MI SYSTEM

BU Installation Systems
Installation Technical Manual
Technical Data
MI System

Version 2.1 **10.2018**

Terms of common cooperation / Legal disclaimer

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

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

Content and overview of this manual

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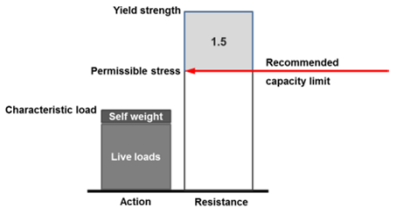
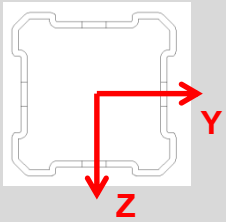
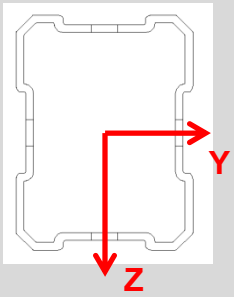
MI-Girders

Designation	Item number
MI-90 3m	**304798**
MI-90 6m	**304799**
MI-120 3m	**304800**
MI-120 6m	**304801**



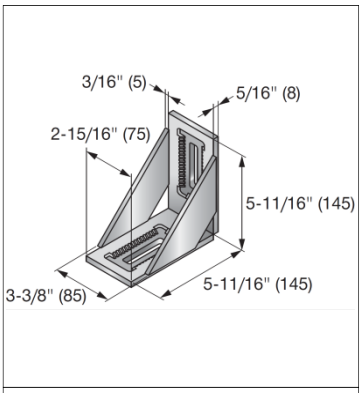
Technical data			MI-90	MI-120
For girder MI / cross section including torsion				
Cross-sectional area	A	[mm²]	1057.4	1456.24
Channel weight		[kg/m]	9.43	12.64
Material				
yield strength	$f_{y,k}$	[N/mm²]	235.0	235.0
permissible stress*	σ_{rec}	[N/mm²]	167.9	167.9
E-module		[N/mm²]	210000	210000
thrust-module		[N/mm²]	81000	81000
Surface				
hot dip galvanized		[µm]	75	75
Cross-section values Y-axis				
Axis of gravity	e_y	[mm]	45.0	60.0
moment of inertia	I_y	[cm⁴]	120.75	280.72
Section modulus	W_y	[cm³]	26.83	46.79
Radius of gyration	i_y	[cm]	3.38	4.39
Cross-section values Z-axis				
Axis of gravity	e_z	[mm]	45.00	45.00
moment of inertia	I_z	[cm⁴]	120.75	181.65
Section modulus	W_z	[cm³]	26.83	40.37
Radius of gyration	i_z	[cm]	3.38	3.53
Data to the torsion				
torsional moment of inertia	It	[cm⁴]	164.82	314.97
torsional section modulus	W_t	[cm³]	38.82	71.69

Material composition: DD11 MOD - EN 10111, S235JR - EN 10025-2
Corrosion protection: Hot-dip galvanized, 75 µm - ASTM A123

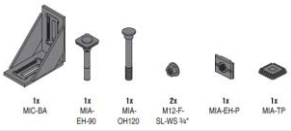
MIC-BA Connector

Designation	Item number
MIC-BA	**2174677**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Toothed Plate	**ISO 1461**	**45**
Backing Plate (Min.)	**ISO 1461**	**45**
Bolt; Nut	**ISO 1461**	**40; 45**



Hardware included per connector

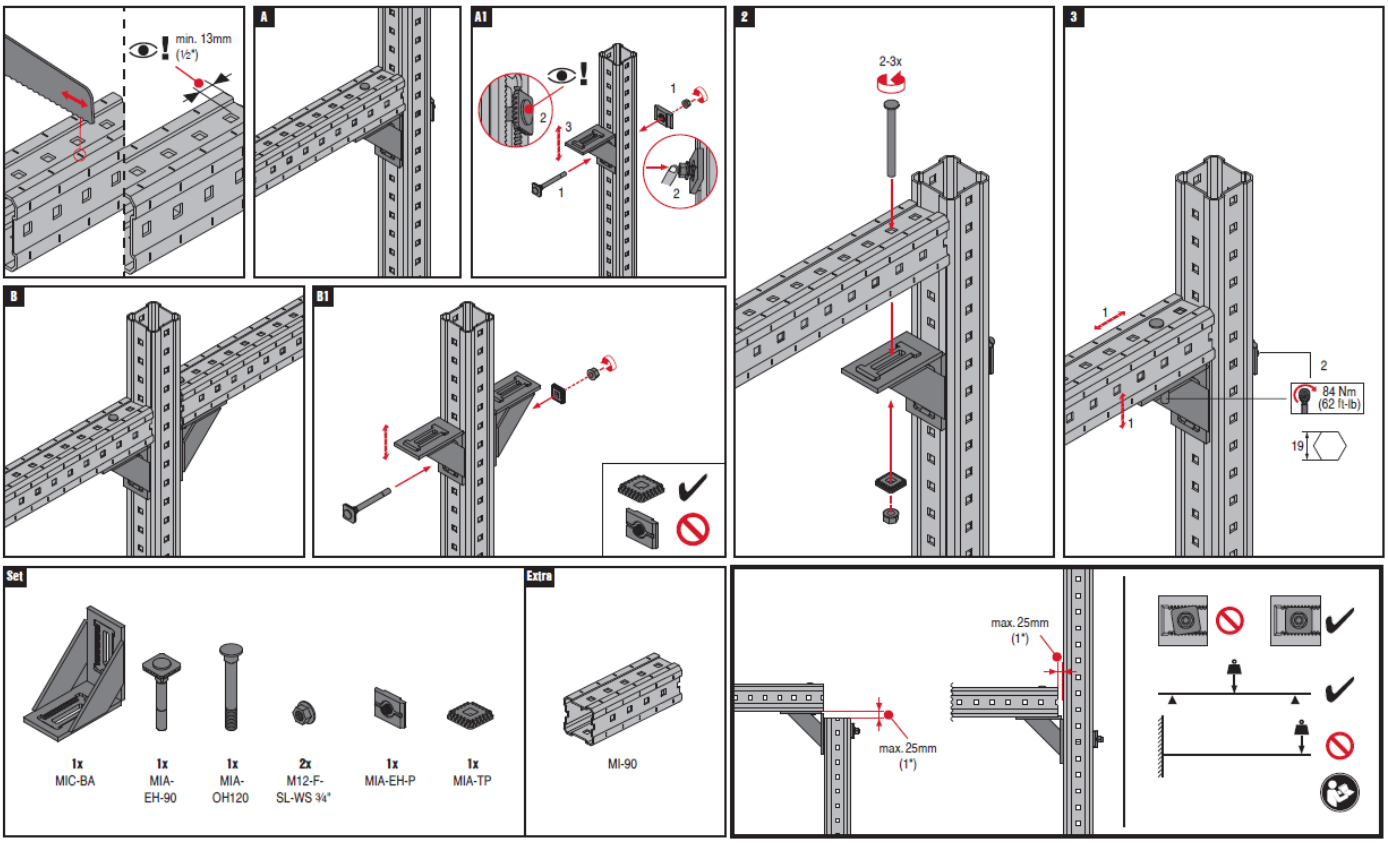


Weight:
2227g incl. components

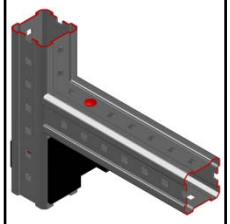
Description:
Hot dipped galvanized, 90° Hilti MI angle connector, used for connecting two perpendicular MI girders. The baseplate has a serrated slot for improved shear loads and fine adjustment.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Toothed Plate S235JR - (DIN EN10025-2)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Backing Plate (Min.) EN-GJMW-400-5 (DIN EN 1562)	$f_y = 220 \frac{N}{mm^2}$	$f_u = 400 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-BA Connector

Possible loading cases		
Standard	**Double**	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

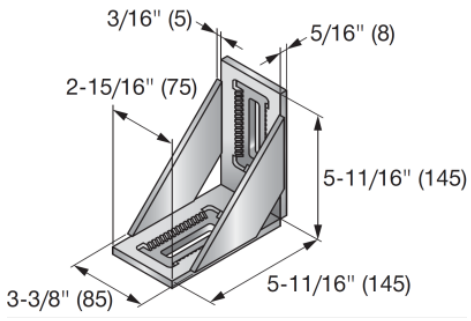
Standards and codes:

