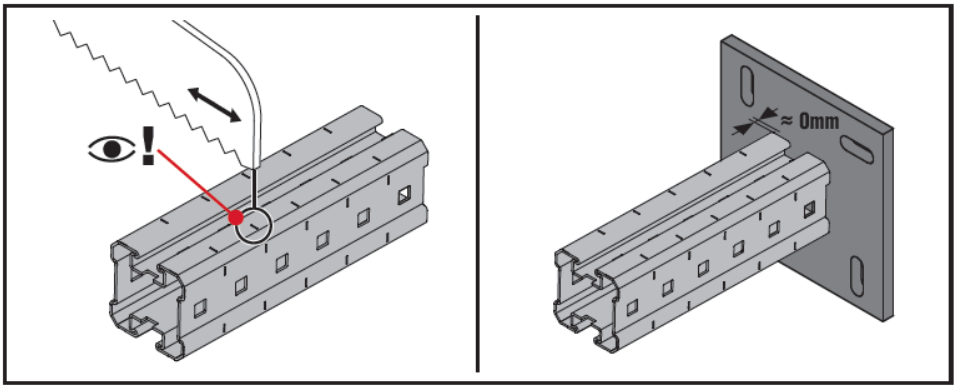
Weight:
6552g connector (6782g incl. accessories)

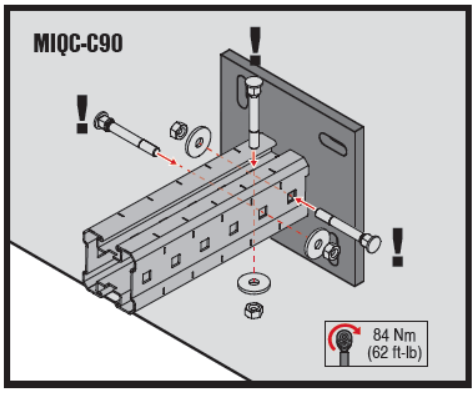
Submittal text:
Hilti base material connector, 90°, MIQ system, MIQC-S90-BC, Hot dipped galvanized, base material connector typically used for connection of perpendicular Hilti MIQ girder to structural steel with open section perpendicular to structural steel beam. The connected girder is slid onto connection interface of the connector and through bolted by 2 pieces of MIA-OH and self locking nut (both included in the pack) in the first and second hole closest to the end of the girder, the connection to structural steel could be done either by 4 pcs of Hilti MI-SGC M12 (not in pack) beam clamps to flange (width 165-235mm width) of I-beam or by boxing any structural steel profile (width 165-235mm) using Hilti backing plate MIQB-SB (not in pack) and 4x M12 Hilti threaded rods and 4x M12-F-SL WS3/4 self locking nuts (both not in pack) material weight 6782 grams incl. all connectivity material.

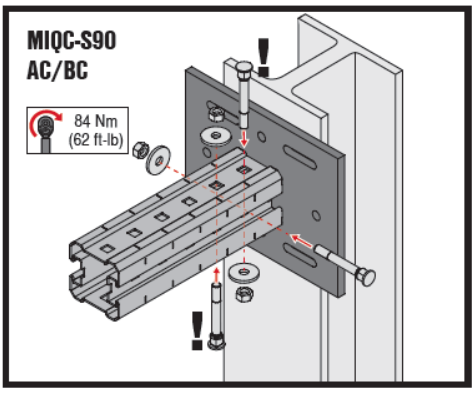
Material properties:

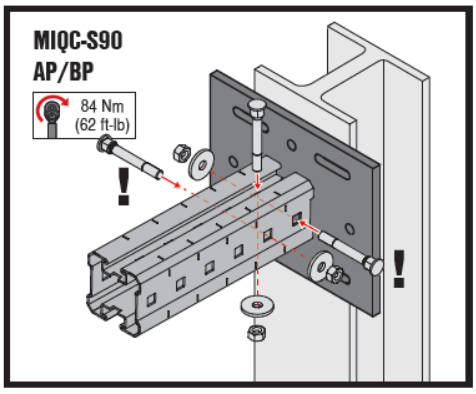
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

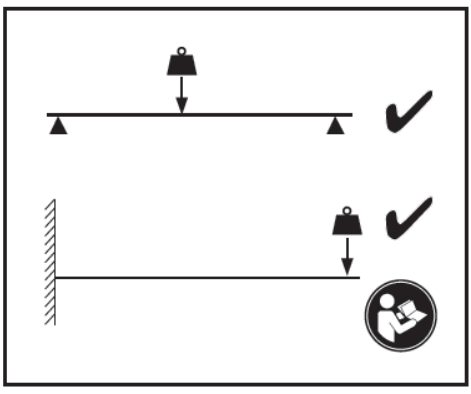
Instruction For Use:





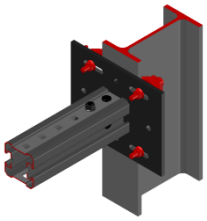
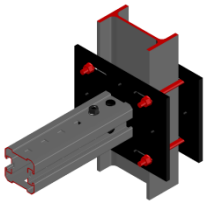






Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-BC base material connector

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

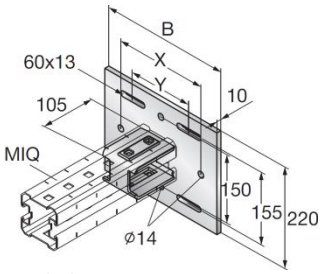
Standards and codes:

• 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

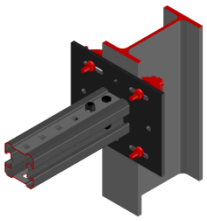
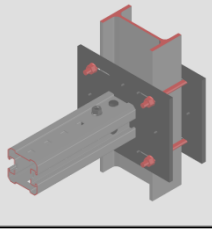
Simplified drawing:

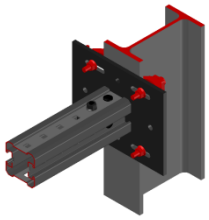


B = 350 mm
X = 300 mm
Y = 210 mm

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

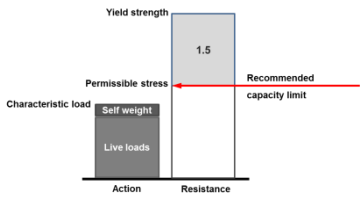
MIQC-S90-BC base material connector

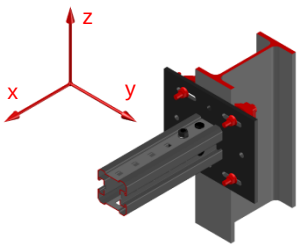
Possible loading cases		
Clamped	Boxed	
		

Loading case: Clamped	Combinations covered by loading case
BOM: Base material connector incl. all connectivity material **1x MIQC-S90-BC** **2120272** Beam clamp **4x MI-SGC M12** **233859**	Connector used for fi xing MIQ girder, perpendicularly to fl ange (width of 165-235mm) of structural steel open section, perpendicularly to structural steel beam 

Recommended loading capacity - simplified for most common applications

Method



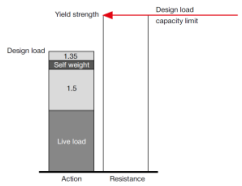


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
17.3	6.0	6.0

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

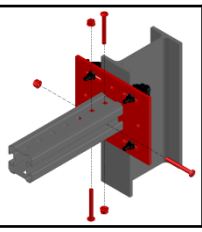
Design loading capacity - 3D 1/2

Method

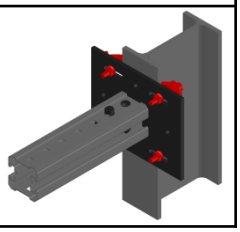


Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-S90-BC



2. Beam clamps 4x MI-SGC M12

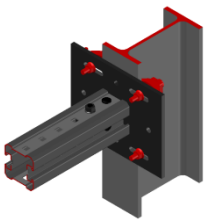
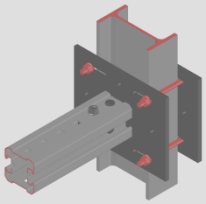


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-BC base material connector

Conditions of the loading capacity tables:

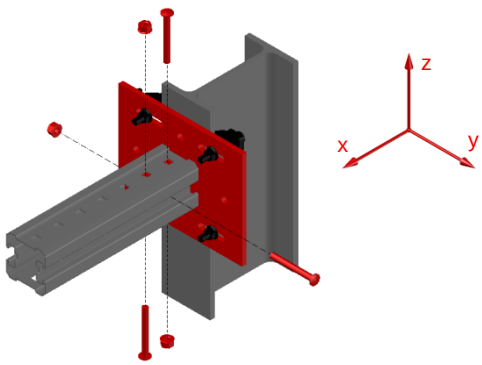
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Clamped	Boxed	
		

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 MIQC-S90-BC (Including screws MIA-OH90 connecting channel and connector and welds)

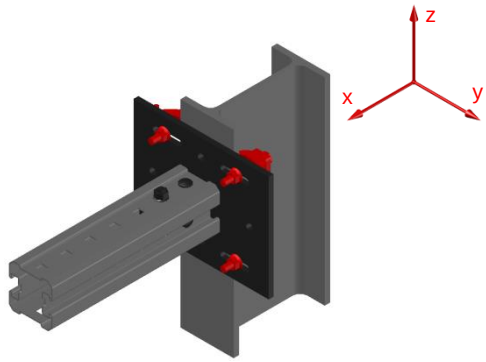


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
26.00	36.40	46.95	46.95	13.18	13.18
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.37	1.37	0.84	0.84	0.70	0.70

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. Clamps 4x MI-SGC M12



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
34.80	*	9.00	9.00	9.00	9.00
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.06	1.06	2.09	2.09	2.09	2.09

Interaction:

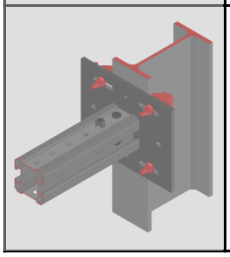
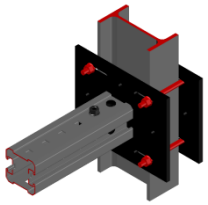
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$$

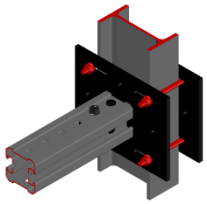
* not decisive

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

MIQC-S90-BC base material connector

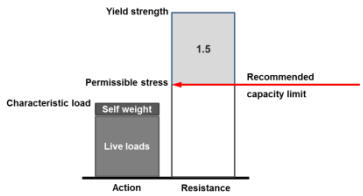
Possible loading cases

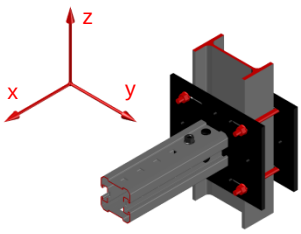
Clamped	Boxed	
		

Loading case: Boxed	Combinations covered by loading case
BOM: Base material connector incl. all connectivity material **1x MIQC-S90-BC** **2120272** Back (base) plate **1x MIQB-SB** **2123566** Threaded rods **4x AM12x1000 8.8 HDG…m** **419103** Self-locking nut **8x M12-F-SL WS3/4** **382897**	Connector used for fixing MIQ girder, perpendicularly to flange (width of 165-235mm) of structural steel open section, perpendicularly to structural steel beam 

Recommended loading capacity - simplified for most common applications

Method



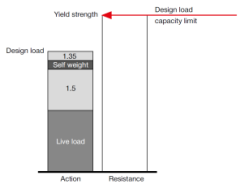


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
17.3	5.0	5.0

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

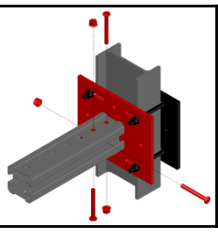
Design loading capacity - 3D 1/2

Method

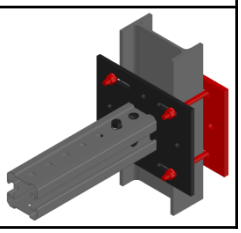


Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-S90-BC



2. Threated rods M12 / 8.8 in connection with MIQB-SB plate

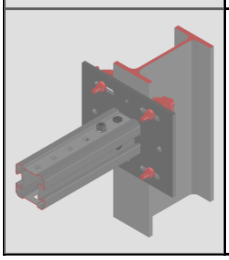
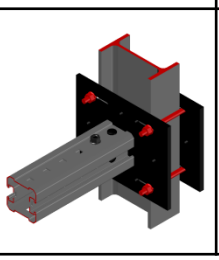


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-BC base material connector

Conditions of the loading capacity tables:

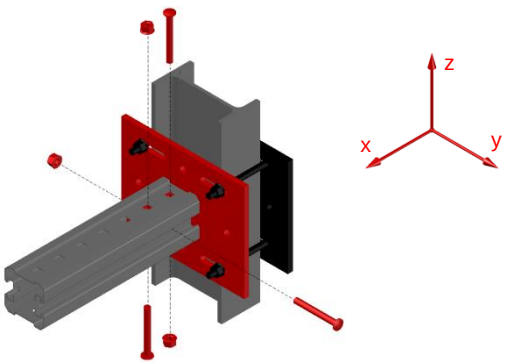
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Clamped	Boxed	
		

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 MIQC-S90-BC (Including screws MIA-OH90 connecting channel and connector and welds)

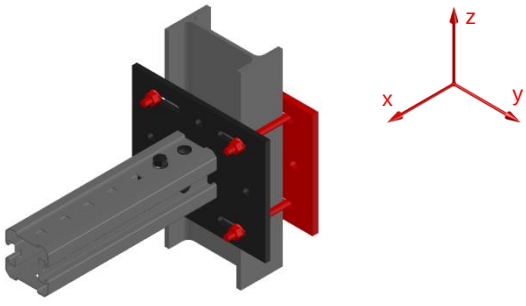


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
26.00	36.40	46.95	46.95	13.18	13.18
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.37	1.37	0.84	0.84	0.70	0.70

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. Threated rods M12 / 8.8 in connection with MIQB-SB plate



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
194.23	34.23	7.42	7.42	7.42	7.42
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.87	0.87	11.65	11.65	11.65	11.65

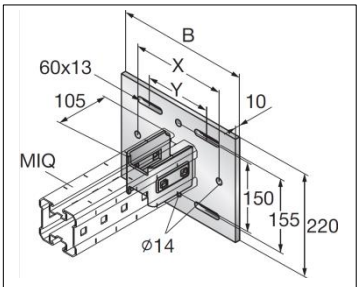
Interaction:

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

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

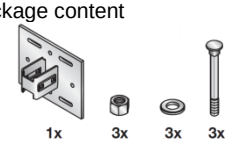
MIQC-S90-AP base material connector

Designation	Item number
MIQC-S90-AP base material connector	**2120271**



B = 280 mm
X = 200 mm
Y = 140 mm

Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 micr ons

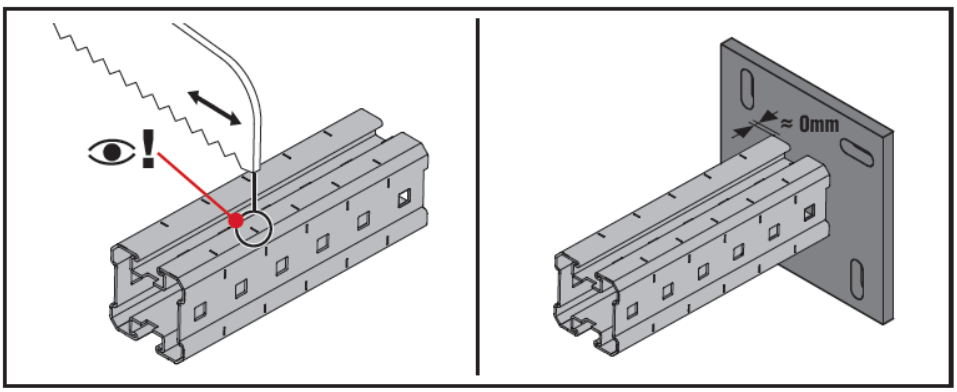
Weight:
5343g connector (5699g incl. accessories)

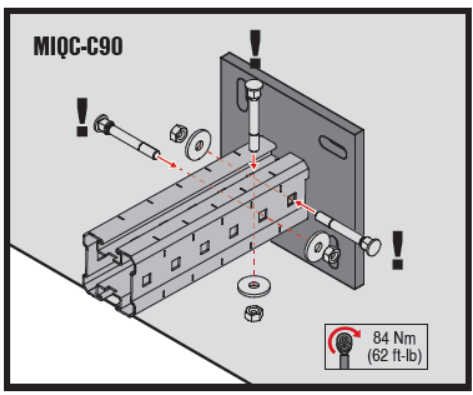
Submittal text:
Hilti base material connector, 90°, MIQ system, MIQC-S90-AP, Hot dipped galvanized, base material connector typically used for connection of perpendicular Hilti MIQ girder to structural steel with open section parallel to structural steel beam. The connected girder is slid onto connection interface of the connector and through bolted by 2 pieces of MIA-OH and self locking nut (both included in the pack) in the first and second hole closest to the end of the girder, the connection to structural steel could be done either by 4 pcs of Hilti MI-SGC M12 (not in pack) beam clamps to flange (75-165mm width) of I-beam or by boxing any structural steel profile (width 75-165mm) using Hilti backing plate MIQB-SA (not in pack) and 4x M12 Hilti threaded rods and 4x M12-F-SL WS3/4 self locking nuts (both not in pack), material weight 5699 grams incl. all connectivity material.

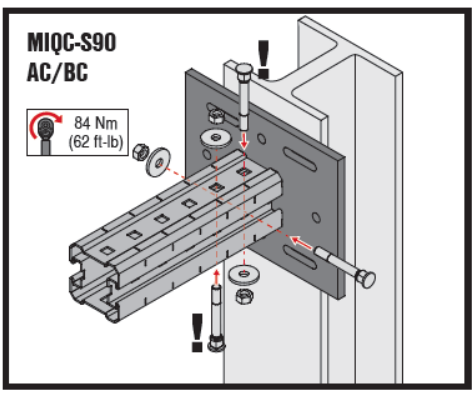
Material properties:

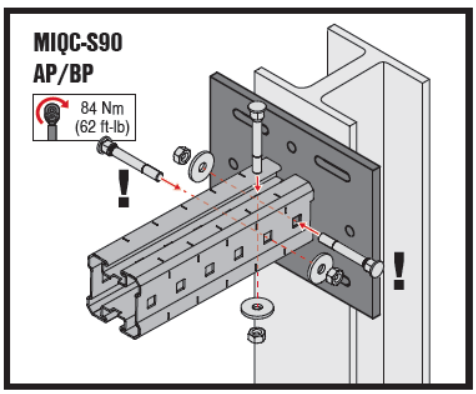
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

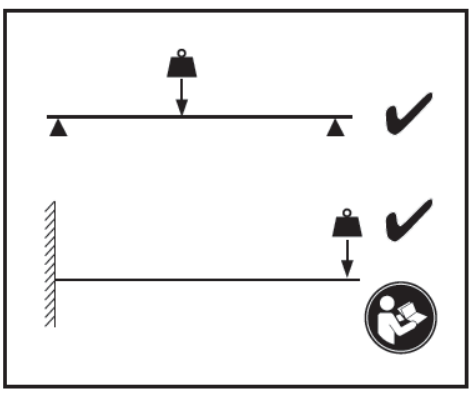
Instruction For Use:





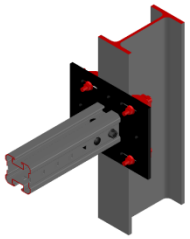
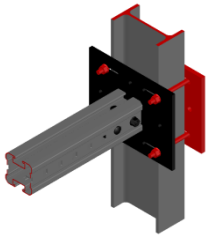






Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-AP base material connector

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

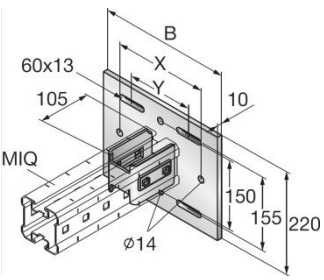
Standards and codes:

• 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

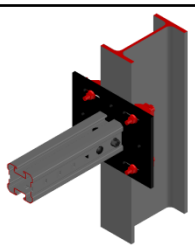
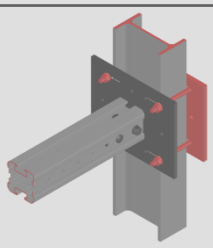
Simplified drawing:

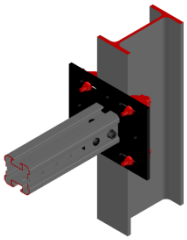


B = 280 mm
X = 200 mm
Y = 140 mm

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

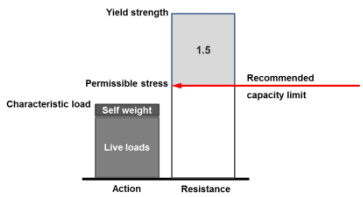
MIQC-S90-AP base material connector

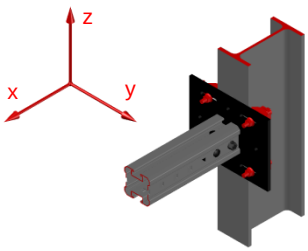
Possible loading cases		
Clamped	Boxed	
		

Loading case: Clamped	Combinations covered by loading case
BOM: **1x MIQC-S90-AP** **2120271** Base material connector incl. all connectivity material **4x MI-SGC M12** **233859** Beam clamp	Connector used for fixing MIQ girder, perpendicularly to flange (width of 75-165mm) of structural steel open section, perpendicularly to structural steel beam 

Recommended loading capacity - simplified for most common applications

Method



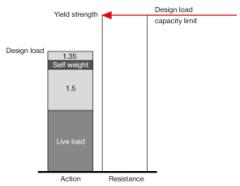


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
23.2	6.0	6.0

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

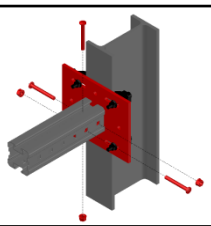
Design loading capacity - 3D 1/2

Method

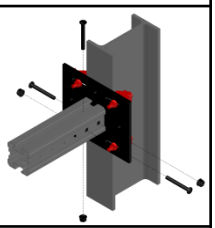


Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-S90-AP



2. Beam clamps 4x MI-SGC M12

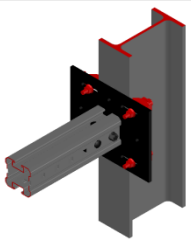
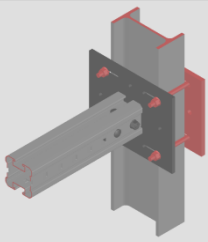


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-AP base material connector

Conditions of the loading capacity tables:

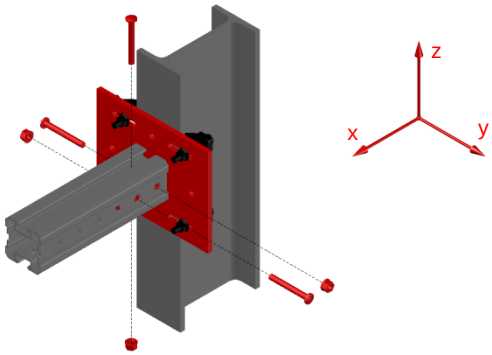
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Clamped	Boxed	
		

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 MIQC-S90-BC (Including screws MIA-OH90 connecting channel and connector and welds)

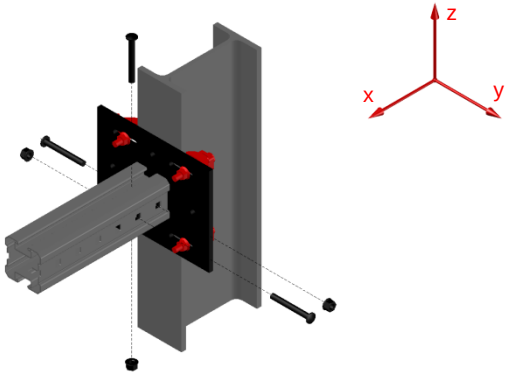


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
36.64	36.64	13.18	13.18	57.03	57.03
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.37	1.37	2.21	2.21	0.84	0.84

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. Clamps 4x MI-SGC M12



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
34.80	*	9.00	9.00	9.00	9.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.81	0.81	2.09	2.09	1.39	1.39

Interaction:

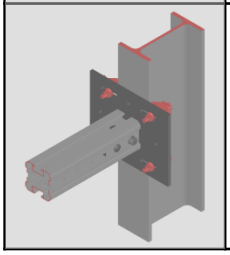
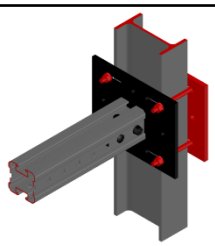
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \le 1$$

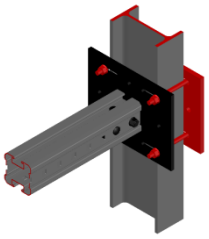
* not decisive

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

MIQC-S90-AP base material connector

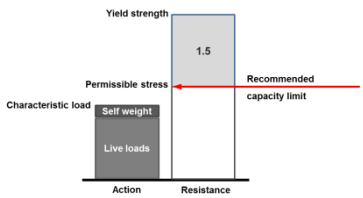
Possible loading cases

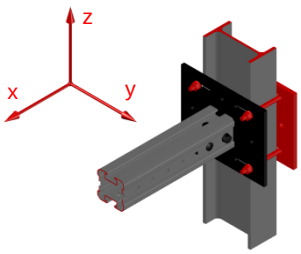
Clamped	Boxed	
		

Loading case: Boxed	Combinations covered by loading case
BOM: Base material connector incl. all connectivity material **1x MIQC-S90-AP** **2120271** Back (base) plate **1x MIQB-SB** **2123566** Threaded rods **4x AM12x1000 8.8 HDG…m** **419103** Self-locking nut **8x M12-F-SL WS3/4** **382897**	Connector used for fixing MIQ girder, perpendicularly to flange (width of 75-165mm) of structural steel open section, perpendicularly to structural steel beam 

Recommended loading capacity - simplified for most common applications

Method



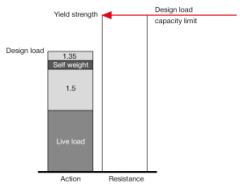


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
24.00	5.0	5.0

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

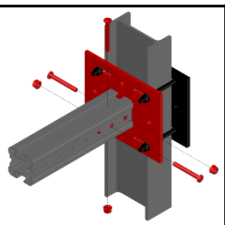
Design loading capacity - 3D 1/2

Method

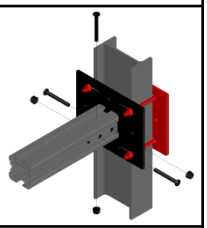


Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-S90-AP



2. Threated rods M12 / 8.8 in connection with MIQB-SA plate

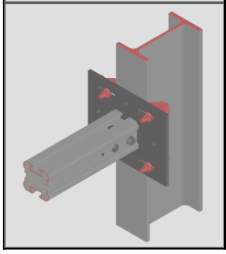
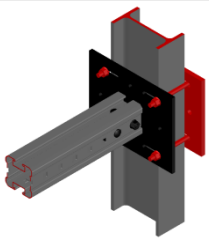


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-AP base material connector

Conditions of the loading capacity tables:

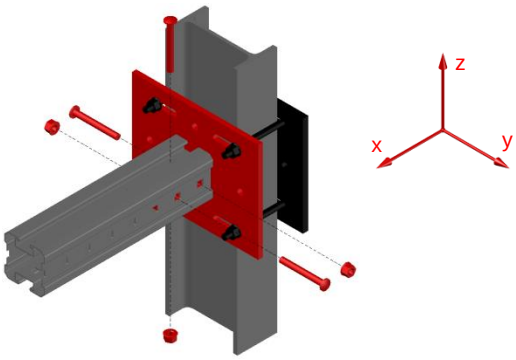
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Clamped	Boxed	
		

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 MIQC-S90-AP (Including screws MIA-OH90 connecting channel and connector and welds)

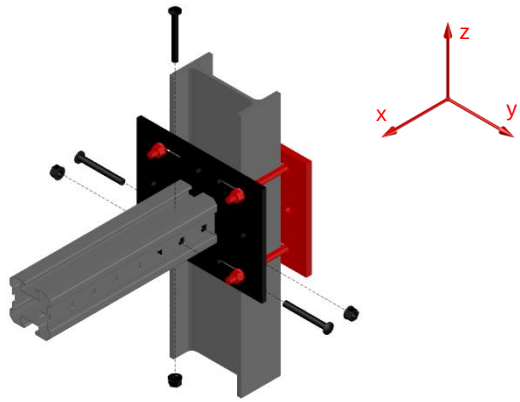


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
36.64	36.64	13.18	13.18	57.03	57.03
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.37	1.37	2.21	2.21	0.84	0.84

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. Threated rods M12 / 8.8 in connection with MIQB-SA plate



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
194.23	35.97	7.42	7.42	7.42	7.42
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.67	0.67	11.65	11.65	7.77	7.77

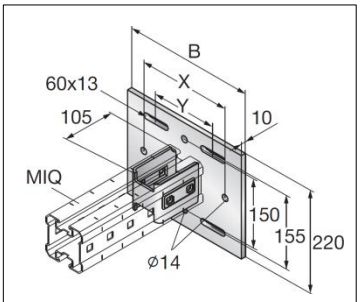
Interaction:

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

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

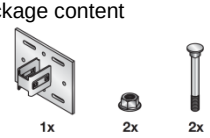
MIQC-S90-BP base material connector

Designation	Item number
MIQC-S90-BP base material connector	**2120273**



B = 350 mm
X = 300 mm
Y = 210 mm

Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 micr ons

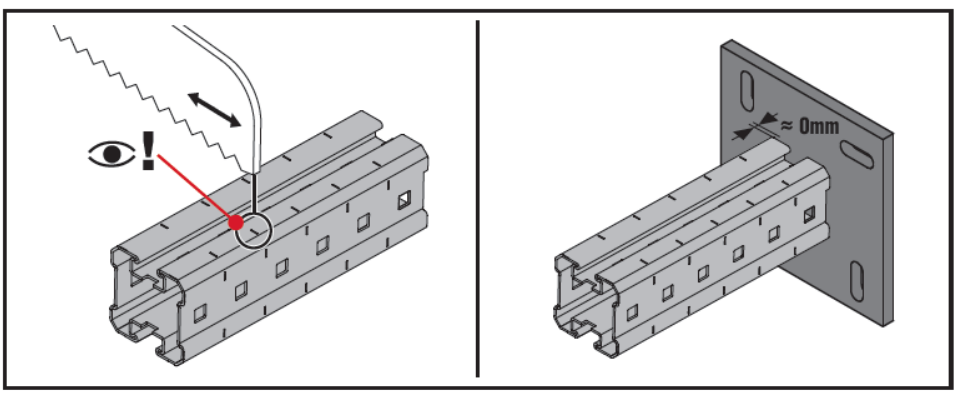
Weight:
6552g connector (6782g incl. accessories)

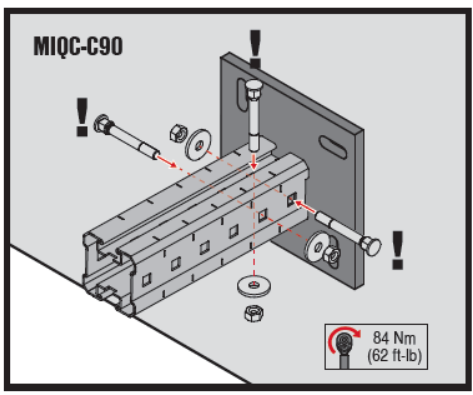
Submittal text:
Hilti base material connector, 90°, MIQ system, MIQC-S90-BP, hot dipped galvanized, base material connector typically used for connection of perpendicular Hilti MIQ girder to structural steel with open section parallel to structural steel beam. The connected girder is slid onto connection interface of the connector and through bolted by 2 pieces of MIA-OH and self locking nut (both included in the pack) in the first and second hole closest to the end of the girder, the connection to structural steel could be done either by 4 pcs of Hilti MI-SGC M12 (not in pack) beam clamps to flange (width165-235mm width) of I-beam or by boxing any structural steel profile (width 165-235mm) using Hilti backing plate MIQB-SB (not in pack) and 4x M12 Hilti threaded rods and 4x M12-F-SL WS3/4 self locking nuts (both not in pack), material weight 6782 grams incl. all connectivity material.