• 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	06.2012
• 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

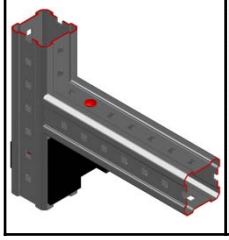
Software:
- Ansys 18.2
- Mathcad 15.0
- Microsoft Excel

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

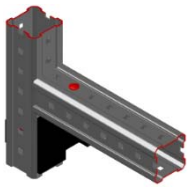
Simplified drawing:

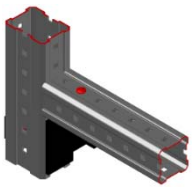


MIC-BA Connector

Standard	Double	
		

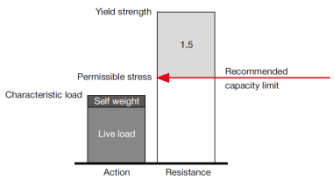
Loading case: Standard	Combinations covered by loading case
Bill of Material for this loading case: For fixation on MI-90 girder **1x MIC-BA** **2174677** For fixation on MI-120 **1x MIC-BA** **2174677** **1x MIA-EH120** **304888** MIA-EH90 remains unused	Connector used for Connecting MI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle

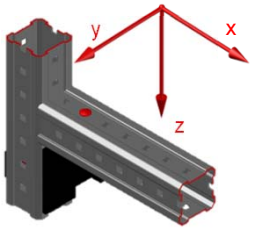




Recommended loading capacity - simplified for most common applications

Method



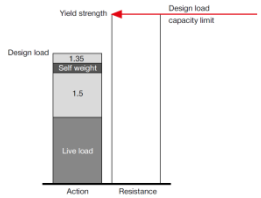


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
6.13	4.07	4.47

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

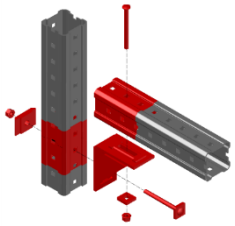
Design loading capacity - 3D 1/2

Method



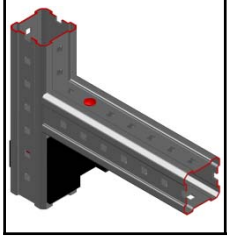
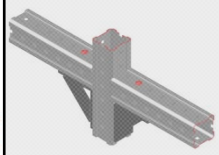
Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation



MIC-BA Connector

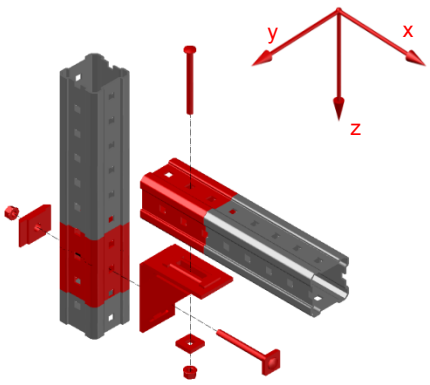
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double	
		

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. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation

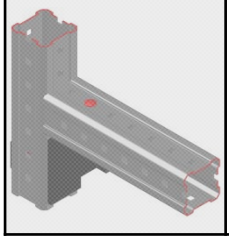


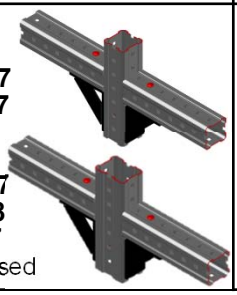
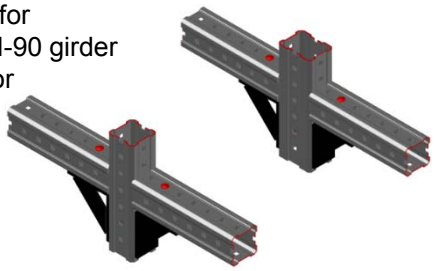
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
9.20	9.70	6.10	6.10	19.60	6.70
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.28	0.28	0.00	0.00	0.00	0.00

includes cross section resistance of steel plate and contact pressure
Interaction:

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

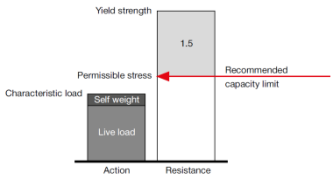
MIC-BA Connector

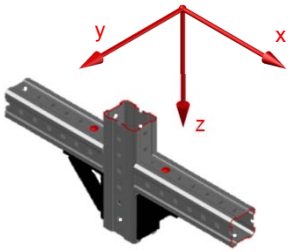
Standard	Double	
		

Loading case: Double	Combinations covered by loading case
Bill of Material for this loading case: For fixation on MI-90 girder **2x MIC-BA 2174677** **1x MIA-TP 305707** MIA-EH-P remains unused For fixation on MI-120 **2x MIC-BA 2174677** **1x MIA-EH120 304888** **1x MIA-TP 305707** MIA-EH90 and MIA-EH-P remains unused 	Connector used for Connecting 2xMI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle 

Recommended loading capacity - simplified for most common applications

Method



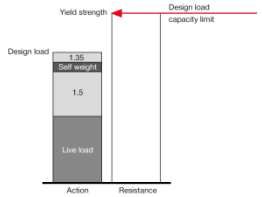


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
5.52	4.07	4.02

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

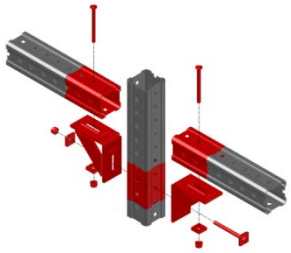
Design loading capacity - 3D 1/2

Method



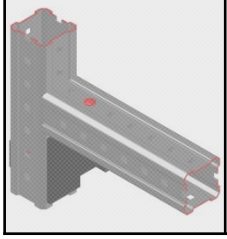
Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation



MIC-BA Connector

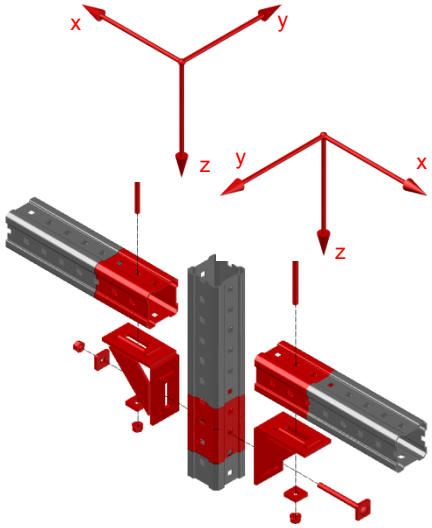
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double	
		

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. 1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation Resistance values for one side of the connection system**

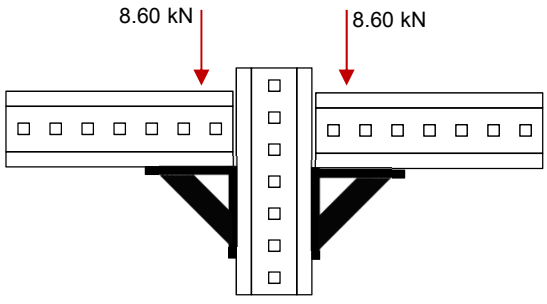


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
8.28**	8.60**	6.10**	6.10**	8.60**	6.03**
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.28**	0.28**	0.00	0.00	0.00	0.00

includes cross section resistance of steel plate and contact pressure
Interaction:

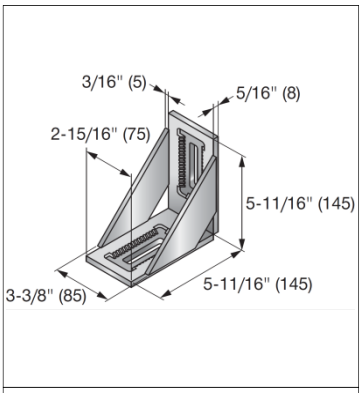
$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{y,Ed}}{F_{y,Rd}} + \frac{F_{z,Ed}}{F_{z,Rd}} + \frac{M_{x,Ed}}{M_{x,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \le 1$$