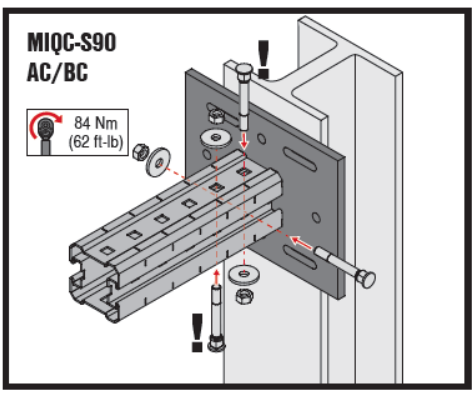
Material properties:

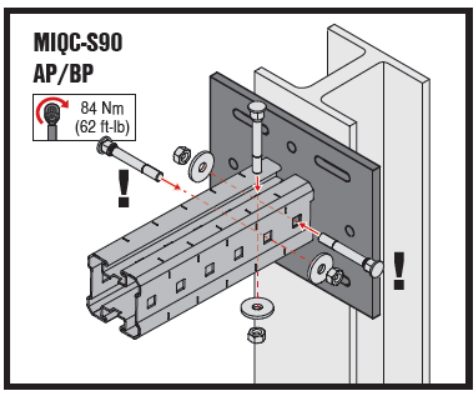
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

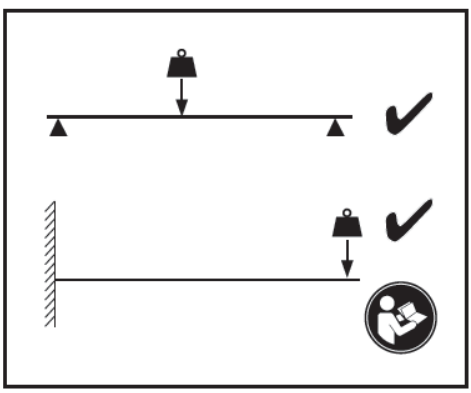
Instruction For Use:





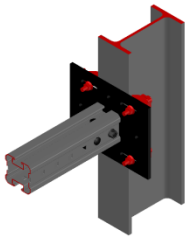
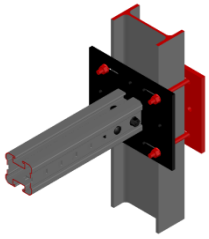






Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-BP base material connector

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Hardware tests

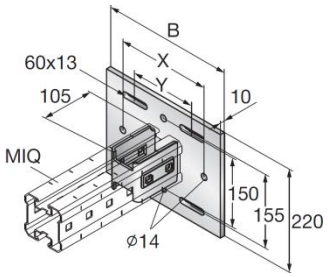
Standards and codes:

• 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

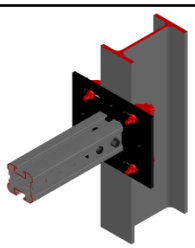
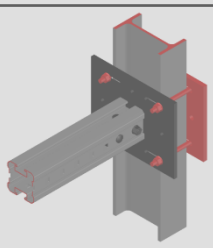
Simplified drawing:

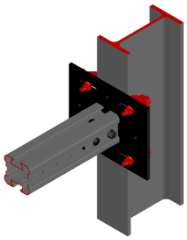


B = 350 mm
X = 300 mm
Y = 210 mm

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

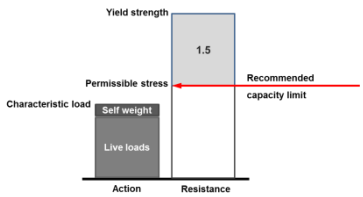
MIQC-S90-BP base material connector

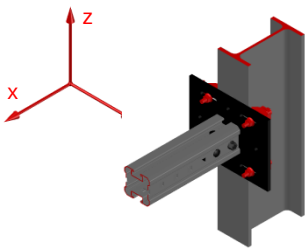
Possible loading cases		
Clamped	Boxed	
		

Loading case: Clamped	Combinations covered by loading case
BOM: Base material connector incl. all connectivity material **1x MIQC-S90-BP** **2120273** Beam clamp **4x MI-SGC M12** **233859**	Connector used for fixing MIQ girder, perpendicularly to flange (width of 75-165mm) of structural steel open section, perpendicularly to structural steel beam 

Recommended loading capacity - simplified for most common applications

Method



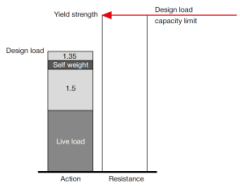


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
17.30	6.00	6.00

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

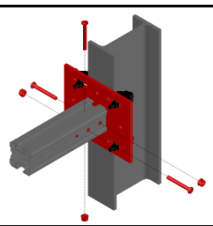
Design loading capacity - 3D 1/2

Method

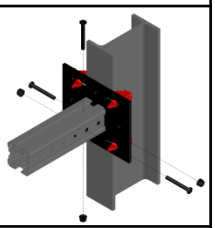


Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-S90-BP



2. Beam clamps 4x MI-SGC M12

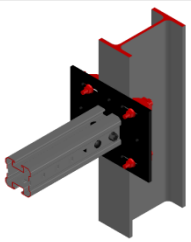
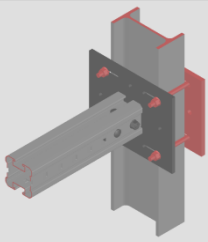


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-BP base material connector

Conditions of the loading capacity tables:

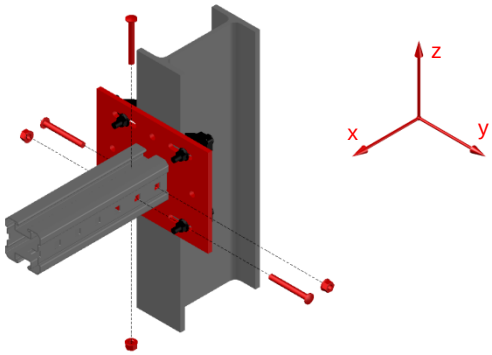
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Clamped	Boxed	
		

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 MIQC-S90-BP (Including screws MIA-OH90 connecting channel and connector and welds)

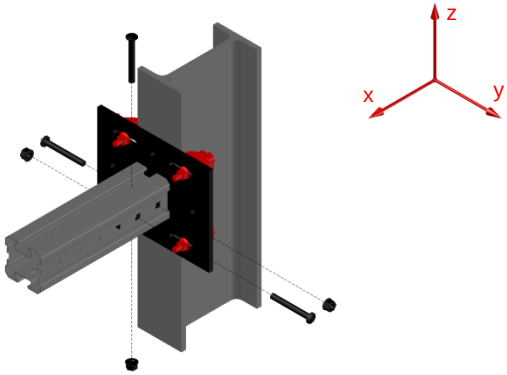


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
26.00	36.64	13.18	13.18	46.95	46.95
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.37	1.37	2.21	2.21	0.84	0.84

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. Clamps 4x MI-SGC M12



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
34.80	*	9.00	9.00	9.00	9.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.06	1.06	2.09	2.09	2.09	2.09

Interaction:

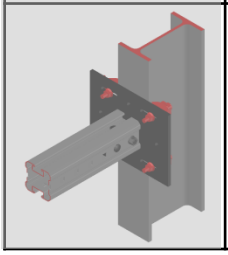
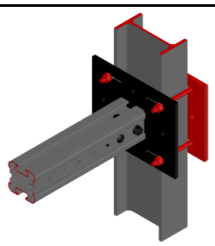
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$$

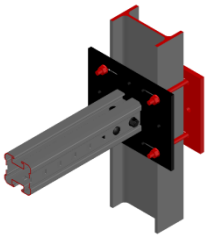
* not decisive

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

MIQC-S90-BP base material connector

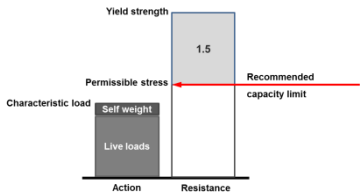
Possible loading cases

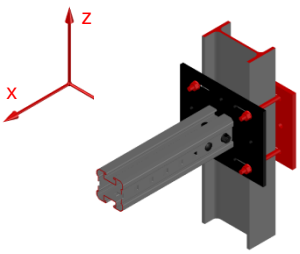
Clamped	Boxed	
		

Loading case: Boxed		Combinations covered by loading case
BOM: Base material connector incl. all connectivity material **1x MIQC-S90-BP** Back (base) plate **1x MIQB-SB** Threaded rods **4x AM12x1000 8.8 HDG…m** Self-locking nut **8x M12-F-SL WS3/4**	 **2120273** **2123566** **419103** **382897**	Connector used for fixing MIQ girder, perpendicularly to flange (width of 165-235mm) of structural steel open section, perpendicularly to structural steel beam 

Recommended loading capacity - simplified for most common applications

Method



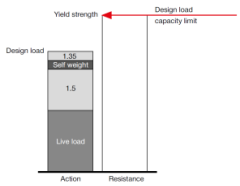


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
17.3	5.0	5.0

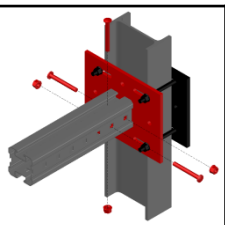
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

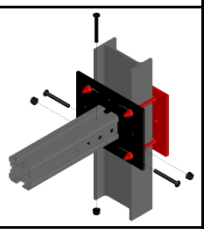
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

1. Steel connector MIQC-S90-BP 

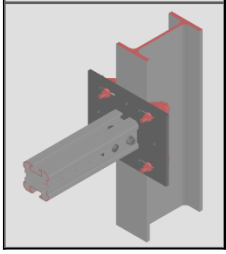
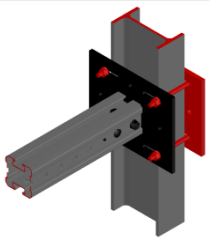
2. Threaded rods M12 / 8.8 in connection with MIQB-SB plate 

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

MIQC-S90-BP base material connector

Conditions of the loading capacity tables:

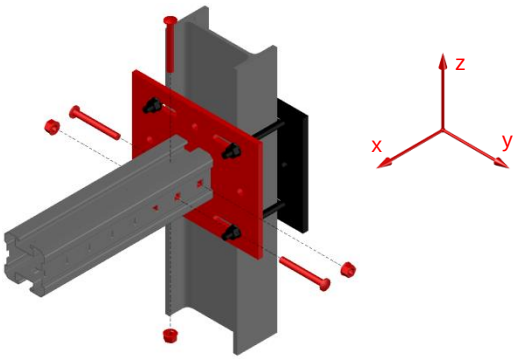
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Clamped	Boxed	
		

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 MIQC-S90-BP (Including screws MIA-OH90 connecting channel and connector and welds)

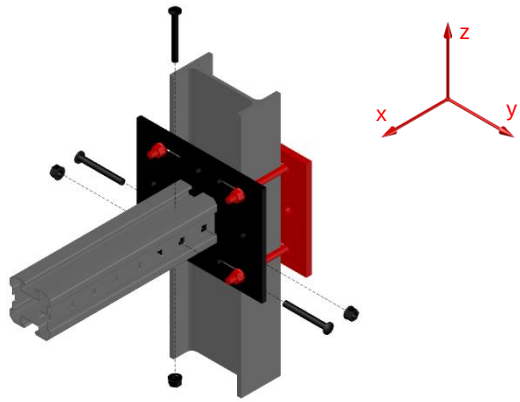


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
26.00	36.64	13.18	13.18	46.95	46.95
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.37	1.37	2.21	2.21	0.84	0.84

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. Threated rods M12 / 8.8 in connection with MIQB-SB plate



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
194.23	34.23	7.42	7.42	7.42	7.42
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.87	0.87	11.65	11.65	11.65	11.65

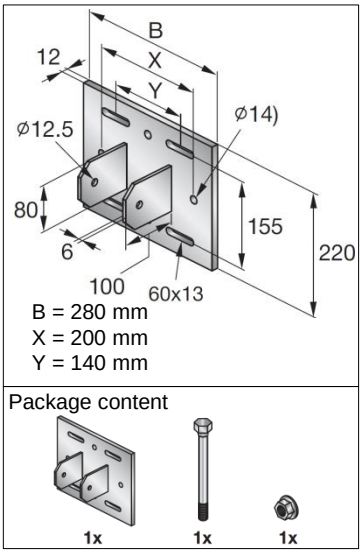
Interaction:

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

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

MIC-SA-MA Base Material Connector - Steel

Designation	Item number
MIC-SA-MA	**304815**



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

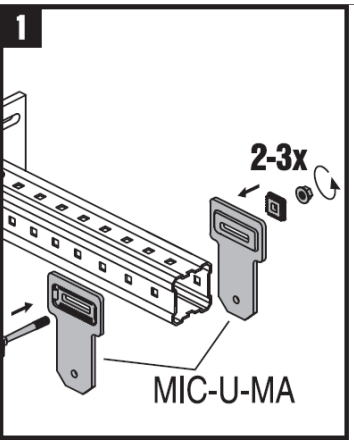
Weight:
6290 g incl. components

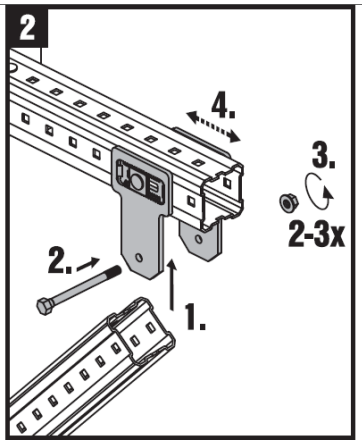
Submittal text:
Hilti Hot-dipped galvanized baseplate connector, typically used for anchoring an MIQ-90 girder to a steel beam in an angle, usually when it's used as a brace for another girder. Four oblong anchor holes enable fine tuning of baseplate position, and girder is connected using one bolt through a hole, which enables various angles.

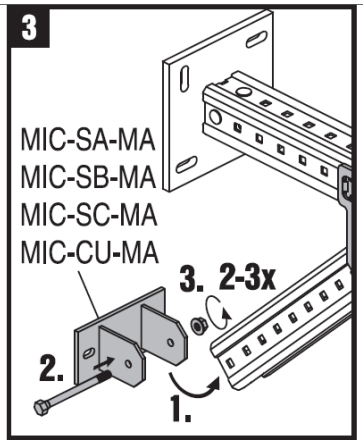
Material properties:

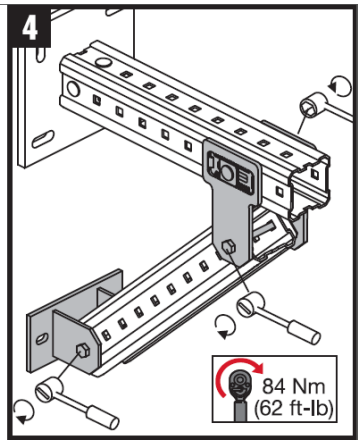
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:





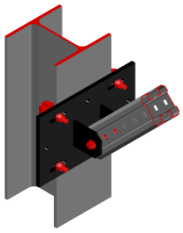
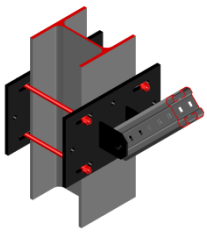




The same assembly principles and torque moments should be applied for MIQ girders

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

MIC-SA-MA Base Material Connector - Steel

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation

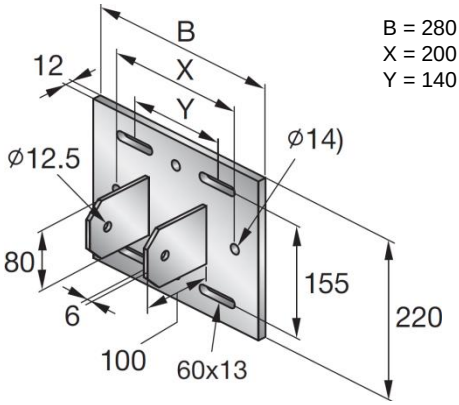
Standards and codes:

• 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

Software:
- Mathcad 15.0
- Microsoft Excel

Environmental conditions:
- indoors, outdoors
- static loads
- no fatigue loads

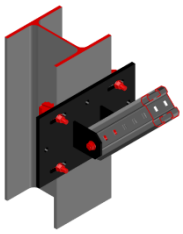
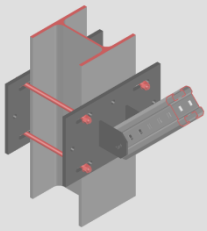
Simplified drawing:

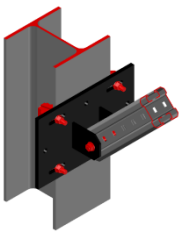
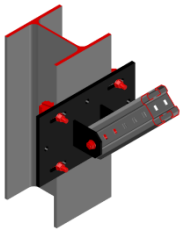


B = 280 mm
X = 200 mm
Y = 140 mm

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

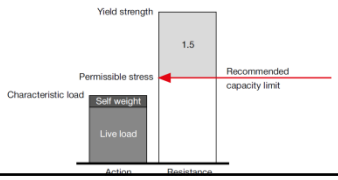
MIC-SA-MA Base Material Connector - Steel

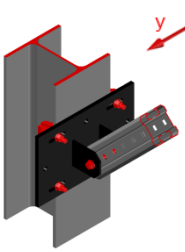
Clamped	Boxed	
		

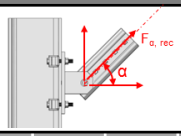
Loading case: Clamped	Combinations covered by loading case
BOM: Connector incl. all associated components **MIC-SA-MA** **304815** Beam clamps **4x MI-SGC M12** **233859** 	Connector used for an angled connection of MIQ-90 to structural steel profiles (bracing). For flange width 75-165mm. 

Recommended loading capacity - simplified for most common applications

Method







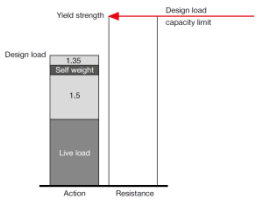
±Fy,rec. [kN]
2.15

α	0°	30°	45°	60°	90°
$\pm F_{\alpha,rec.}$ [kN]	18.30	6.92	5.49	4.82	4.66

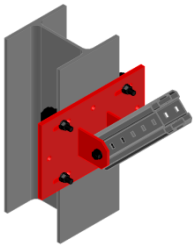
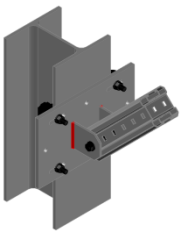
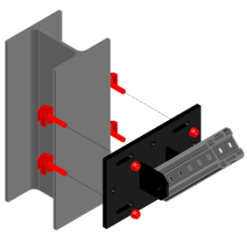
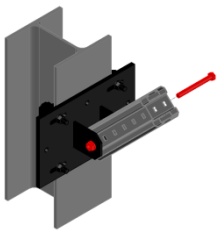
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

Design loading capacity - 3D 1/3

Method



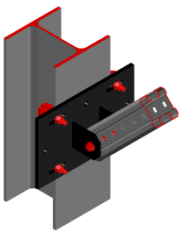
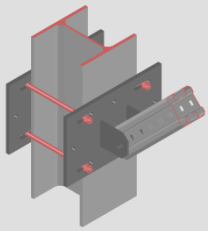
Limiting components of capacity evaluated in following tables:

1. Steel connector	2. Welds	3. Beam clamps	4. Hexagonal bolt in MIQ-girder
			

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

MIC-SA-MA Base Material Connector - Steel

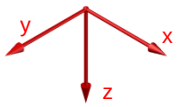
Conditions of the loading capacity tables:
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

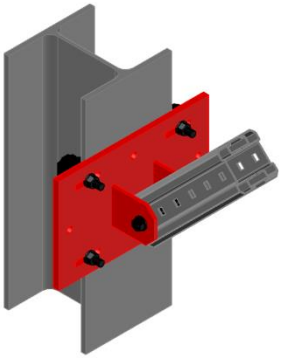
Clamped	Boxed	
		

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





The values for Mx, My and Mz take into account the eccentricity between load application at hexagonal bolt axis and baseplate.

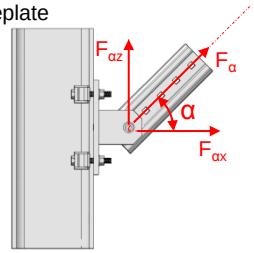
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
58.60	73.93	3.22	3.22	37.13	37.13
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.81	1.81	2.60	2.60	0.23	0.23

includes cross section resistance of steel base plate and the two flange plates Interaction for a general force Fα in plain x/z with a certain inclination α and a force Fy considering their eccentricities:

Interaction:

with ex = horizontal eccentricity between hexagonal bolt axis and baseplate

e_x=0.07m



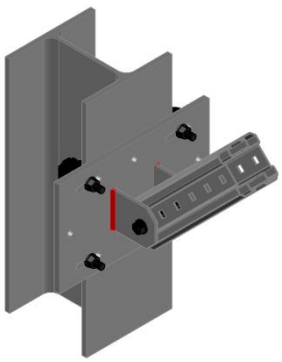
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

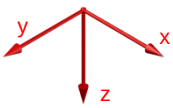
$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha$ -> $M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{...} = F_{...} * e_{...}$

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

2. Welds





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
274.92	274.92	224.47	224.47	224.47	224.47
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
10.89	10.89	3.09	3.09	13.33	13.33

Interaction:

with: e_x= 0.07m

$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha$ -> $M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

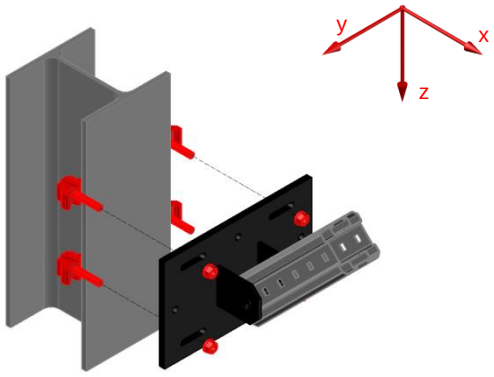
$$\frac{F_{x.Ed.\alpha}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed.\alpha}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed.\alpha}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \le 1$$

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

MIC-SA-MA Base Material Connector - Steel

Design loading capacity - 3D 3/3

3. Beam clamps



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
34.80	Not decisive	9.00	9.00	9.00	9.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.81	0.81	2.07	2.07	1.39	1.39

Interaction:

with: e_x= 0.07m

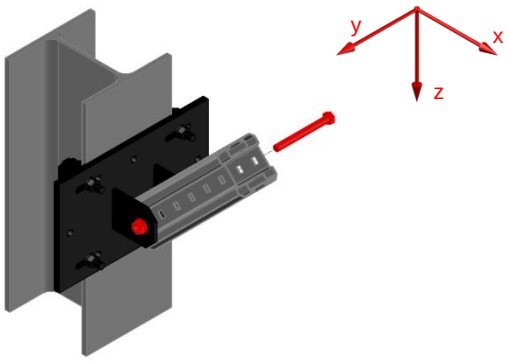
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha$ -> $M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

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

4. Hexagonal bolt in MIQ-girder



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
27.45	27.45	Not decisive	Not decisive	27.45	27.45
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.34	1.34	0.00	0.00	0.00	0.00

Interaction:

$F_{\alpha Rd} = F_{xRd} = F_{zRd}$

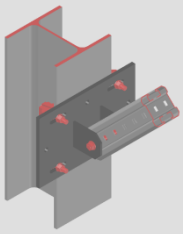
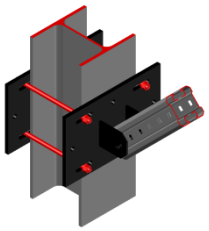
The resistance $F_{\alpha Rd}$ of the hexagon bolt is the same for each angle α in plane x/z, therefore no interaction.

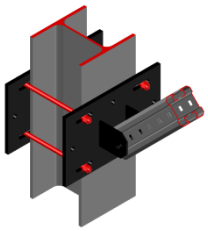
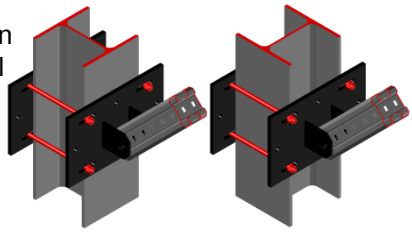
The normal force F_α in the inclined strut has to be compared with the resistance value $F_{\alpha Rd.}$

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

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

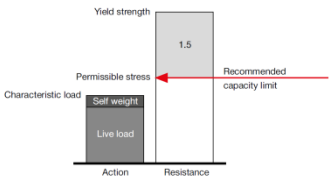
MIC-SA-MA Base Material Connector - Steel

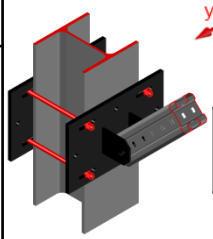
Clamped	Boxed	
		

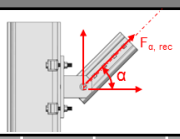
Loading case: Boxed	Combinations covered by loading case
BOM: Connector incl. all associated components **1x MIC-SA-MA 304815** **Base plate** **1x MIB-SA 304821** **Threaded rods cut to particular length** **4x AM12x1000 8.8 HDG…m 419103** **Nut** **8x M12-F-SL WS3⁄4 382897** 	Connector used for an angled connection of MI-90 to structural steel profiles (bracing). For flange width 75-165mm. 

Recommended loading capacity - simplified for most common applications

Method







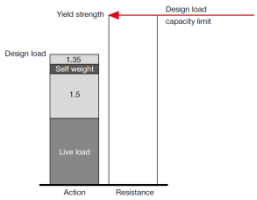
±Fy,rec. [kN]
2.15

α	0°	30°	45°	60°	90°
$\pm F_{\alpha,rec.}$ [kN]	18.30	7.77	5.95	5.10	4.74

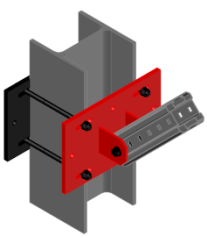
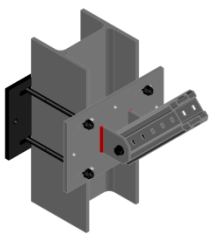
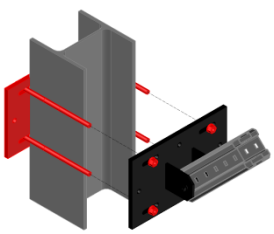
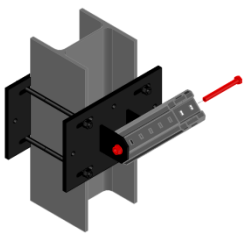
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

Design loading capacity - 3D 1/3

Method



Limiting components of capacity evaluated in following tables:

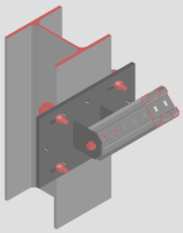
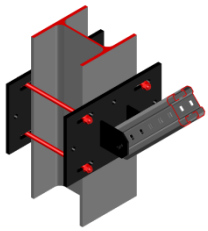
1. Steel connector	2. Welds	3. Back plate with bolts	4. Hexagonal bolt in MI channel
			

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

MIC-SA-MA Base Material Connector - Steel

Conditions of the loading capacity tables:

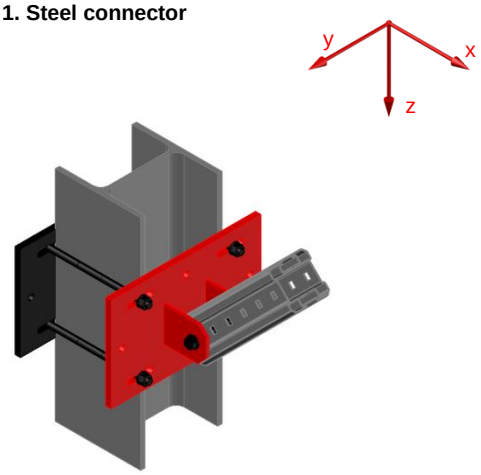
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Clamped	Boxed	
		

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



The values for Mx, My and Mz take into account the eccentricity between load application at hexagonal bolt axis and baseplate.

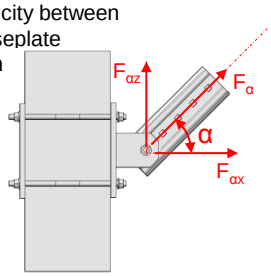
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
58.60	73.93	3.22	3.22	37.13	37.13
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.81	1.81	2.60	2.60	0.23	0.23

includes cross section resistance of steel base plate and the two flange plates Interaction for a general force Fα in plain x/z with a certain inclination α and a force Fy considering their eccentricities:

Interaction:

with ex = horizontal eccentricity between hexagonal bolt axis and baseplate

e_x=0.07m



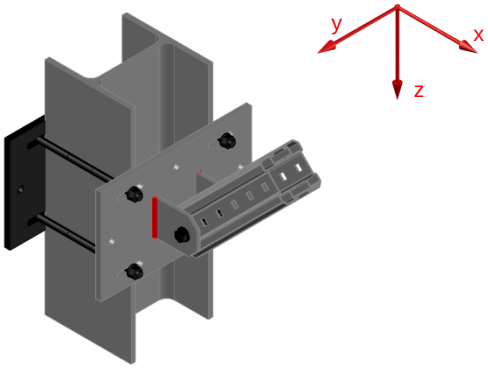
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha \rightarrow M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

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

2. Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
274.92	274.92	224.47	224.47	224.47	224.47
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
10.89	10.89	3.09	3.09	13.33	13.33

Interaction: **with: e_x= 0.07m**

$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha \rightarrow M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{v.Ed} * e_x$

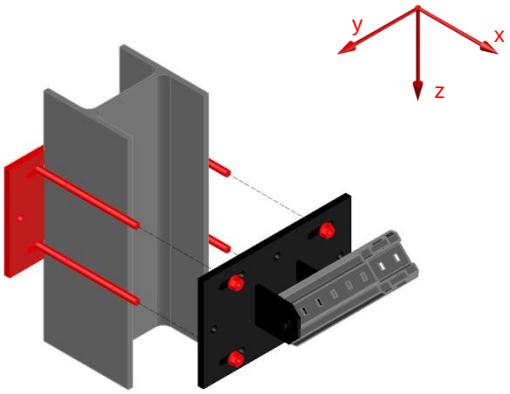
$$\frac{F_{x.Ed.\alpha}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed.\alpha}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed.\alpha}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \le 1$$

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

MIC-SA-MA Base Material Connector - Steel

Design loading capacity - 3D 3/3

3. Back plate with bolts



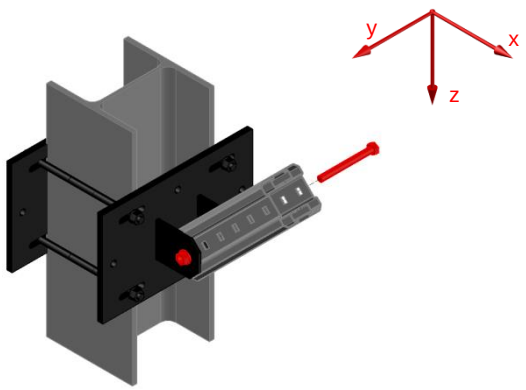
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
194.23	56.07	7.42	7.42	7.42	7.42
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.67	0.67	11.56	11.56	7.77	7.77

Interaction::

with: e_x= 0.07m
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$
$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha$ -> $M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$
$M_{z.Ed} = F_{y.Ed} * e_x$

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

4. Hexagonal bolt in MIQ-girder



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
27.45	27.45	Not decisive	Not decisive	27.45	27.45
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.34	1.34	0.00	0.00	0.00	0.00

Interaction:

$F_{\alpha Rd} = F_{xRd} = F_{zRd}$

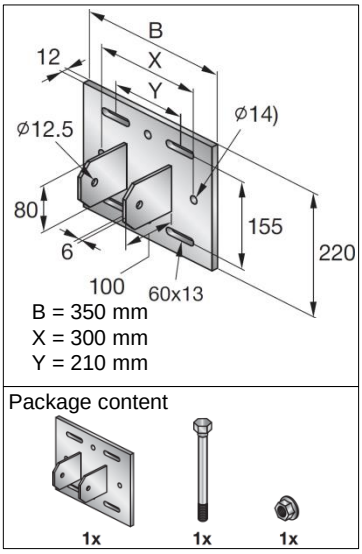
The resistance $F_{\alpha Rd}$ of the hexagon bolt is the same for each angle α in plane x/z, therefore no interaction.
The normal force F_α in the inclined strut has to be compared with the resistance value $F_{\alpha Rd.}$

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

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

MIC-SB-MA Base Material Connector - Steel

Designation	Item number
MIC-SB-MA	**304816**



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

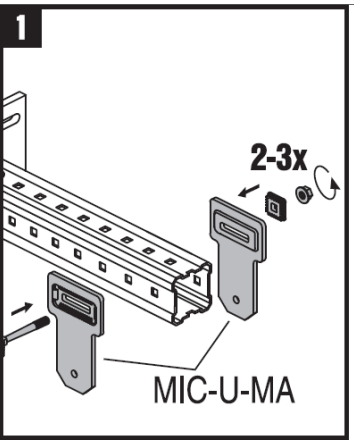
Weight:
7740 g incl. components

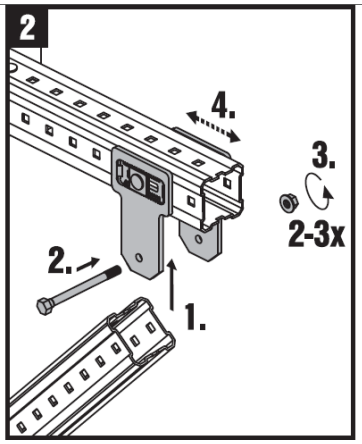
Submittal text:
Hilti Hot-dipped galvanized baseplate connector, typically used for anchoring an MIQ-90 girder to a steel beam in an angle, usually when it's used as a brace for another girder. Four oblong anchor holes enable fine tuning of baseplate position, and girder is connected using one bolt through a hole, which enables various angles.

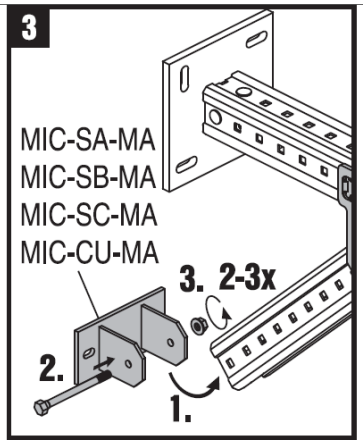
Material properties:

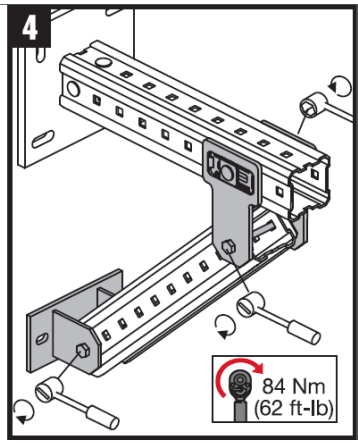
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:





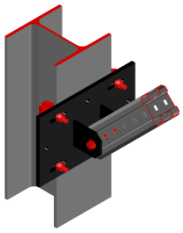
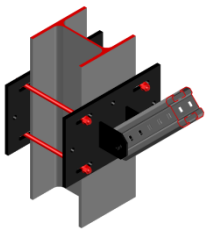




The same assembly principles and torque moments should be applied for MIQ girders

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

MIC-SB-MA Base Material Connector - Steel

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation

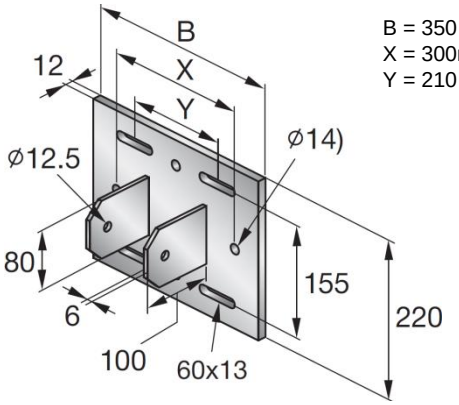
Standards and codes:

• 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

Software:
- Mathcad 15.0
- Microsoft Excel

Environmental conditions:
- indoors, outdoors
- static loads
- no fatigue loads

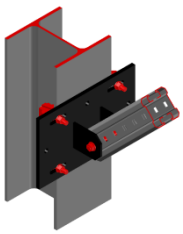
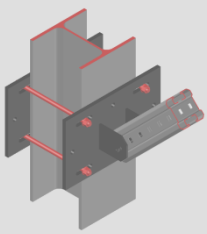
Simplified drawing:



B = 350 mm
X = 300mm
Y = 210 mm

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

MIC-SB-MA Base Material Connector - Steel

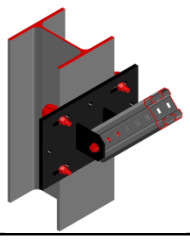
Clamped	Boxed	
		

Loading case: Clamped

BOM:

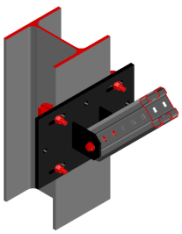
Connector incl. all associated components

MIC-SB-MA	**304816**
Beam clamps	
4x MI-SGC M12	**233859**



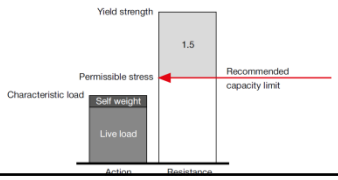
Combinations covered by loading case

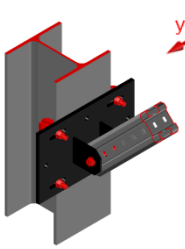
Connector used for an angled connection of MI-90 to structural steel profiles (bracing).
For flange width 165-235mm.