**Explanation how to apply resistance values - example of F_z



MIC-BAH Connector

Designation	Item number
MIC-BAH	**2179532**



Hardware included per connector

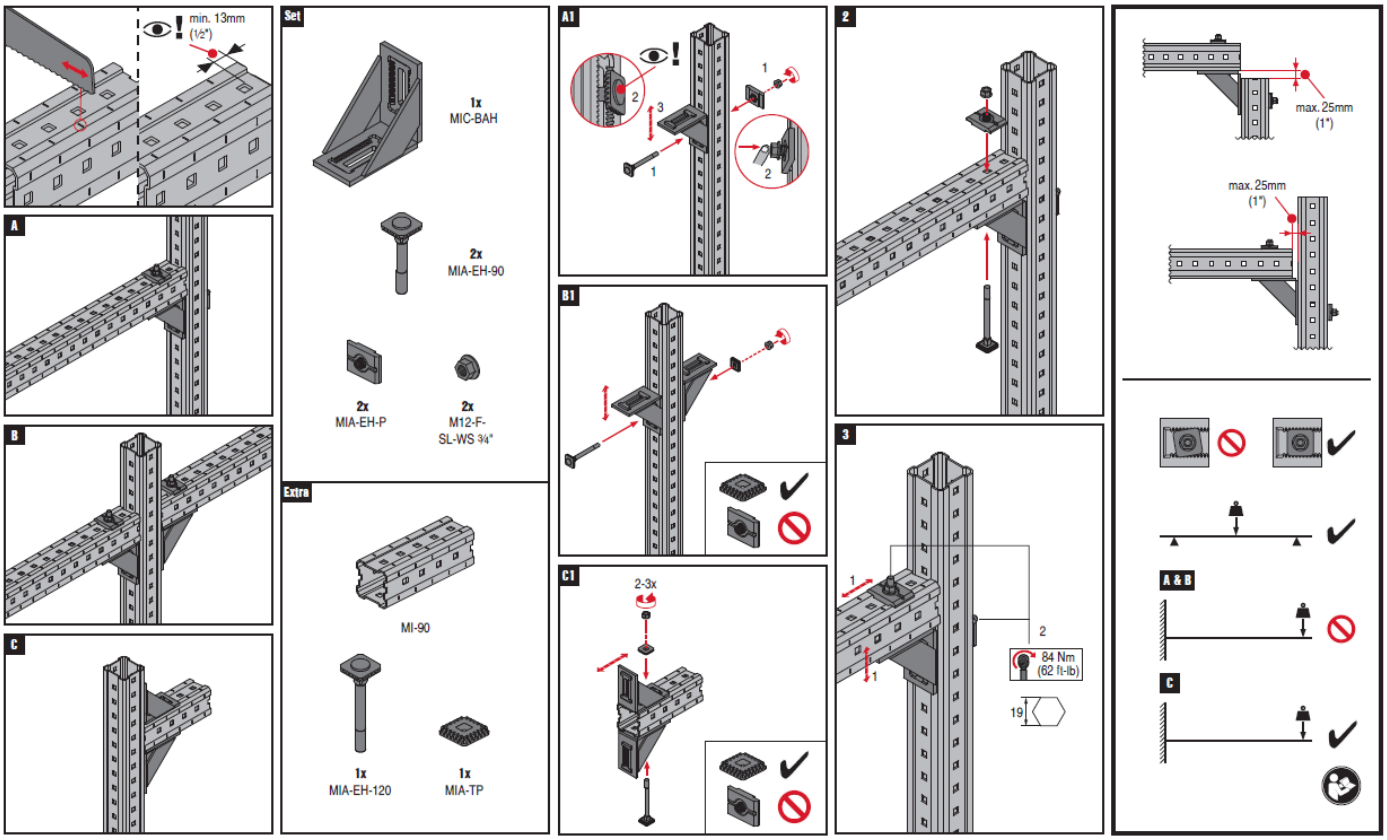
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Toothed Plate	**ISO 1461**	**45**
Backing Plate (Min.)	**ISO 1461**	**45**
Bolt; Nut	**ISO 1461**	**40; 45**

Weight:
2227g

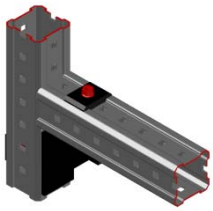
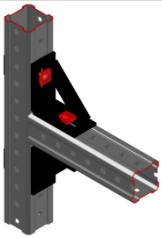
Description:
Hot dipped galvanized, 90° Hilti MI angle connector, used for connecting two perpendicular MI girders. The baseplate has a serrated slot for improved shear loads and fine adjustment. Suitable for cantilever applications only when used in Double configuration as defined in the IFU.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Toothed Plate S235JR - (DIN EN10025-2)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Backing Plate (Min.) EN-GJMW-400-5 (DIN EN 1562)	$f_y = 220 \frac{N}{mm^2}$	$f_u = 400 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-BAH Connector

Possible loading cases		
Standard	**Double One Side**	**Double Both Sides**
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

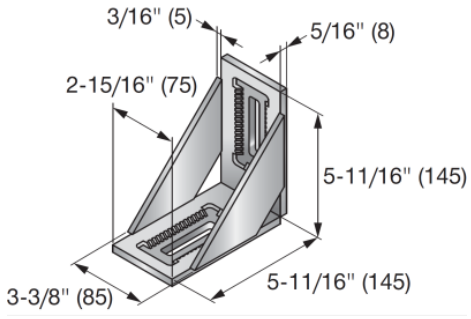
Standards and codes:

• 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	06.2012
• 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

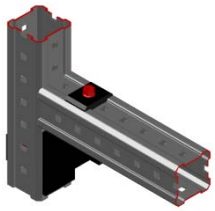
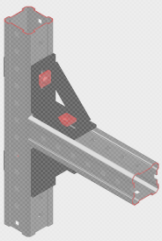
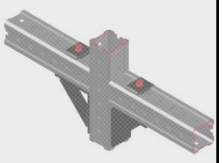
Software:
- Ansys 18.2
- Mathcad 15.0
- Microsoft Excel

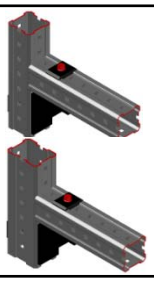
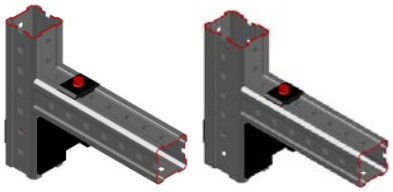
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



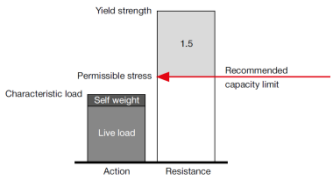
MIC-BAH Connector

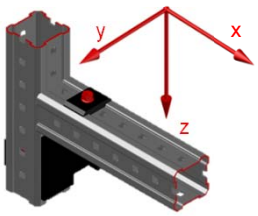
Standard	Double One Side	Double Both Sides
		

Loading case: Standard	Combinations covered by loading case
Bill of Material for this loading case: For fixation on MI-90 girder **1x MIC-BAH 2179532** For fixation on MI-120 **1x MIC-BAH 2179532** **1x MIA-EH120 304888** MIA-EH90 remains unused 	Connector used for Connecting MI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle 

Recommended loading capacity - simplified for most common applications

Method



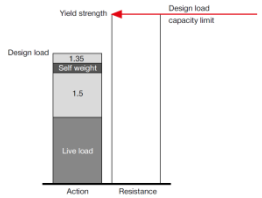


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
8.59	4.07	8.59

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

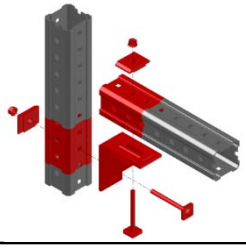
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

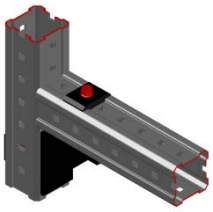
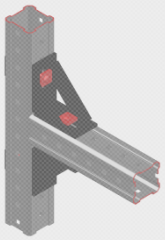
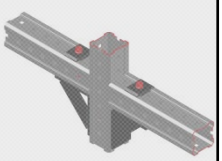
1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation



MIC-BAH Connector

Validity:

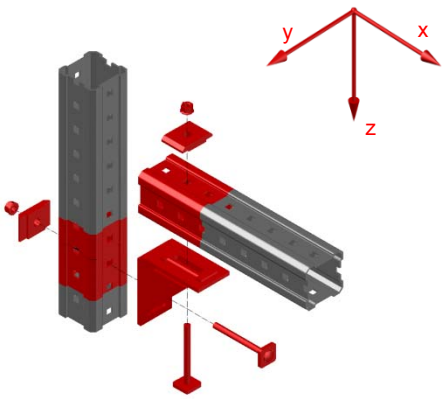
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double One Side	Double Both Sides
		

Design loading capacity - 3D 2/2

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

1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation

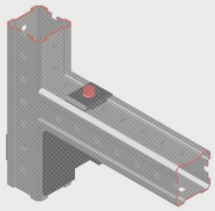
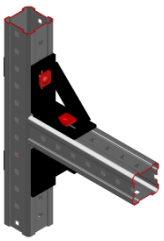
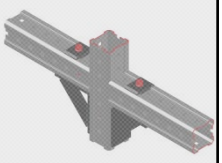


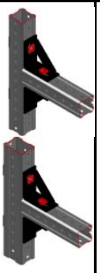
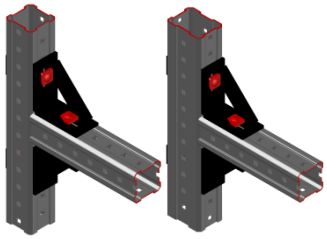
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
12.88	20.80	6.10	6.10	20.80	12.88
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.62	0.62	0.00	0.00	0.00	0.00

includes cross section resistance of steel plate and contact pressure
Interaction:

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

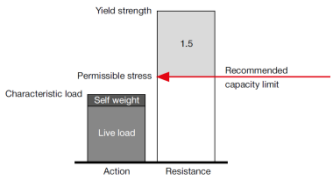
MIC-BAH Connector

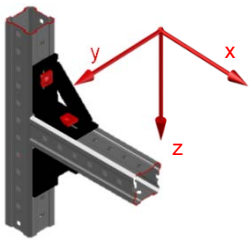
Standard	Double One Side	Double Both Sides
		

Loading case: Double One Side	Combinations covered by loading case
Bill of Material for this loading case: For fixation on MI-90 girder **2x MIC-BAH 2179532** **1x MIA-TP 305707** 1xMI-EH90 and 1xMIA-EH-P remain unused For fixation on MI-120 **2x MIC-BAH 2179532** **1x MIA-TP 305707** **2x MIA-EH120 304888** 3xMIA-EH90 and 2xMIA-EH-P remain unused 	Connector used in pair for Connecting MI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle 

Recommended loading capacity - simplified for most common applications

Method



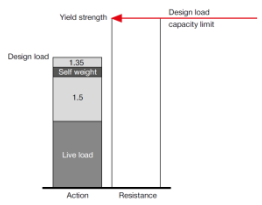


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
16.33	8.13	22.73

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

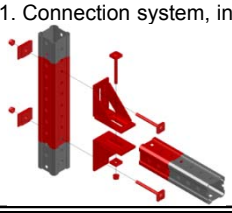
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

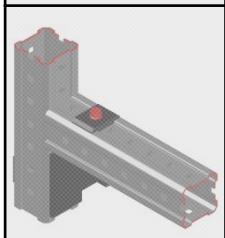
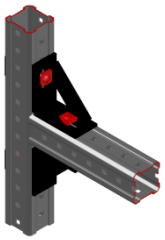
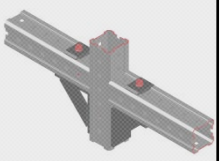
1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation



MIC-BAH Connector

Validity:

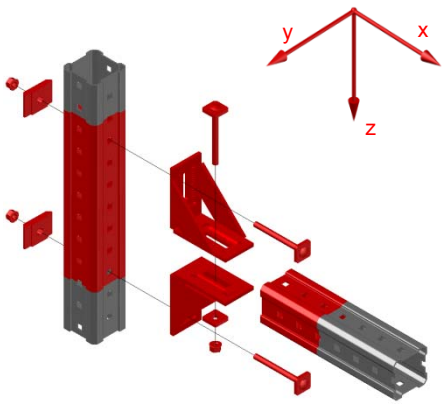
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double One Side	Double Both Sides
		

Design loading capacity - 3D 2/2

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

1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation

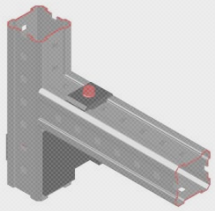
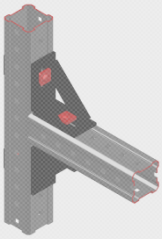


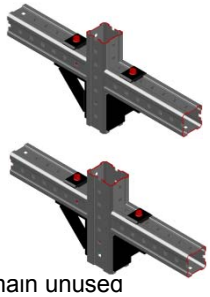
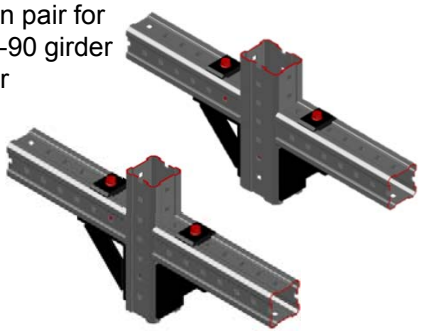
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
24.50	28.60	12.20	12.20	34.10	34.10
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.87	1.87	2.10	2.10	1. 16	1. 16

includes cross section resistance of steel plate and contact pressure
Interaction:

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

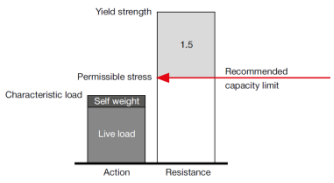
MIC-BAH Connector

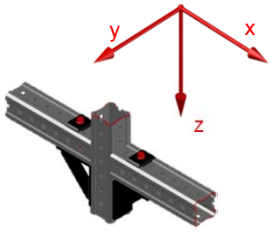
Standard	Double One Side	Double Both Sides
		

Loading case: Double Both Sides	Combinations covered by loading case
Bill of Material for this loading case: For fixation on MI-90 girder **2x MIC-BAH 2179532** **1x MIA-TP 305707** 1x MI-EH90 and MIA-EH-P remain unused For fixation on MI-120 **2x MIC-BAH 2179532** **1x MIA-EH120 304888** **1x MIA-TP 305707** The 2x MIA-EH90 and 2x MIA-EH-P remain unused 	Connector used in pair for Connecting 2xMI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle 

Recommended loading capacity - simplified for most common applications

Method



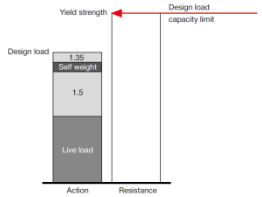


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
7.63	4.07	5.73

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

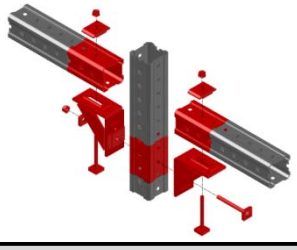
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

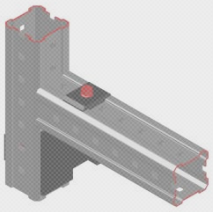
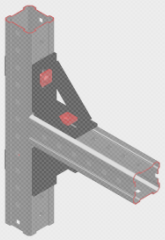
1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation



MIC-BAH Connector

Validity:

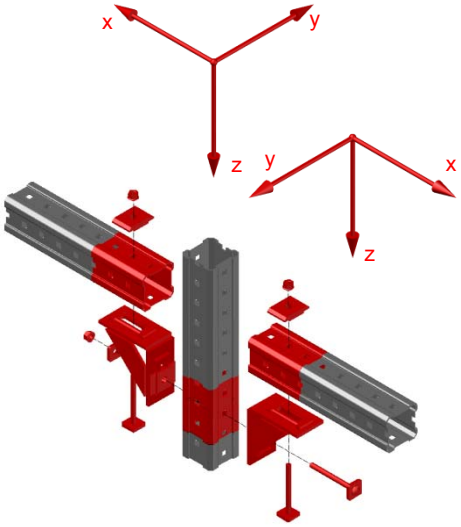
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double One Side	Double Both Sides
		

Design loading capacity - 3D 2/2

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

1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation
Resistance values for one side of the connection system**