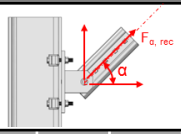


Recommended loading capacity - simplified for most common applications

Method







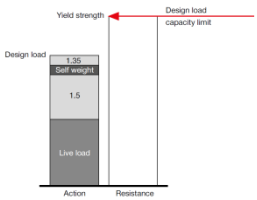
±Fy,rec. [kN]
2.15

α	0°	30°	45°	60°	90°
$\pm F_{\alpha,rec.}$ [kN]	18.30	6.92	5.49	4.82	4.66

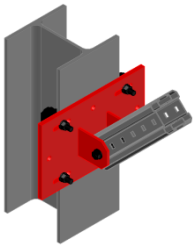
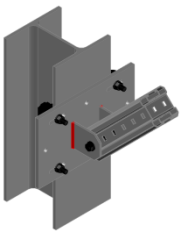
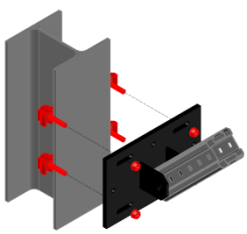
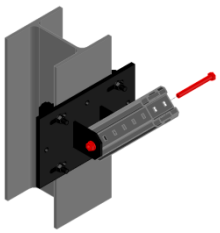
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

Design loading capacity - 3D 1/3

Method



Limiting components of capacity evaluated in following tables:

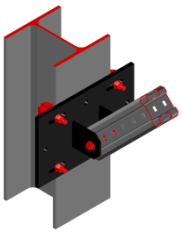
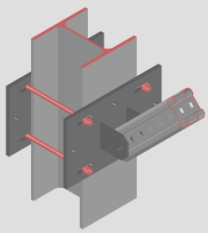
1. Steel connector	2. Welds	3. Beam clamps	4. Hexagonal bolt in MIQ-girder
			

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

MIC-SB-MA Base Material Connector - Steel

Conditions of the loading capacity tables:

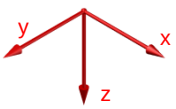
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

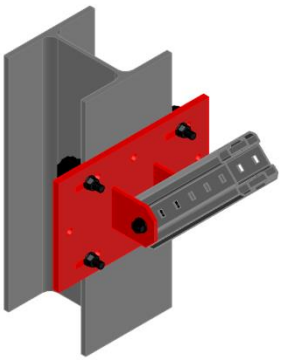
Clamped	Boxed	
		

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





The values for Mx, My and Mz take into account the eccentricity between load application at hexagonal bolt axis and baseplate.

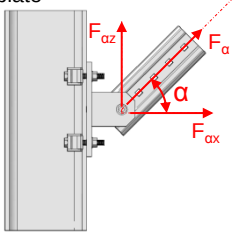
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
43.19	50.50	3.22	3.22	23.25	23.25
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.13	1.13	1.63	1.63	0.23	0.23

includes cross section resistance of steel base plate and the two flange plates Interaction for a general force Fα in plain x/z with a certain inclination α and a force Fy considering their eccentricities:

Interaction:

with ex = horizontal eccentricity between hexagonal bolt axis and baseplate

e_x=0.07m



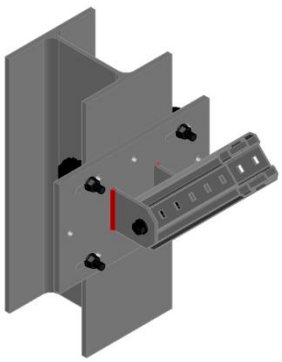
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

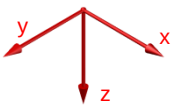
$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha \rightarrow M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

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

2. Welds





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
274.92	274.92	224.47	224.47	224.47	224.47
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
10.89	10.89	3.09	3.09	13.33	13.33

Interaction:

with: e_x= 0.07m

$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha \rightarrow M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

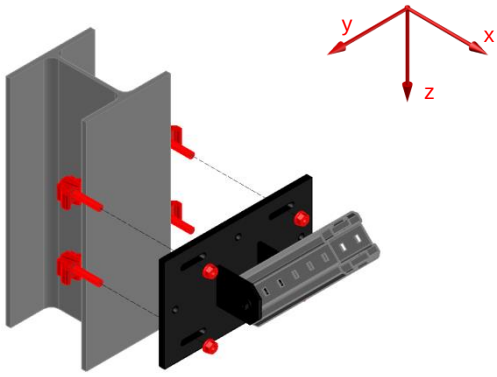
$$\frac{F_{x.Ed.\alpha}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed.\alpha}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed.\alpha}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$$

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

MIC-SB-MA Base Material Connector - Steel

Design loading capacity - 3D 3/3

3. Beam clamps



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
34.80	Not decisive	9.00	9.00	9.00	9.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.06	1.06	2.07	2.07	2.80	2.80

Interaction:

with: e_x= 0.07m

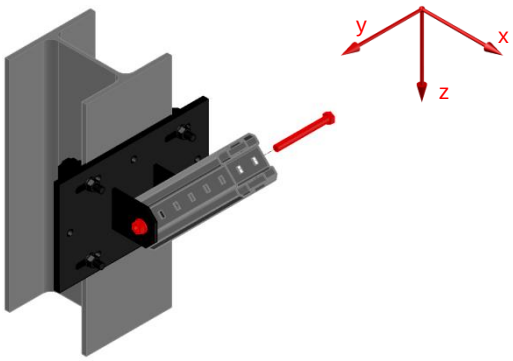
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha$ -> $M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

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

4. Hexagonal bolt in MIQ-girder



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
27.45	27.45	Not decisive	Not decisive	27.45	27.45
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.34	1.34	0.00	0.00	0.00	0.00

Interaction:

$F_{\alpha Rd} = F_{xRd} = F_{zRd}$

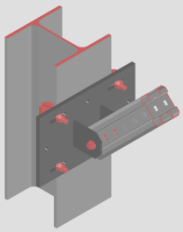
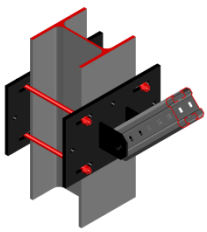
The resistance $F_{\alpha Rd}$ of the hexagon bolt is the same for each angle α in plane x/z, therefore no interaction.

The normal force F_α in the inclined strut has to be compared with the resistance value $F_{\alpha Rd.}$

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

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

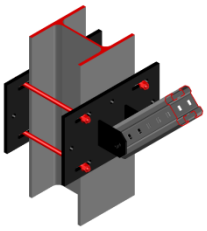
MIC-SB-MA Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Boxed

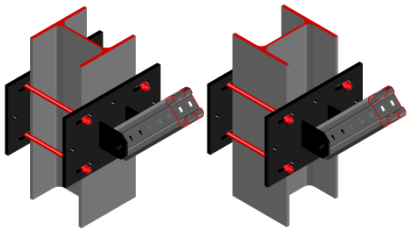
BOM:
Connector incl. all associated components

1x MIC-SB-MA	**304816**
Base plate	
1x MIB-SB	**304822**
Threaded rods cut to particular length	
4x AM12x1000 8.8 HDG…m	**419103**
Nut	
8x M12-F-SL WS3⁄4	**382897**



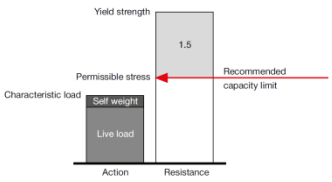
Combinations covered by loading case

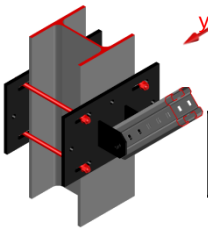
Connector used for an angled connection of MI-90 to structural steel profiles (bracing).
For flange width 165-235mm.

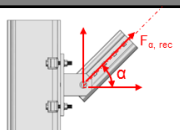


Recommended loading capacity - simplified for most common applications

Method







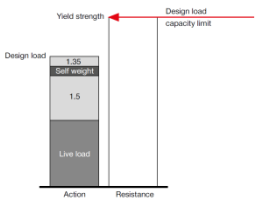
±Fy,rec. [kN]
2.15

α	0°	30°	45°	60°	90°
$\pm F_{\alpha,rec.}$ [kN]	18.30	7.34	5.74	4.99	4.74

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

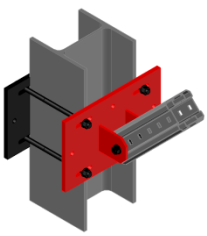
Design loading capacity - 3D 1/3

Method

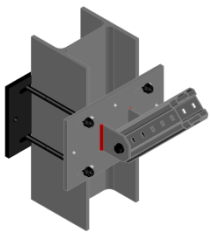


Limiting components of capacity evaluated in following tables:

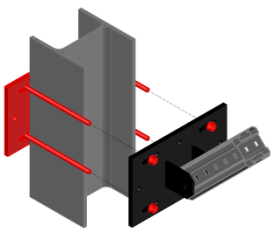
1. Steel connector



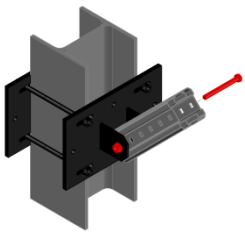
2. Welds



3. Back plate with bolts



4. Hexagonal bolt in MIQ-girder

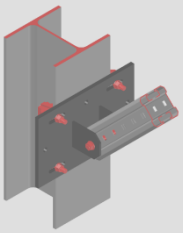
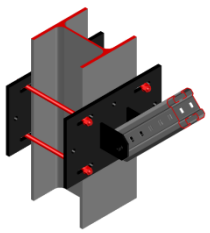


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIC-SB-MA Base Material Connector - Steel

Conditions of the loading capacity tables:

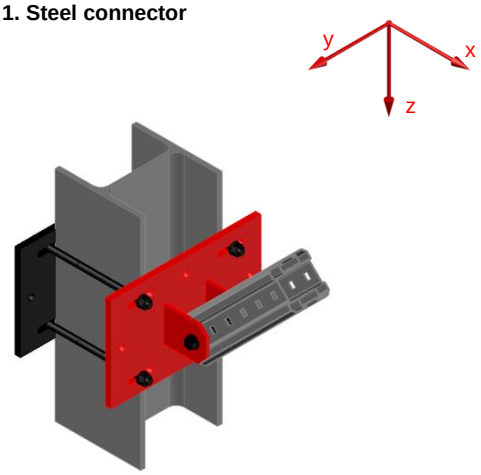
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Clamped	Boxed	
		

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



The values for Mx, My and Mz take into account the eccentricity between load application at hexagonal bolt axis and baseplate.

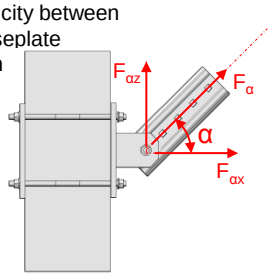
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
43.19	50.50	3.22	3.22	23.25	23.25
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.13	1.13	1.63	1.63	0.23	0.23

includes cross section resistance of steel base plate and the two flange plates Interaction for a general force Fα in plain x/z with a certain inclination α and a force Fy considering their eccentricities:

Interaction:

with ex = horizontal eccentricity between hexagonal bolt axis and baseplate

e_x=0.07m



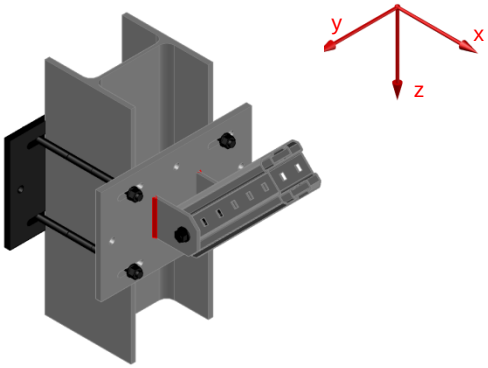
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha \rightarrow M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

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

2. Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
274.92	274.92	224.47	224.47	224.47	224.47
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
10.89	10.89	3.09	3.09	13.33	13.33

Interaction: **with:** e_x= 0.07m

$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha \rightarrow M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

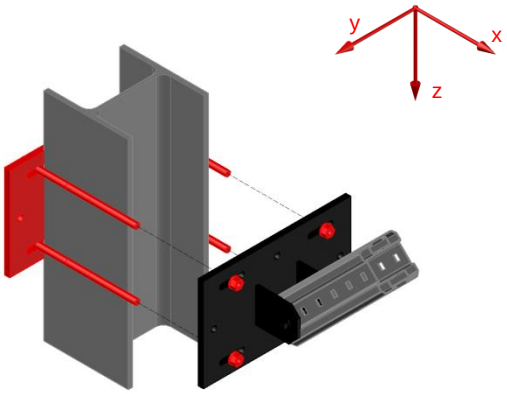
$$\frac{F_{x.Ed.\alpha}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed.\alpha}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed.\alpha}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$$

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

MIC-SB-MA Base Material Connector - Steel

Design loading capacity - 3D 3/3

3. Back plate with bolts



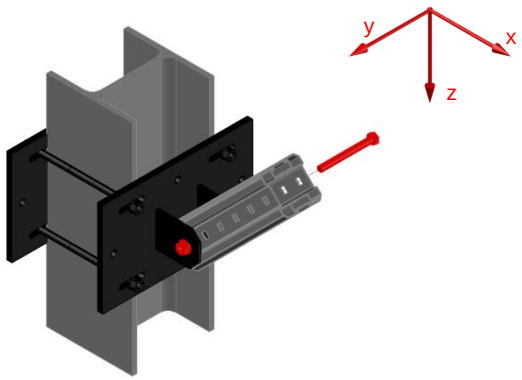
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
194.23	42.26	7.42	7.42	7.42	7.42
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.88	0.88	11.56	11.56	15.64	15.64

Interaction::

with: e_x= 0.07m
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$
$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha$ -> $M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$
$M_{z.Ed} = F_{y.Ed} * e_x$

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

4. Hexagonal bolt in MI channel



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
27.45	27.45	Not decisive	Not decisive	27.45	27.45
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.34	1.34	0.00	0.00	0.00	0.00

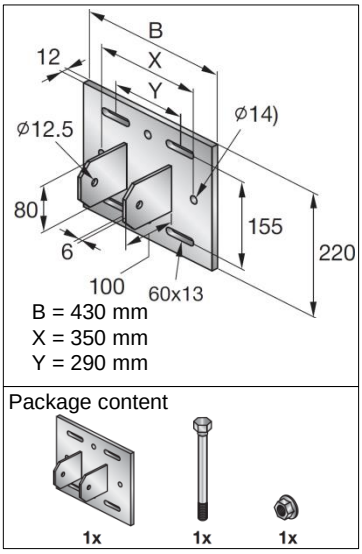
Interaction:
$F_{\alpha Rd} = F_{xRd} = F_{zRd}$
The resistance $F_{\alpha Rd}$ of the hexagon bolt is the same for each angle α in plane x/z, therefore no interaction.
The normal force F_α in the inclined strut has to be compared with the resistance value $F_{\alpha Rd.}$

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

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

MIC-SC-MA Base Material Connector - Steel

Designation	Item number
MIC-SC-MA	**304817**



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 microns

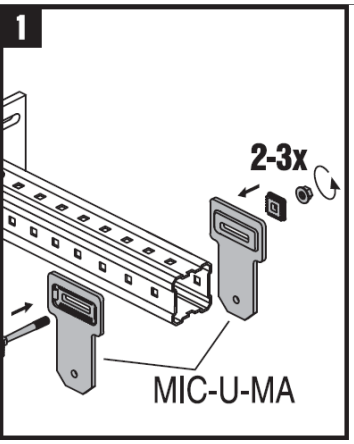
Weight:
9400 g incl. components

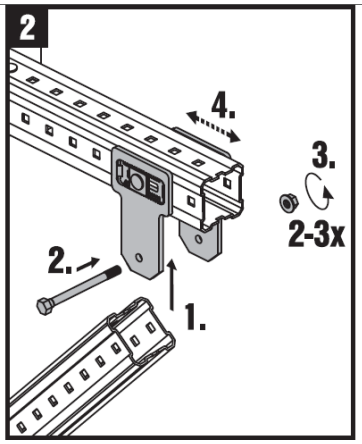
Submittal text:
Hilti Hot-dipped galvanized baseplate connector, typically used for anchoring an MI-90 and MIQ-90 girders to a steel beam in an angle, usually when it's used as a brace for another girder. Four oblong anchor holes enable fine tuning of baseplate position, and girder is connected using one bolt through a hole, which enables various angles.