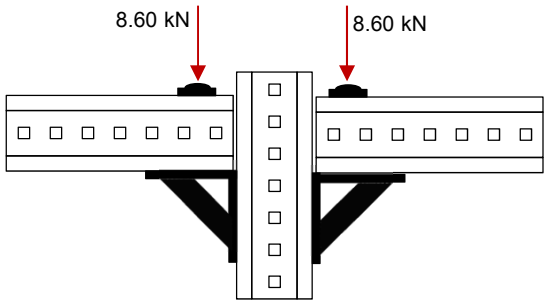


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
11.44**	17.64**	6.10**	6.10**	8.60**	8.60**
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.62**	0.62**	0.00	0.00	0.00	0.00

Interaction:

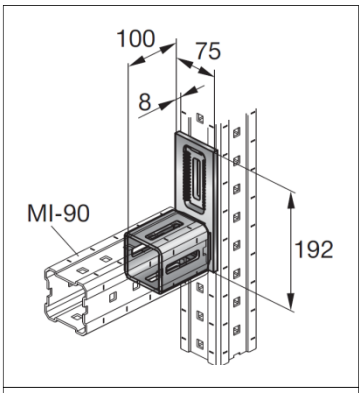
$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{y,Ed}}{F_{y,Rd}} + \frac{F_{z,Ed}}{F_{z,Rd}} + \frac{M_{x,Ed}}{M_{x,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$$

**Explanation how to apply resistance values - example of F_z

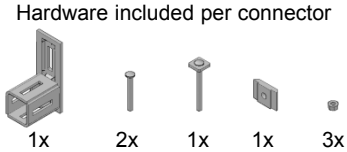


MIC-90-UH Connector

Designation	Item number
MIC-90-UH	**2179533**



Hardware included per connector



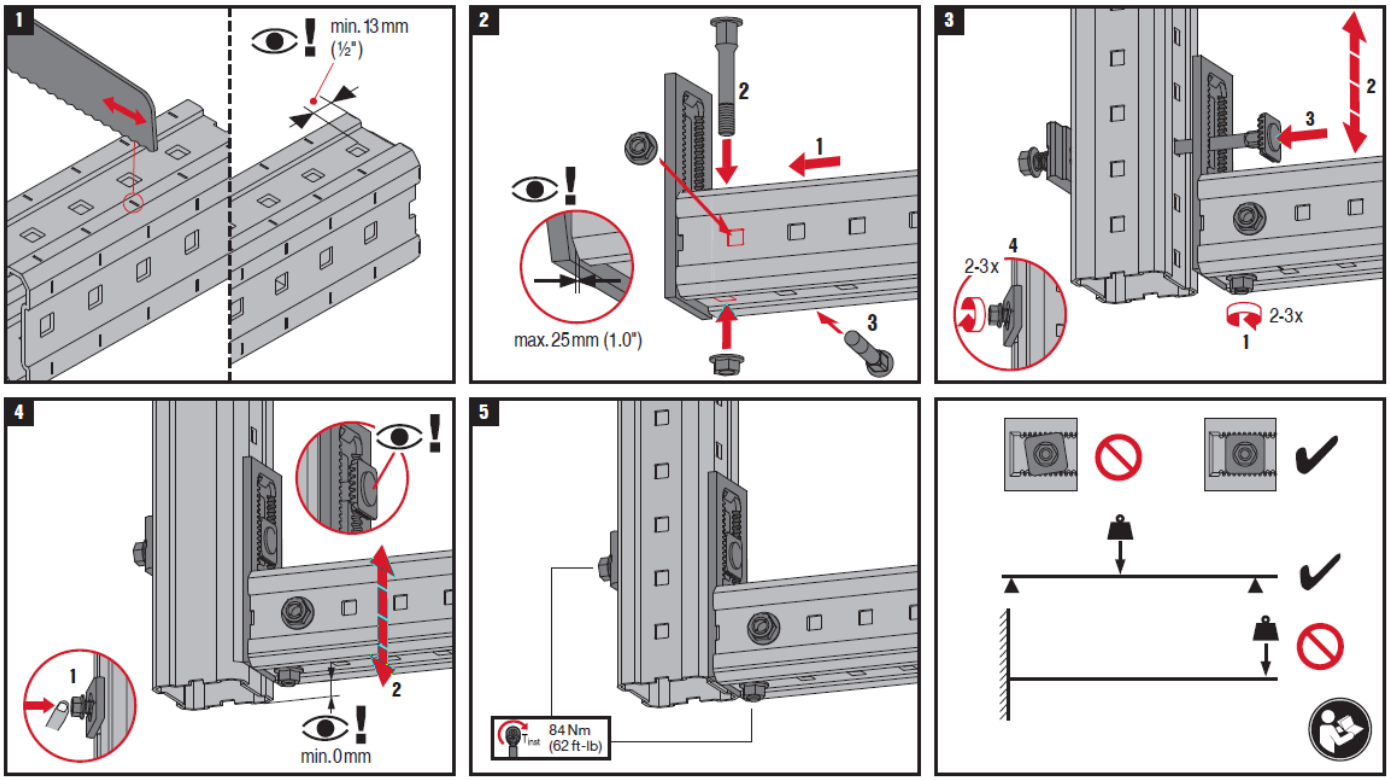
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Toothed Plate	**ISO 1461**	**45**
Backing Plate (Min.)	**ISO 1461**	**45**
Bolt; Nut	**ISO 1461**	**40; 45**

Weight:
2510 g incl. components

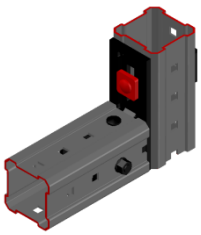
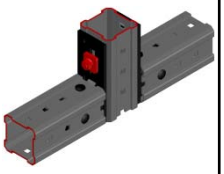
Submittal text:
Hot dipped galvanized, 90° Hilti MI angle connector, used for connecting two perpendicular MI girders. The baseplate has a serrated slot for improved shear loads and fine adjustment, and the connector is connected with an oblong hole. Not suitable for cantilever applications.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Toothed Plate S235JR - (DIN EN10025-2)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Backing Plate (Min.) EN-GJMW-400-5 (DIN EN 1562)	$f_y = 220 \frac{N}{mm^2}$	$f_u = 400 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-90-UH Connector

Possible loading cases		
Standard	Double	
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation

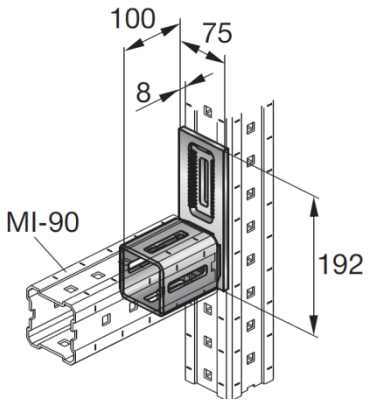
Standards and codes:

• 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

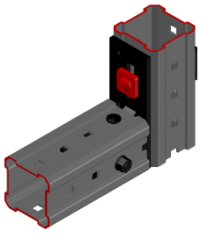
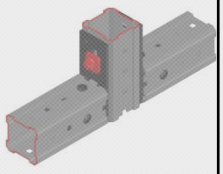
Software:
- Mathcad 15.0
- Microsoft Excel

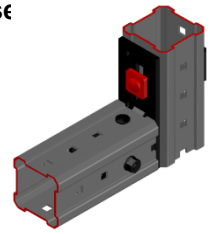
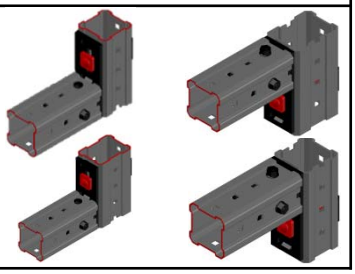
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



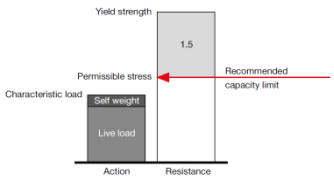
MIC-90-UH Connector

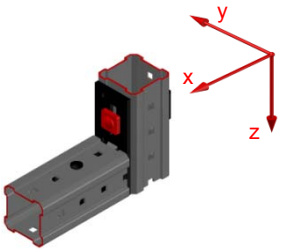
Standard	Double	
		

Loading case: Standard	Combinations covered by loading case
Bill of Material for this loading case For fixation on MI-90 girder Angle incl. all components **1x MIC-90-UH** **2179533** For fixation on MI-120 **1x MIC-90-UH** **2179533** **1x MIA-EH120** **304888** The MIA-EH90 remain unused 	Connector used for connecting MI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle 

Recommended loading capacity - simplified for most common applications

Method



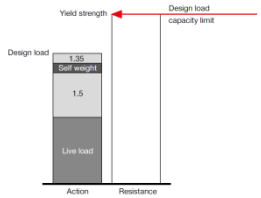


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
2.00	9.82	11.33

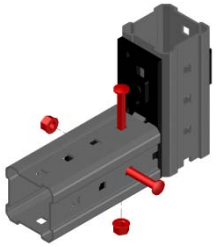
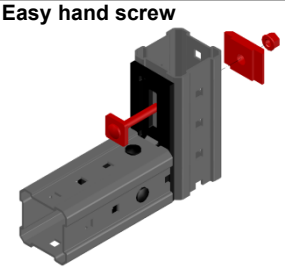
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

Design loading capacity - 3D 1/3

Method

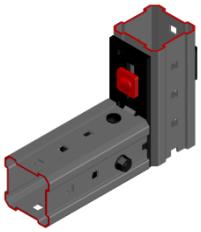
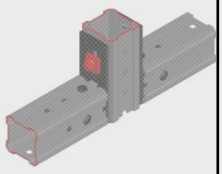


Limiting components of capacity evaluated in following tables:

1. Steel connector	2. Welds	3. **One hand screw**	4. **Easy hand screw**
			

MIC-90-UH Connector

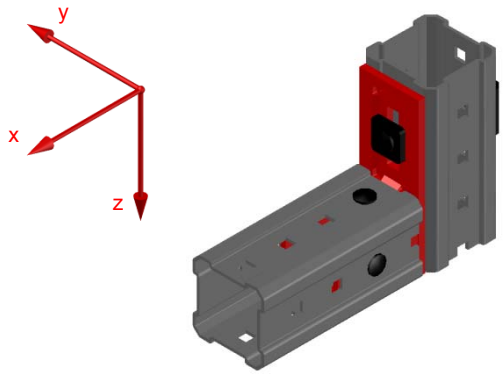
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double	
		

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



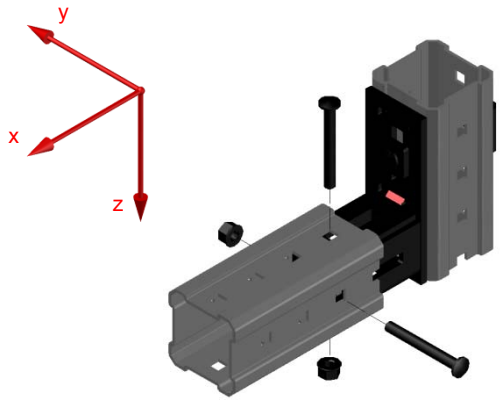
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.00	Not decisive	14.73	14.73	63.92	63.92
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.36	1.36	0.00	0.00	0.00	0.00

includes cross section resistance of steel plate and contact pressure

Interaction:

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

2. Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
244.38	244.38	99.77	99.77	99.77	99.77
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
5.99	5.99	0.00	0.00	0.00	0.00

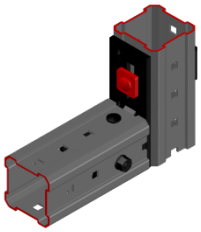
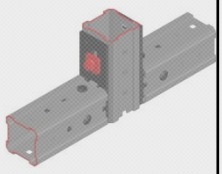
Interaction:

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

MIC-90-UH Connector

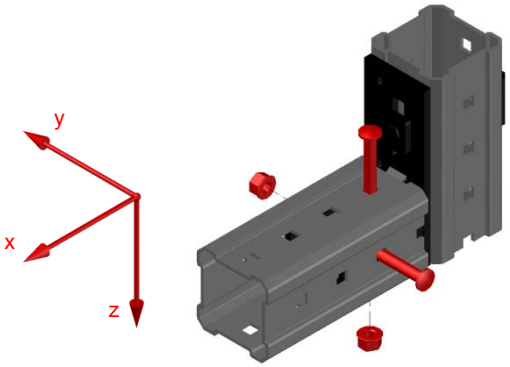
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double	
		

Design loading capacity - 3D 3/3

3. One hand screw -in connection to MIC-90-U and MI90-channel



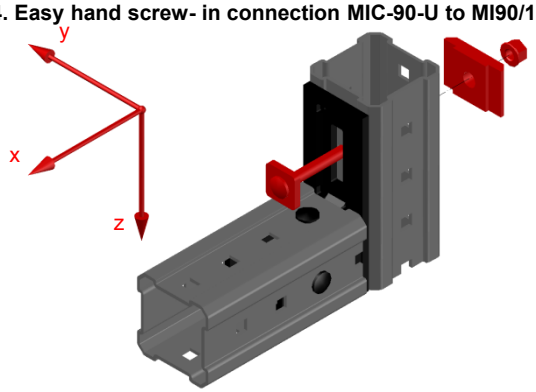
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.00	3.00	36.29	36.29	36.29	36.29
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.20	1.20	0.00	0.00	0.00	0.00

includes shear of the bolt, friction resistance, bearing resistance at connector plate and at channel MI90

Interaction:

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

4. Easy hand screw- in connection MIC-90-U to MI90/120-channel



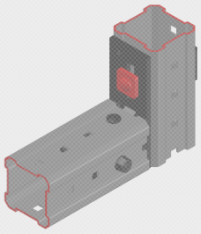
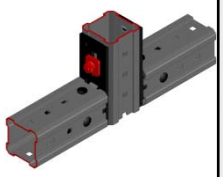
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.00	Not decisive	Not decisive	Not decisive	16.99	16.99
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
Note decisive	Not decisive	0.00	0.00	0.00	0.00

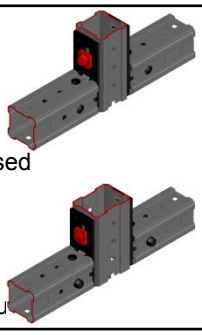
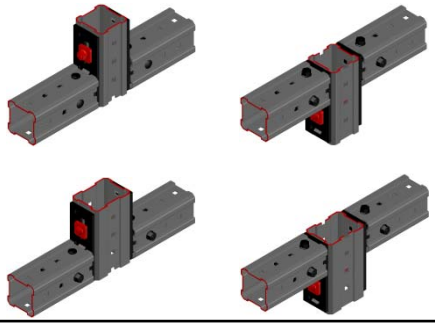
includes shear, bending and tension of the bolt, bearing resistance channel MI-90/120 and tooth plate, resistance of screw plate

Interaction:

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

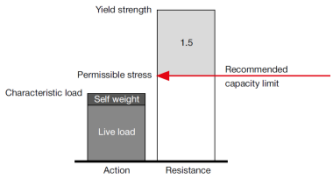
MIC-90-UH Connector

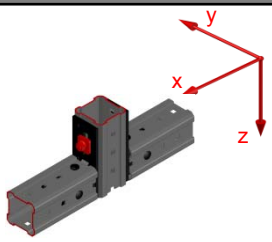
Standard	Double	
		

Loading case: Double	Combinations covered by loading case
Bill of Material for this loading case: For fixation on MI-90 girder Angle incl. all components **1x MIC-90-UH 2179533** **1x MIA-TP 305707** The backing plate MIA-EH-P remain unused For fixation on MI-120 **1x MIC-90-UH 2179533** **1x MIA-TP 305707** **1x MIA-EH120 304888** The MIA-EH90 and MIA-EH-P remain unu 	Connector used for connecting 2xMI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle 

Recommended loading capacity - simplified for most common applications

Method





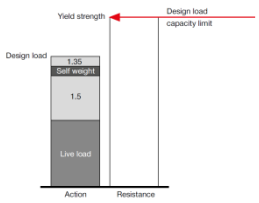
Individual connector capacity limit

±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
2.00	9.82	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.