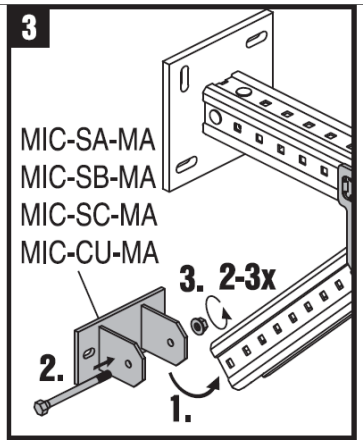
Material properties:

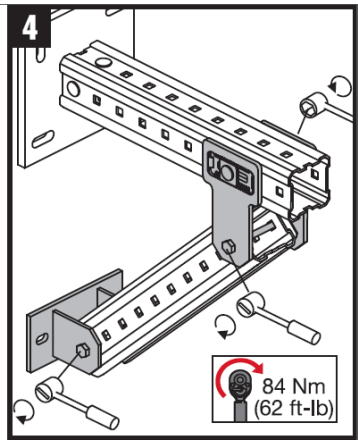
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:





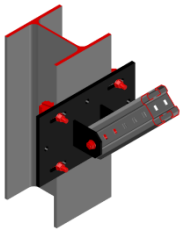
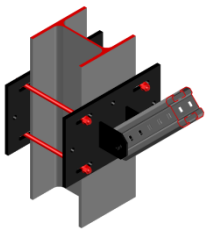




The same assembly principles and torque moments should be applied for MIQ girders

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

MIC-SC-MA Base Material Connector - Steel

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation

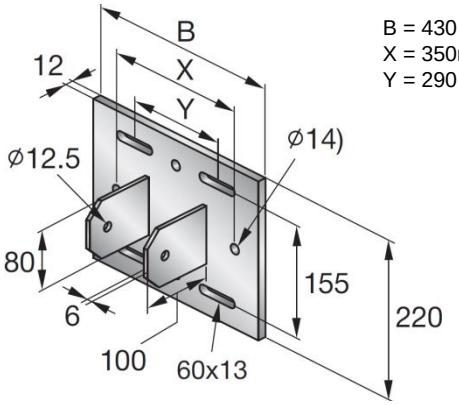
Standards and codes:

• 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

Software:
- Mathcad 15.0
- Microsoft Excel

Environmental conditions:
- indoors, outdoors
- static loads
- no fatigue loads

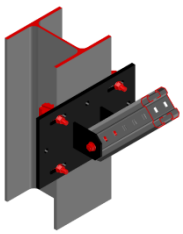
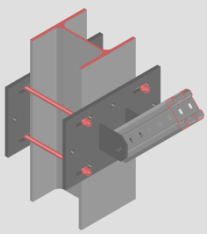
Simplified drawing:

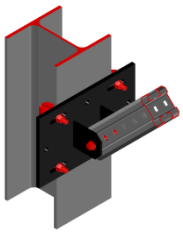
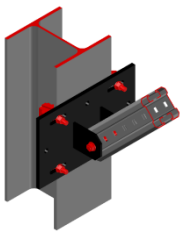


B = 430 mm
X = 350mm
Y = 290 mm

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

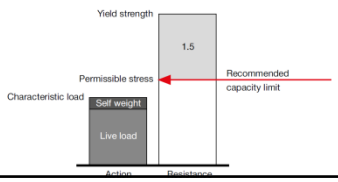
MIC-SC-MA Base Material Connector - Steel

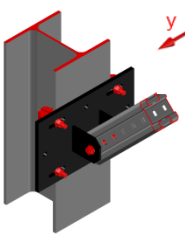
Clamped	Boxed	
		

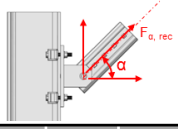
Loading case: Clamped	Combinations covered by loading case
BOM: Connector incl. all associated components **MIC-SC-MA** **304817** Beam clamps **4x MI-SGC M12** **233859** 	Connector used for an angled connection of MI-90 to structural steel profiles (bracing). For flange width 235-300mm. 

Recommended loading capacity - simplified for most common applications

Method







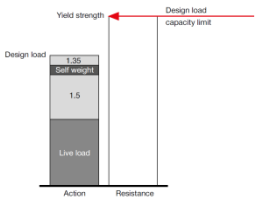
±Fy,rec. [kN]
2.15

α	0°	30°	45°	60°	90°
$\pm F_{\alpha,rec.}$ [kN]	18.30	6.92	5.49	4.82	4.66

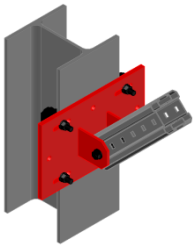
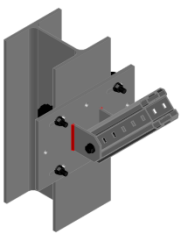
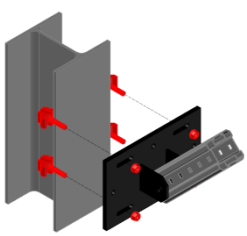
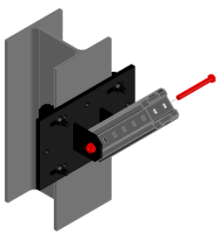
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

Design loading capacity - 3D 1/3

Method



Limiting components of capacity evaluated in following tables:

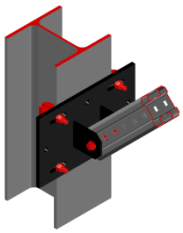
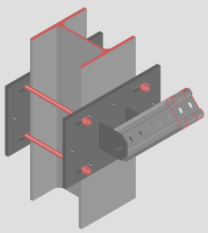
1. Steel connector	2. Welds	3. Beam clamps	4. Hexagonal bolt in MIQ-girder
			

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

MIC-SC-MA Base Material Connector - Steel

Conditions of the loading capacity tables:

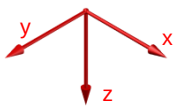
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

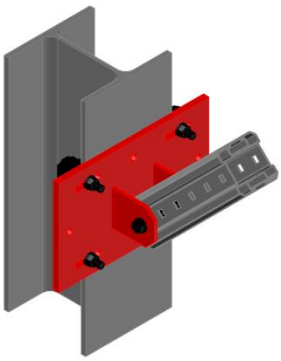
Clamped	Boxed	
		

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





The values for Mx, My and Mz take into account the eccentricity between load application at hexagonal bolt axis and baseplate.

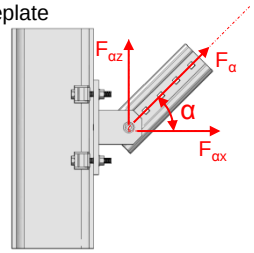
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
34.47	38.38	3.22	3.22	15.78	15.78
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.77	0.77	1.10	1.10	0.23	0.23

includes cross section resistance of steel base plate and the two flange plates Interaction for a general force Fα in plain x/z with a certain inclination α and a force Fy considering their eccentricities:

Interaction:

with ex = horizontal eccentricity between hexagonal bolt axis and baseplate

e_x=0.07m



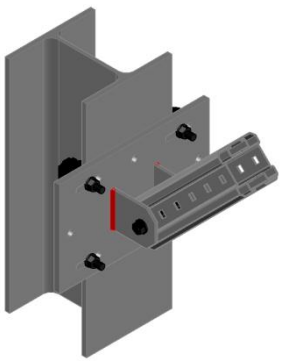
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

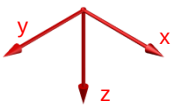
$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha$ -> $M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

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

2. Welds





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
274.92	274.92	224.47	224.47	224.47	224.47
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
10.89	10.89	3.09	3.09	13.33	13.33

Interaction:

with: e_x= 0.07m

$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha$ -> $M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

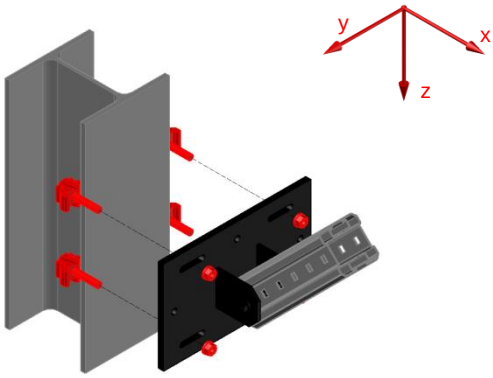
$$\frac{F_{x.Ed.\alpha}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed.\alpha}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed.\alpha}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \le 1$$

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

MIC-SC-MA Base Material Connector - Steel

Design loading capacity - 3D 3/3

3. Beam clamps



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
34.80	Not decisive	9.00	9.00	9.00	9.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.31	1.31	2.07	2.07	4.51	4.51

Interaction:

with: e_x= 0.07m

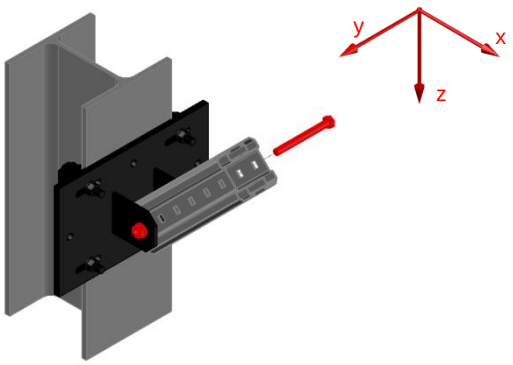
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha$ -> $M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

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

4. Hexagonal bolt in MIQ-girder



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
27.45	27.45	Not decisive	Not decisive	27.45	27.45
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.34	1.34	0.00	0.00	0.00	0.00

Interaction:

$F_{\alpha Rd} = F_{xRd} = F_{zRd}$

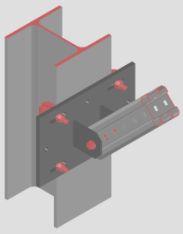
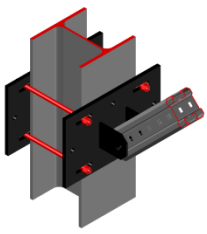
The resistance $F_{\alpha Rd}$ of the hexagon bolt is the same for each angle α in plane x/z, therefore no interaction.

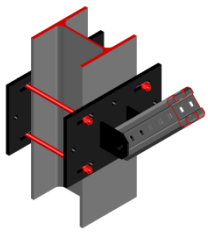
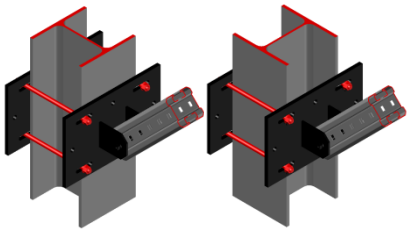
The normal force F_α in the inclined strut has to be compared with the resistance value $F_{\alpha Rd.}$

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

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

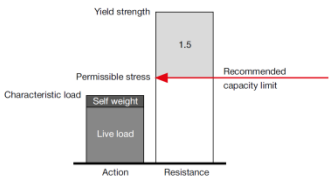
MIC-SC-MA Base Material Connector - Steel

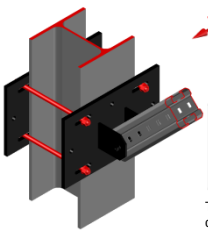
Clamped	Boxed	
		

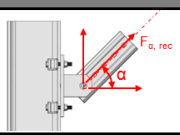
Loading case: Boxed	Combinations covered by loading case
BOM: Connector incl. all associated components **1x MIC-SC-MA 304817** **Base plate** **1x MIB-SC 304823** **Threaded rods cut to particular length** **4x AM12x1000 8.8 HDG…m 419103** **Nut** **8x M12-F-SL WS3⁄4 382897** 	Connector used for an angled connection of MI-90 to structural steel profiles (bracing). For flange width 235-300mm. 

Recommended loading capacity - simplified for most common applications

Method







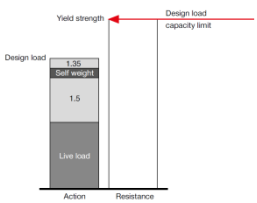
±Fy,rec. [kN]
2.15

α	0°	30°	45°	60°	90°
±$F_{α,rec.}$ [kN]	18.30	6.91	5.51	4.87	4.74

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

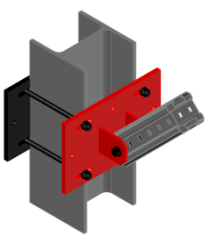
Design loading capacity - 3D 1/3

Method

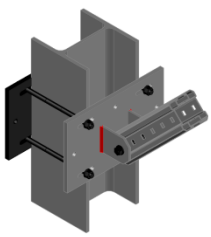


Limiting components of capacity evaluated in following tables:

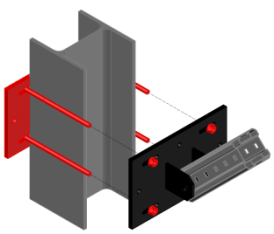
1. Steel connector



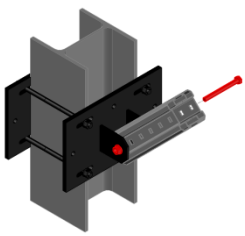
2. Welds



3. Back plate with bolts



4. Hexagonal bolt in MI channel

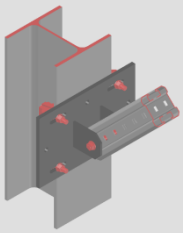
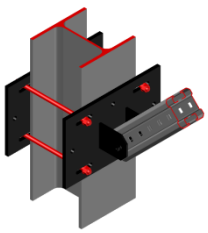


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIC-SC-MA Base Material Connector - Steel

Conditions of the loading capacity tables:

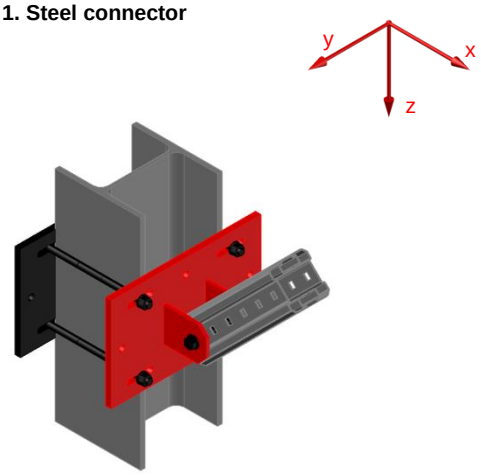
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Clamped	Boxed	
		

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



The values for Mx, My and Mz take into account the eccentricity between load application at hexagonal bolt axis and baseplate.

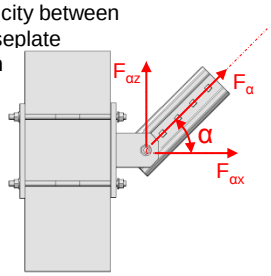
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
34.47	38.38	3.22	3.22	15.78	15.78
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.77	0.77	1.10	1.10	0.23	0.23

includes cross section resistance of steel base plate and the two flange plates Interaction for a general force Fα in plain x/z with a certain inclination α and a force Fy considering their eccentricities:

Interaction:

with ex = horizontal eccentricity between hexagonal bolt axis and baseplate

e_x=0.07m



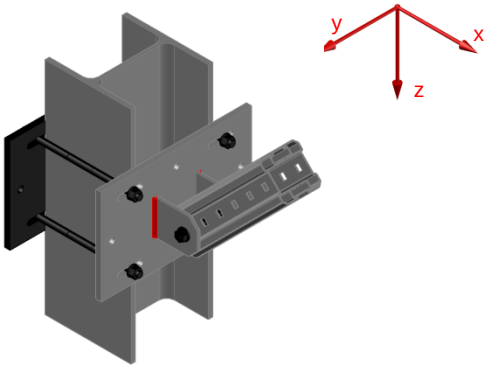
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha \rightarrow M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

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

2. Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
274.92	274.92	224.47	224.47	224.47	224.47
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
10.89	10.89	3.09	3.09	13.33	13.33

Interaction: **with:** **e_x= 0.07m**

$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha \rightarrow M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

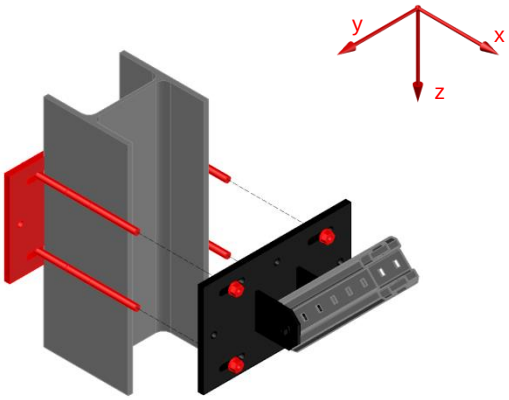
$$\frac{F_{x.Ed.\alpha}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed.\alpha}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed.\alpha}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$$

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

MIC-SC-MA Base Material Connector - Steel

Design loading capacity - 3D 3/3

3. Back plate with bolts



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
194.23	33.10	7.42	7.42	7.42	7.42
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.08	1.08	11.56	11.56	25.15	25.15

Interaction::

with: e_x= 0.07m

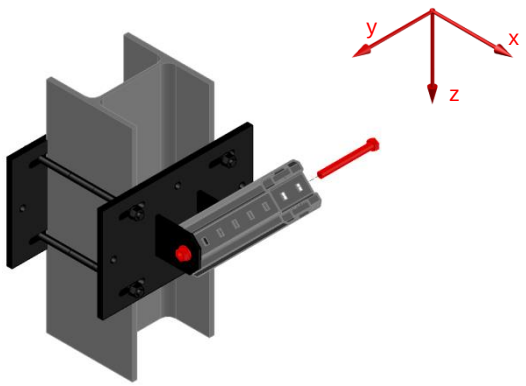
$F_{x.Ed.\alpha} = F_\alpha * \cos\alpha$

$F_{z.Ed.\alpha} = F_\alpha * \sin\alpha$ -> $M_{y.Ed.\alpha} = F_{z.Ed.\alpha} * e_x$

$M_{z.Ed} = F_{y.Ed} * e_x$

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

4. Hexagonal bolt in MIQ-girder



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
27.45	27.45	Not decisive	Not decisive	27.45	27.45
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.34	1.34	0.00	0.00	0.00	0.00

Interaction:

$F_{\alpha Rd} = F_{xRd} = F_{zRd}$

The resistance $F_{\alpha Rd}$ of the hexagon bolt is the same for each angle α in plane x/z, therefore no interaction.