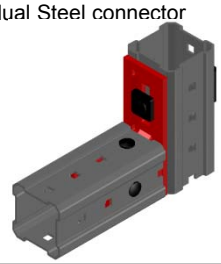
Design loading capacity - 3D 1/3

Method



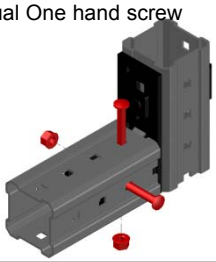
Limiting components of capacity evaluated in following tables:

1. Individual Steel connector

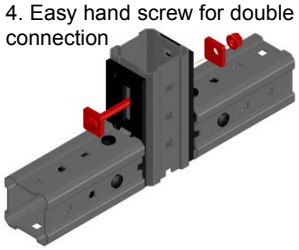


2. Individual Welds

3. Individual One hand screw



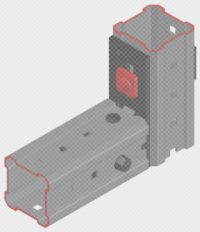
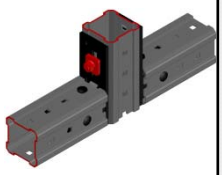
4. Easy hand screw for double connection



MIC-90-UH Connector

Validity:

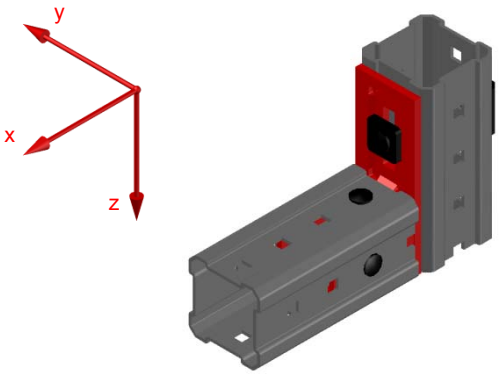
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double	
		

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. Individual Steel connector

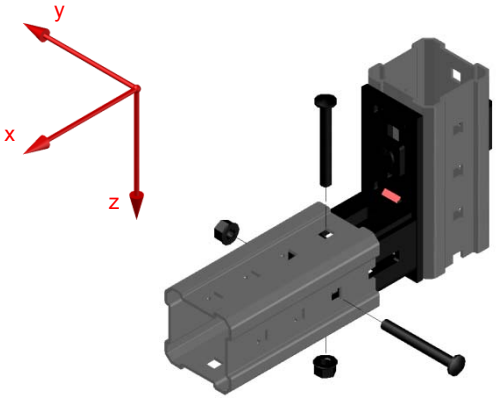


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.00	Not decisive	14.73	14.73	63.92	63.92
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.36	1.36	0.00	0.00	0.00	0.00

Interaction:

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

2. Individual Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
244.38	244.38	99.77	99.77	99.77	99.77
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.99	5.99	0.00	0.00	0.00	0.00

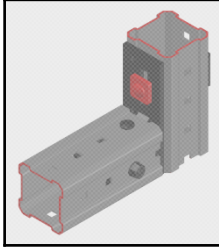
Interaction:

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

MIC-90-UH Connector

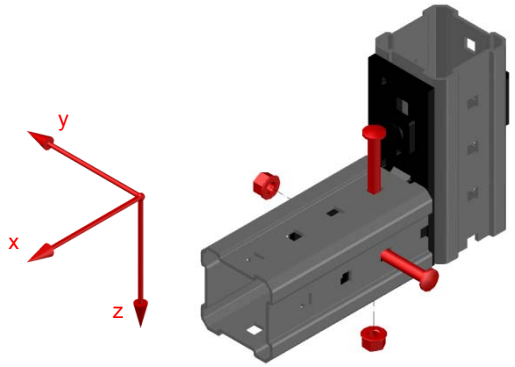
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double	
		

Design loading capacity - 3D 3/3

3. Individual One hand screws -in connection to MIC-90-U and MI90-channel



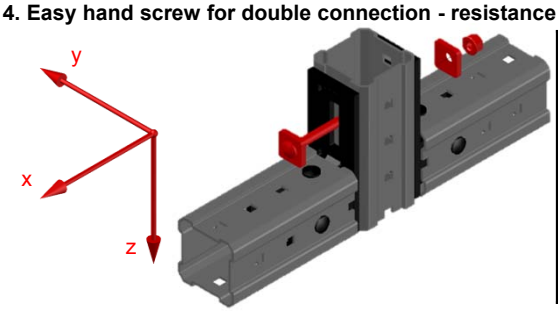
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.00	3.00	36.29	36.29	36.29	36.29
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.20	1.20	0.00	0.00	0.00	0.00

includes shear of the bolt, friction resistance, bearing resistance at connector plate and at channel MI90

Interaction:

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

4. Easy hand screw for double connection - resistance values for one connector* in connection MIC-90-U to MI90/120-channel



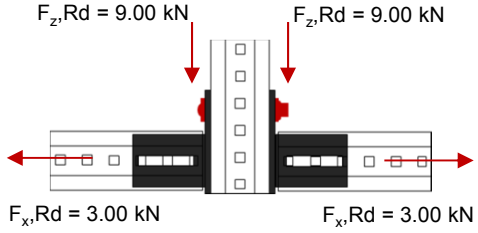
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.00*	Not decisive	Not decisive	Not decisive	9.00*	9.00*
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
Note decisive	Not decisive	0.00	0.00	0.00	0.00

includes shear, bending and tension of the bolt, bearing resistance channel MI-90/120 and tooth plate, resistance of screw plate

Interaction:

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

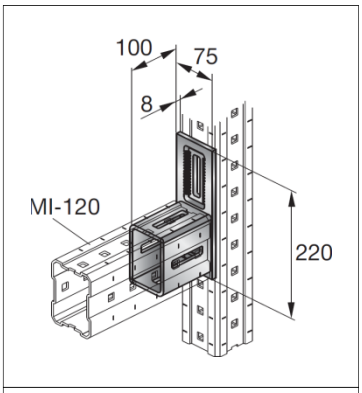
* Explanation how to apply resistance values



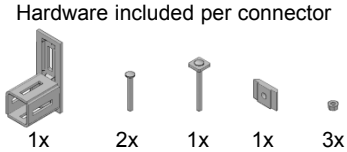
MIC-120-UH Connector

Designation	Item number
MIC-120-UH	**2179534**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Toothed Plate	**ISO 1461**	**45**
Backing Plate (Min.)	**ISO 1461**	**45**
Bolt; Nut	**ISO 1461**	**40; 45**