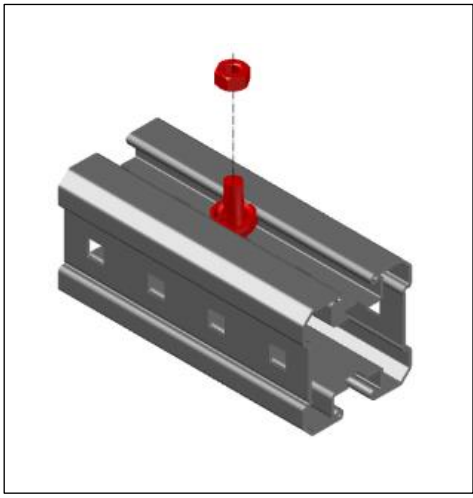
The normal force F_α in the inclined strut has to be compared with the resistance value $F_{\alpha Rd.}$

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

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

MIQA-T T-head bolt - accessories

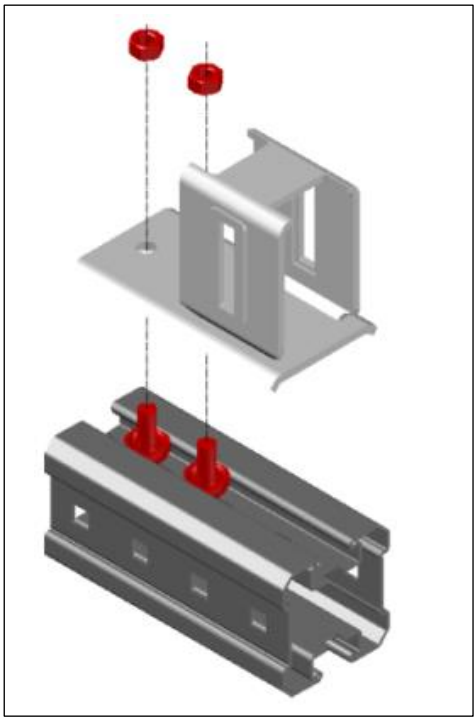
Designation	Item number
MIQA-T T-head bolt	**2120142**



	±Fx,rec. [kN]	±Fz,rec. [kN]
Recommended loading capacity	6.20	11.70

	±Fx,Rd. [kN]	±Fz,Rd. [kN]
Design loading capacity	9.30	17.55

Designation	Item number
2x MIQA-T T-head bolt	**2120142**



	±Fx,rec. [kN]	±Fz,rec. [kN]
Recommended loading capacity	11.20	23.40

	±Fx,Rd. [kN]	±Fz,Rd. [kN]
Design loading capacity	16.80	35.1

MIQM-M wing nut - accessories

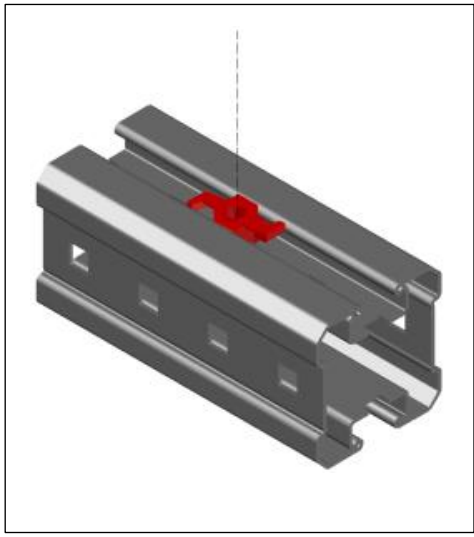
Designation	Item number
MIQM-M10	**2120274**
MIQM-M12	**2120275**
MIQM-M16	**2120276**

Recommended loading capacity

	±Fx,rec. [kN]	±Fz,rec. [kN]
M 10	3.00	8.50
M 12	3.50	8.50
M 16	3.50	8.50

Design loading capacity

	±Fx,Rd. [kN]	±Fz,Rd. [kN]
M 10	4.50	12.75
M 12	5.25	12.75
M 16	5.25	12.75



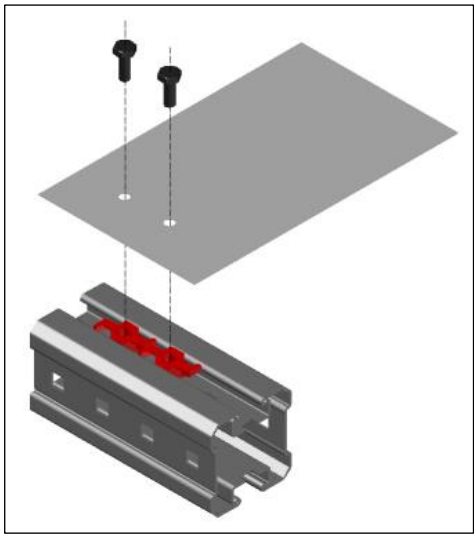
Designation	Item number
2x MIQM-M10	**2120274**
2x MIQM-M12	**2120275**
2x MIQM-M16	**2120276**

Recommended loading capacity

	±Fx,rec. [kN]	±Fz,rec. [kN]
M 10	5.40	17.00
M 12	6.30	17.00
M 16	6.30	17.00

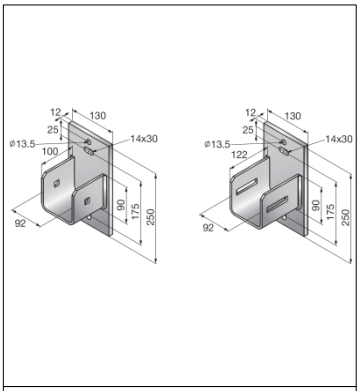
Design loading capacity

	±Fx,Rd. [kN]	±Fz,Rd. [kN]
M 10	8.10	25.50
M 12	9.45	25.50
M 16	9.45	25.50

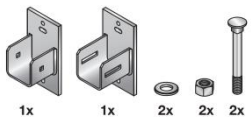


MIC-C90-EDB elevator connector

Designation	Item number
MIC-C90-EDB elevator connector	**2149279**



Package content



Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 micr ons

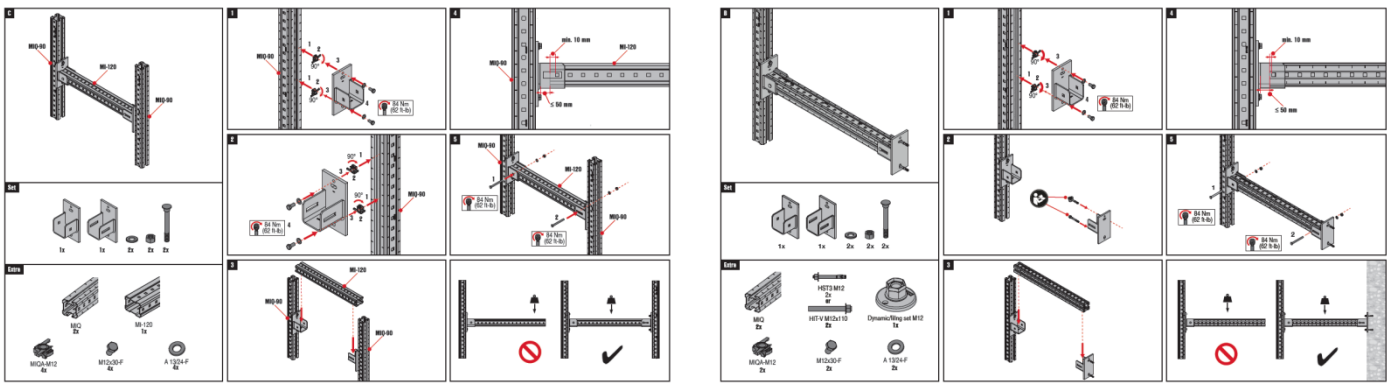
Weight:
9434g incl. accessories

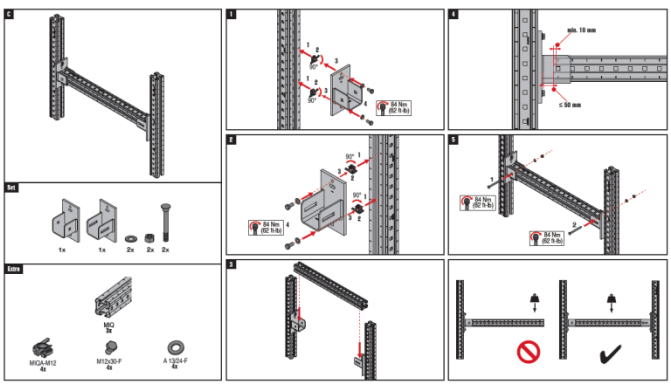
Submittal text:
Hot-dipped galvanised Hilti elevator connector, used primarily to connect an MI or MIQ girder to either a concrete wall or another girder. The baseplate of the connector is fastened to concrete through anchor holes with Hilti HST3 anchors or similar, and with MIA-OH bolts to another girder, secured with two self-locking nuts. Sold as a pair of connectors, one with a single hole and the other with an oblong hole, through which the connector is fastened to the girder with MIA-OH through-bolts. Material weight 9.43kg including all items.

Material properties:

Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S355 JR DIN EN 10025	$F_y = 355 \frac{N}{mm^2}$	$F_u = 490 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

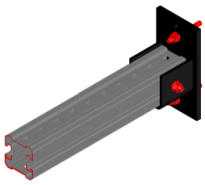
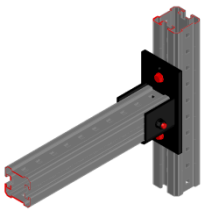
Instruction For Use:





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

MIC-C90-EDB elevator connector

Possible loading cases		
On concrete	On steel	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

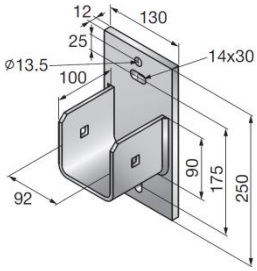
Standards and codes:

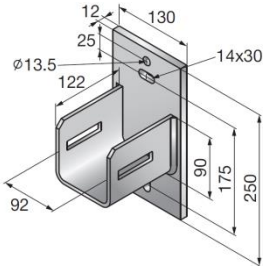
• EN 1990	Basics of structural design	03.2003
• EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General actions – densities, self-weight, imposed loads for buildings	09.2011
• EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings	03.2012
• EN 1993-1-3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

Environmental conditions:
- static loads
- no fatigue loads

Simplified drawing:





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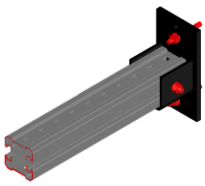
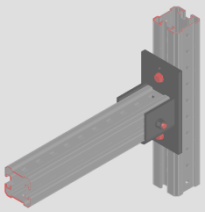
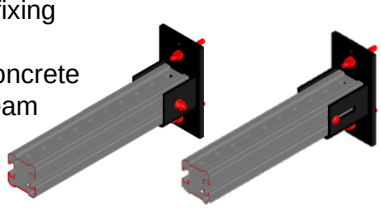
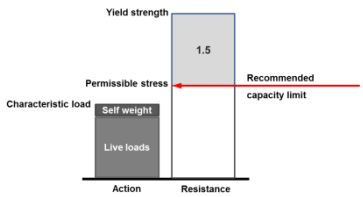
MIC-C90-EDB elevator connector

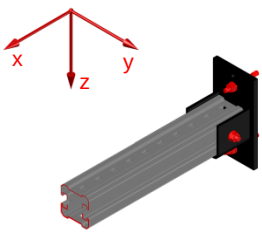
Possible loading cases		
On concrete	On steel	
		

Loading case: On concrete	Combinations covered by loading case
BOM: Base material connector incl. all connectivity material **1x MIC-C90-EDB elevator connector 2149279**	Connector used for fixing MIQ girder, perpendicularly to concrete usually as divider beam (wall to wall) in elevator shaft 

Recommended loading capacity - simplified for most common applications

Method



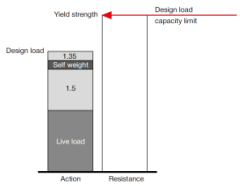


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.40	3.33	5.67

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

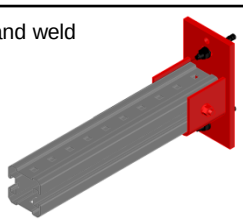
Design loading capacity - 3D 1/2

Method

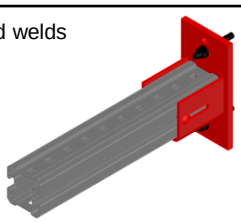


Limiting components of capacity evaluated in following tables:

1. Slotted connector incl. bolt, base plate and weld



2. Connector with hole incl. bolt, plate and welds

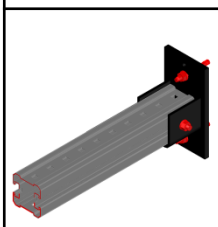
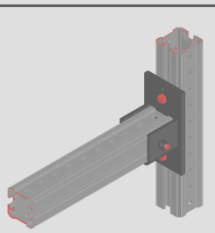


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIC-C90-EDB elevator connector

Conditions of the loading capacity tables:

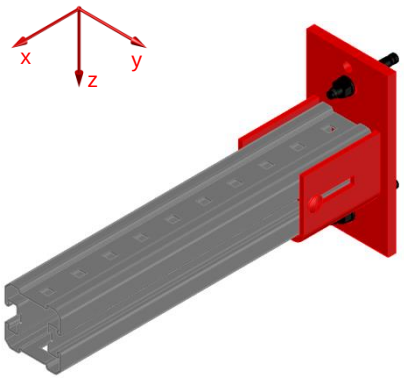
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
On concrete	On steel	
		

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. MIC-C90-EDB Slotted connector incl. bolt, base plate and weld



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.10	2.10	5.00**	5.00**	5.00	5.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.07	0.07	0.00	0.00	0.00	0.00

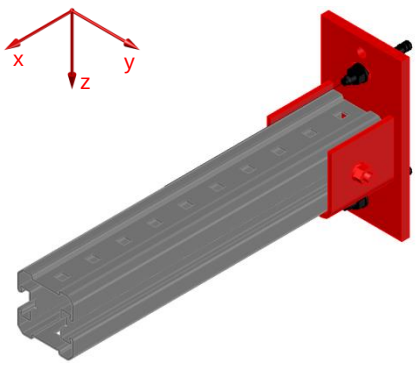
**Values are provided for 1mm local deflection on connector

Interaction:

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

Note: The welds and the one hand screw are modelled appropriately in the FE- calculation and are therefore included in the overall resistance for connector given above.

2. MIC-C90-EDB Connector with hole incl. bolt, plate and welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
10.60	10.60	5.00**	5.00**	5.00	5.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.07	0.07	0.00	0.00	0.00	0.00

**Values are provided for 1mm local deflection on connector

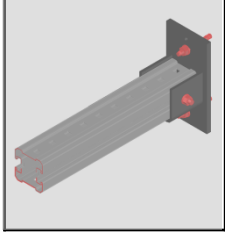
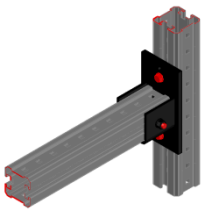
Interaction:

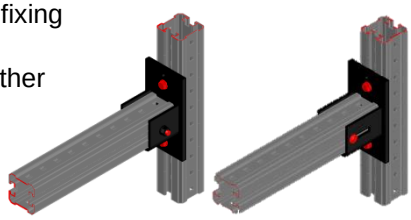
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \le 1$$

Note: The welds and the one hand screw are modelled appropriately in the FE- calculation and are therefore included in the overall resistance for connector given above

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

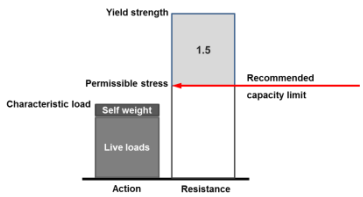
MIC-C90-EDB elevator connector

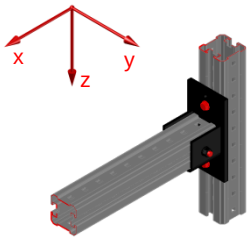
Possible loading cases		
On concrete	On steel	
		

Loading case: On steel	Combinations covered by loading case
BOM: Base material connector incl. all connectivity material **1x MIC-C90-EDB elevator connector** **2149279** Connection to vertical MIQ girder **2x MIQM-M12 wing nut** **2120275** **2x M12x30-F hex. Head screw** **284387**	Connector used for fixing MIQ girder, perpendicularly to other MIQ vertical girder usually as divider beam (wall to wall) in elevator shaft 

Recommended loading capacity - simplified for most common applications

Method



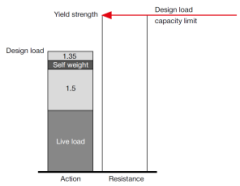


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.4	3.33	5.67

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

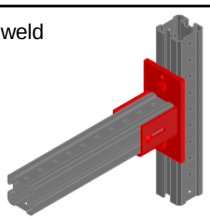
Design loading capacity - 3D 1/2

Method

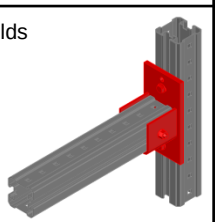


Limiting components of capacity evaluated in following tables:

1. Slotted connector incl. bolt, base plate and weld



2. Connector with hole incl. bolt, plate and welds

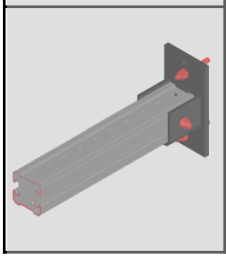
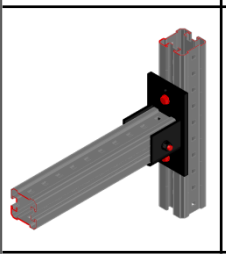


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIQC-S90-BP base material connector

Conditions of the loading capacity tables:

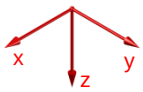
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

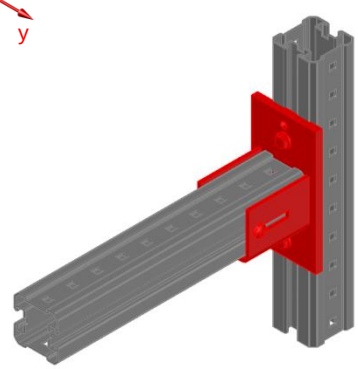
Possible loading cases		
On concrete	On steel	
		

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. MIC-C90-EDB Slotted connector incl. bolt, base plate and weld





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.10	2.10	5.00**	5.00**	5.00	5.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.07	0.07	0.00	0.00	0.00	0.00

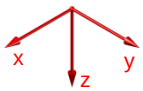
**Values are provided for 1mm local deflection on connector

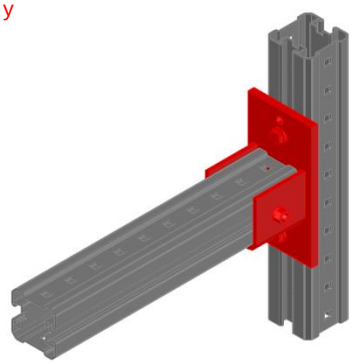
Interaction:

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

Note: The welds and the one hand screw are modelled appropriately in the FE- calculation and are therefore included in the overall resistance for connector given above

2. MIC-C90-EDB Connector with hole incl. bolt, plate and welds





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
10.60	10.60	5.00**	5.00**	5.00	5.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.07	0.07	0.00	0.00	0.00	0.00

**Values are provided for 1mm local deflection on connector

Interaction:

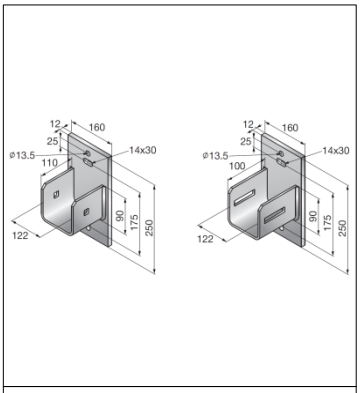
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \le 1$$

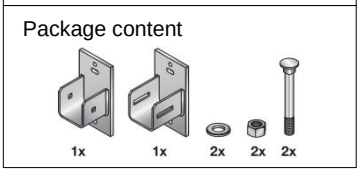
Note: The welds and the one hand screw are modelled appropriately in the FE- calculation and are therefore included in the overall resistance for connector given above

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

MIC-C120-EDB elevator connector

Designation	Item number
MIC-C120-EDB elevator connector	**2149420**





Corrosion protection:
Hot dipped galvanized as per DIN EN ISO 1462, thickness 55 micr ons

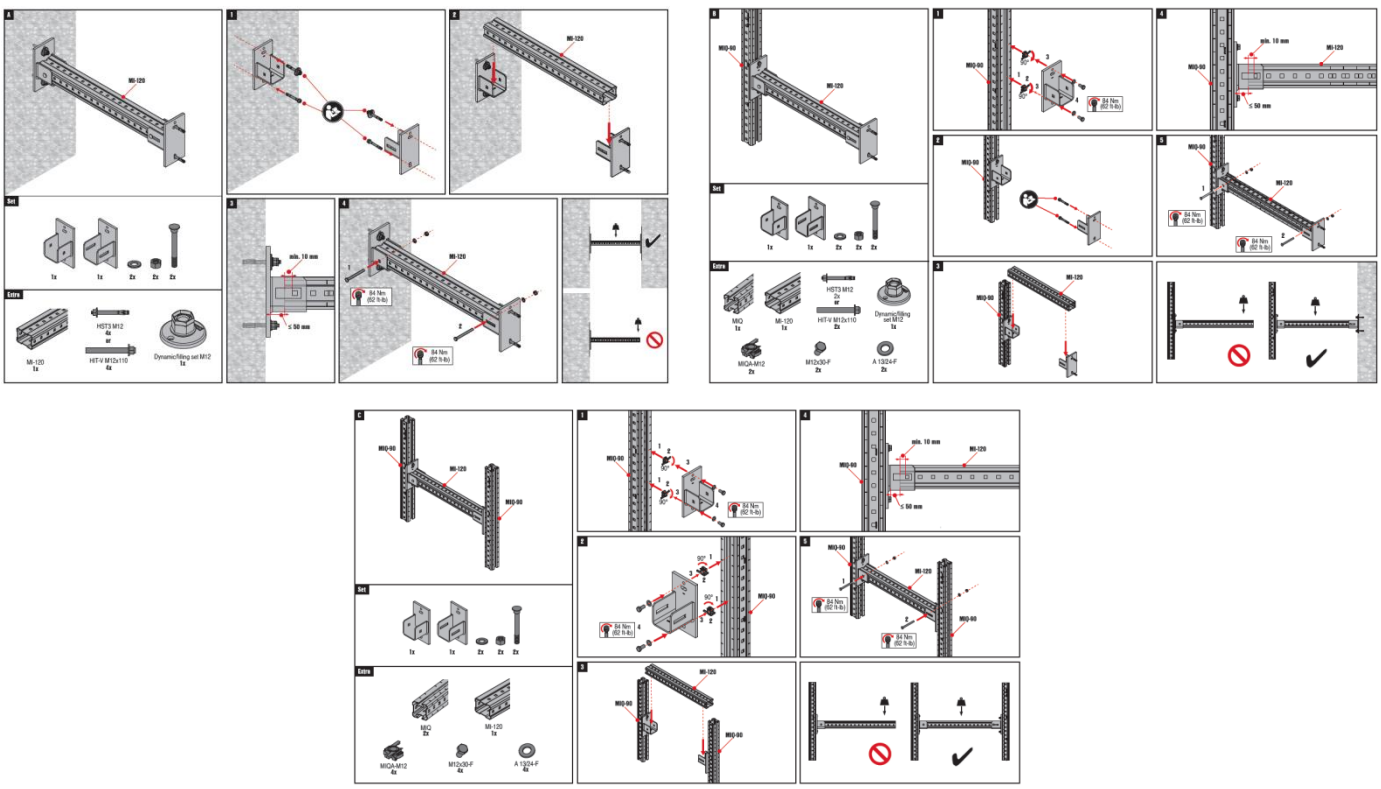
Weight:
11043g incl. accessories

Submittal text:
Hot-dipped galvanised Hilti elevator connector, used primarily to connect an MI or MIQ girder to either a concrete wall or another girder. The baseplate of the connector is fastened to concrete through anchor holes with Hilti HST3 anchors or similar, and with MIA-OH bolts to another girder, secured with two self-locking nuts. Sold as a pair of connectors, one with a single hole and the other with an oblong hole, through which the connector is fastened to the girder with MIA-OH through-bolts. Material weight 11.04kg including all items.

Material properties:

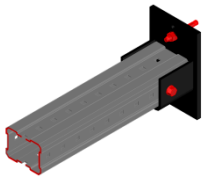
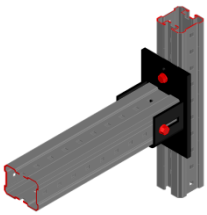
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S355 JR DIN EN 10025	$F_y = 355 \frac{N}{mm^2}$	$F_u = 490 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:



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

MIC-C120-EDB elevator connector

Possible loading cases		
On concrete	On steel	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

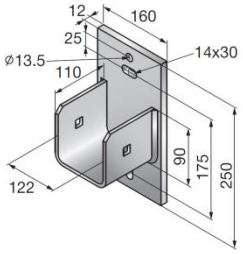
Standards and codes:

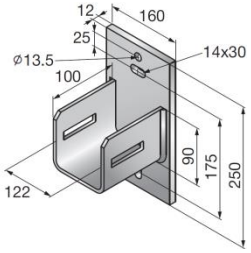
• EN 1990	Basics of structural design	03.2003
• EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General actions – densities, self-weight, imposed loads for buildings	09.2011
• EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings	03.2012
• EN 1993-1-3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

Environmental conditions:
- static loads
- no fatigue loads

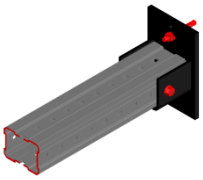
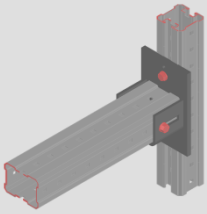
Simplified drawing:

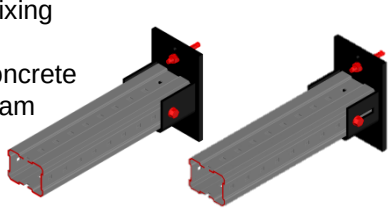




Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

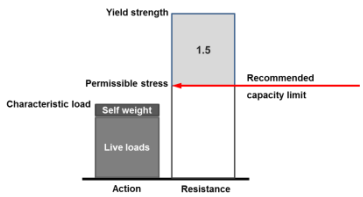
MIC-C120-EDB elevator connector

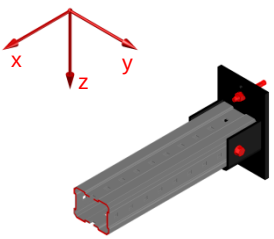
Possible loading cases		
On concrete	On steel	
		

Loading case: On concrete	Combinations covered by loading case
BOM: Base material connector incl. all connectivity material **MIC-C120-EDB elevator connector 2149420**	Connector used for fixing MIQ girder, perpendicularly to concrete usually as divider beam (wall to wall) in elevator shaft 

Recommended loading capacity - simplified for most common applications

Method



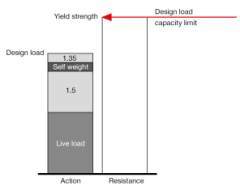


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.40	4.33	6.67

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

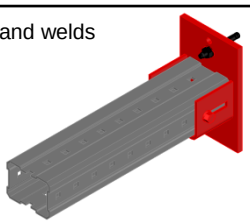
Design loading capacity - 3D 1/2

Method

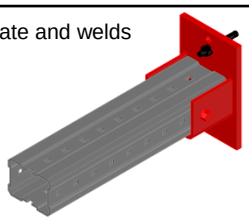


Limiting components of capacity evaluated in following tables:

1. Slotted connector incl. bolt, base plate and welds



2. Connector with hole incl. bolt, base plate and welds

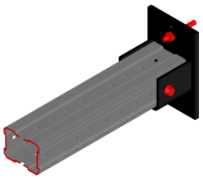
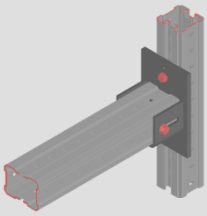


Boundary conditions - **Terms of common cooperation / Legal disclaimer** and guidelines as defined at the beginning of this book need to be mandatorily respected.

MIC-C120-EDB elevator connector

Conditions of the loading capacity tables:

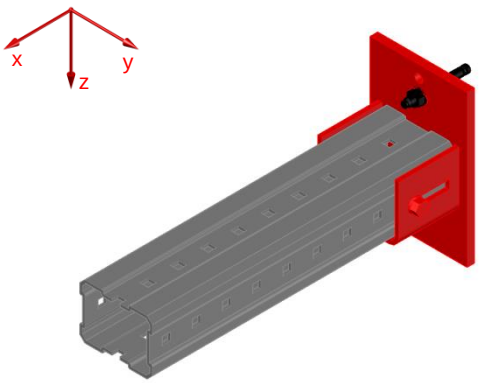
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
On concrete	On steel	
		

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. Slotted connector incl. bolt, base plate and welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.10	2.10	6.50**	6.50**	10.00	10.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.10	0.10	0.00	0.00	0.00	0.00

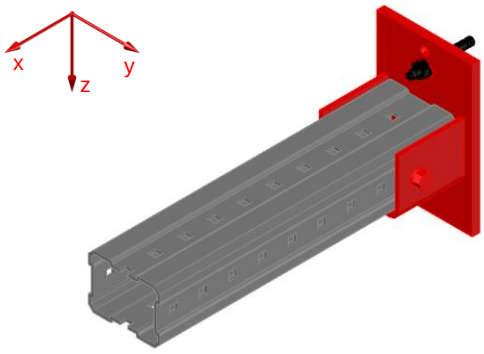
**Values are provided for 1mm local deflection on connector

Interaction:

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

Note: The welds and the one hand screw are modelled appropriately in the FE- calculation and are therefore included in the overall resistance for connector given above

2. Connector with hole incl. bolt, base plate and welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
14.00	14.00	6.50**	6.50**	10.00	10.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.10	0.10	0.00	0.00	0.00	0.00

**Values are provided for 1mm local deflection on connector

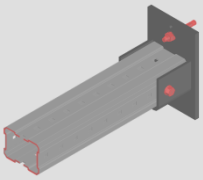
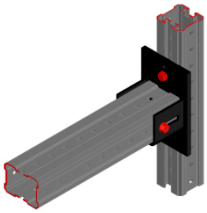
Interaction:

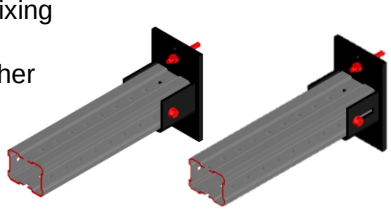
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \le 1$$

Note: The welds and the one hand screw are modelled appropriately in the FE- calculation and are therefore included in the overall resistance for connector given above

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

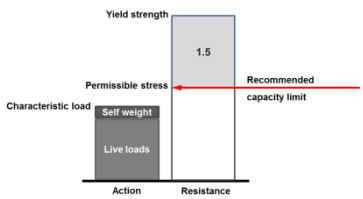
MIC-C120-EDB elevator connector

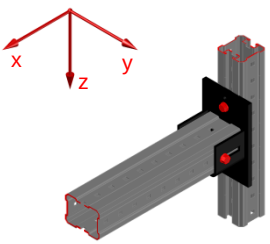
Possible loading cases		
On concrete	On steel	
		

Loading case: On steel	Combinations covered by loading case
BOM: Base material connector incl. all connectivity material **MIC-C120-EDB elevator connector 2149420** Connection to vertical MIQ girder **2x MIQM-M12 wing nut 2120275** **2x M12x30-F hex. Head screw 284387**	Connector used for fixing MI-120 girder, perpendicularly to other MIQ vertical girder usually as divider beam (wall to wall) in elevator shaft 

Recommended loading capacity - simplified for most common applications

Method



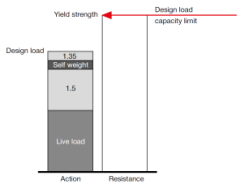


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.40	4.33	6.67

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

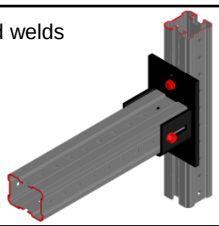
Design loading capacity - 3D 1/2

Method

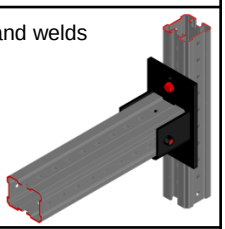


Limiting components of capacity evaluated in following tables:

1. Slotted connector incl. bolt, base plate and welds



2. Connector with hole incl. bolt, base plate and welds



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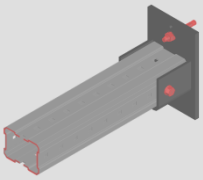
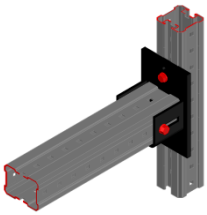
MIC-C120-EDB elevator connector

Conditions of the loading capacity tables:

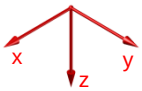
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

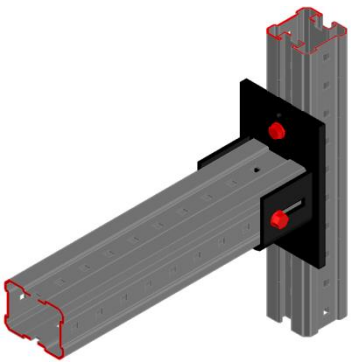
Possible loading cases		
On concrete	On steel	
		

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. Slotted connector incl. bolt, base plate and welds





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.10	2.10	5.00**	5.00**	8.50	8.50
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.10	0.10	0.00	0.00	0.00	0.00

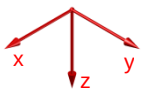
**Values are provided for 1mm local deflection on connector

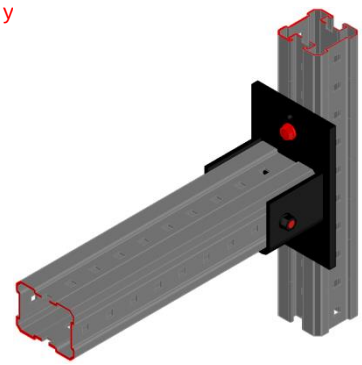
Interaction:

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

Note: The welds and the one hand screw are modelled appropriately in the FE- calculation and are therefore included in the overall resistance for connector given above

2. Connector with hole incl. bolt, base plate and welds





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
10.60	10.600	5.00**	5.00**	8.50	8.50
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.10	0.10	0.00	0.00	0.00	0.00

**Values are provided for 1mm local deflection on connector

Interaction:

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

Note: The welds and the one hand screw are modelled appropriately in the FE- calculation and are therefore included in the overall resistance for connector given above

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