Hardware included per connector

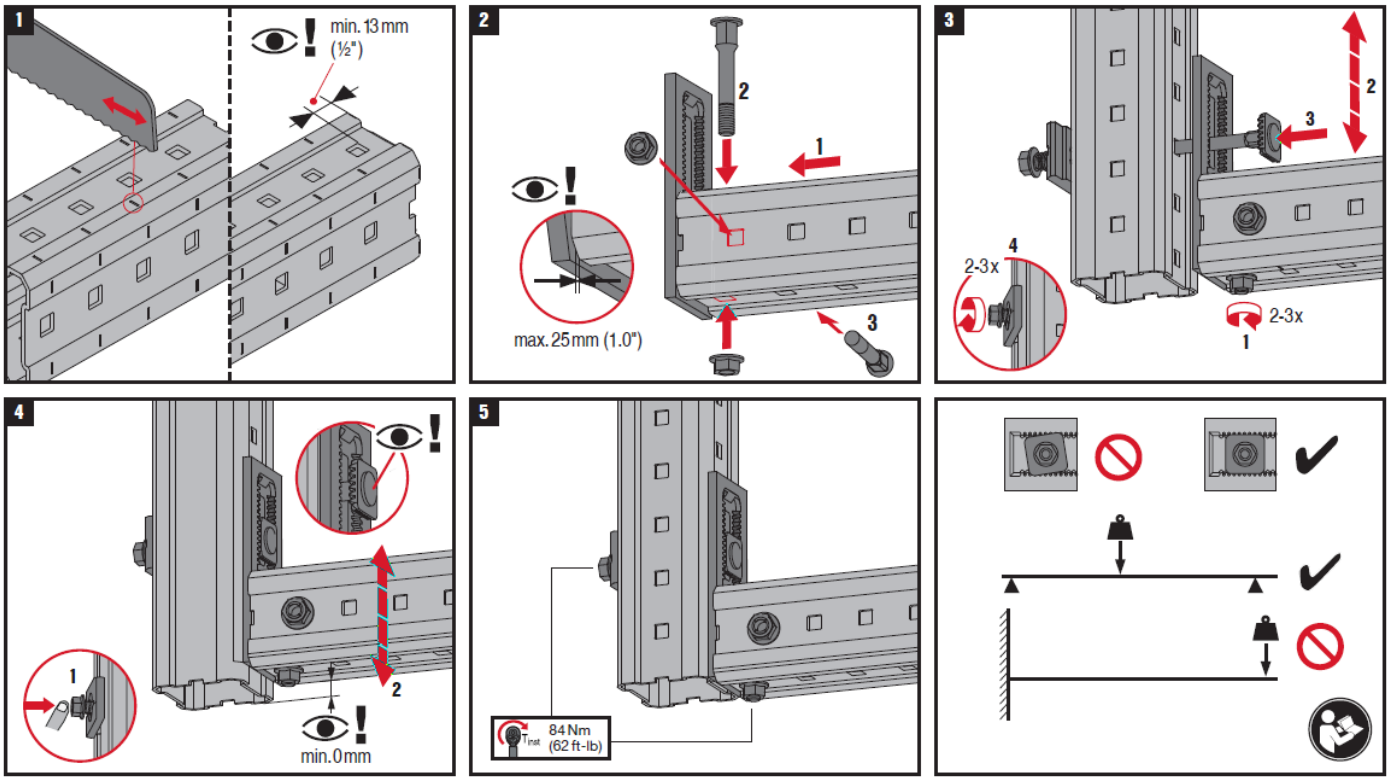


Weight:
2786 g incl. components

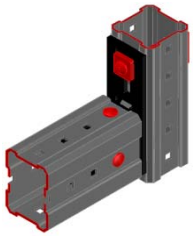
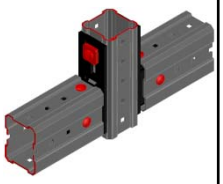
Submittal text:
Hot dipped galvanized, 90° Hilti MI angle connector, used for connecting two perpendicular MI girders. The baseplate has a serrated slot for improved shear loads and fine adjustment, and the connector is connected with an oblong hole. Not suitable for cantilever applications.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Toothed Plate S235JR - (DIN EN10025-2)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Backing Plate (Min.) EN-GJMW-400-5 (DIN EN 1562)	$f_y = 220 \frac{N}{mm^2}$	$f_u = 400 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-120-UH Connector

Possible loading cases		
Standard	Double	
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation

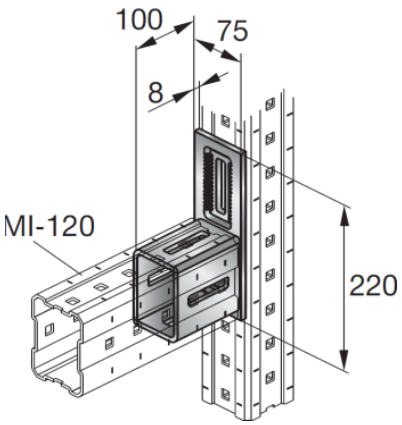
Standards and codes:

• 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

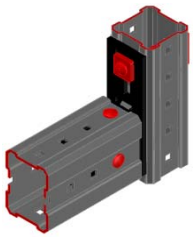
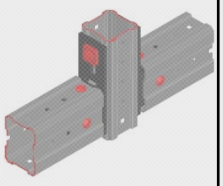
Software:
- Mathcad 15.0
- Microsoft Excel

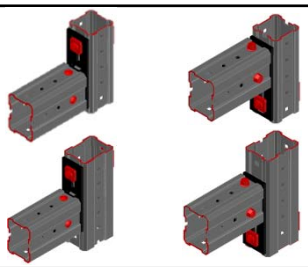
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



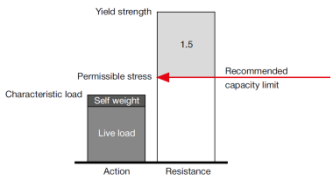
MIC-120-UH Connector

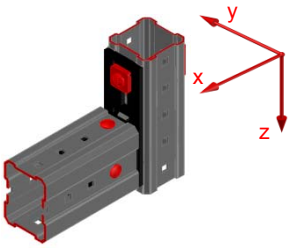
Standard	Double	
		

Loading case: Standard	Combinations covered by loading case
Bill of Material for this loading case For fixation on MI-90 girder Angle incl. all components **1x MIC-90-UH 2179534** For fixation on MI-120 **1x MIC-90-UH 2179533** **1x MIA-EH120 304888** The MIA-EH90 remain unused 	Connector used for connecting MI-120 girder on either MI-90 or MI-120 girder in a 90-degree angle 

Recommended loading capacity - simplified for most common applications

Method



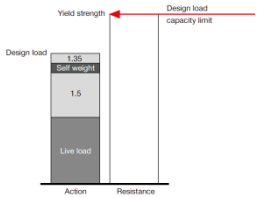


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.33	10.55	11.33

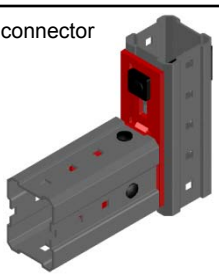
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

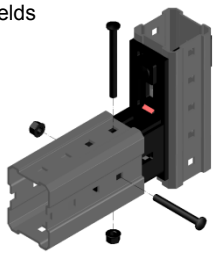
Design loading capacity - 3D 1/3

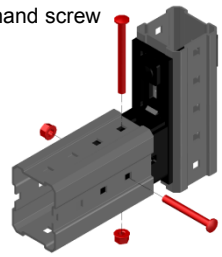
Method

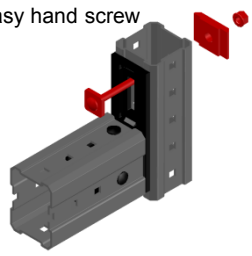


Limiting components of capacity evaluated in following tables:

1. Steel connector 

2. Welds 

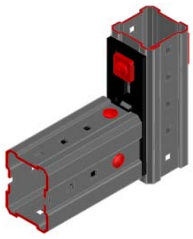
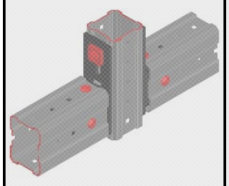
3. One hand screw 

4. Easy hand screw 

MIC-120-UH Connector

Validity:

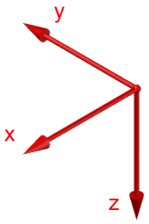
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

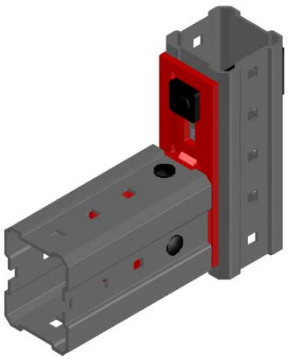
Standard	Double	
		

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





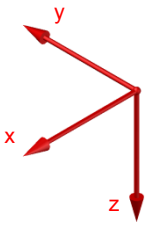
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.60	Not decisive	15.83	15.83	63.92	63.92
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.14	1.14	0.00	0.00	0.00	0.00

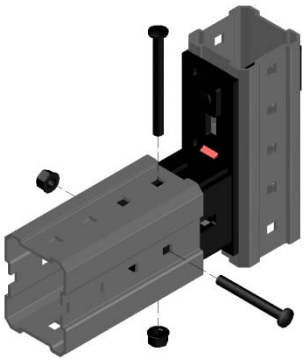
includes cross section resistance of steel plate and contact pressure

Interaction:

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

2. Welds





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
336.02	336.02	99.77	99.77	174.59	174.59
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
9.73	9.73	0.00	0.00	0.00	0.00

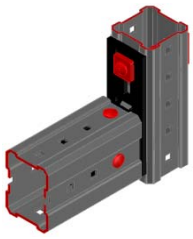
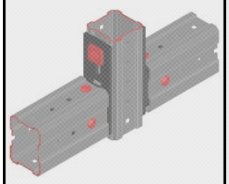
Interaction:

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

MIC-120-UH Connector

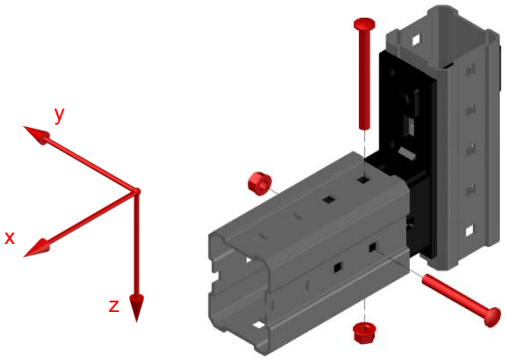
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double	
		

Design loading capacity - 3D 3/3

3. One hand screw -in connection to MIC-90-U and MI90-channel



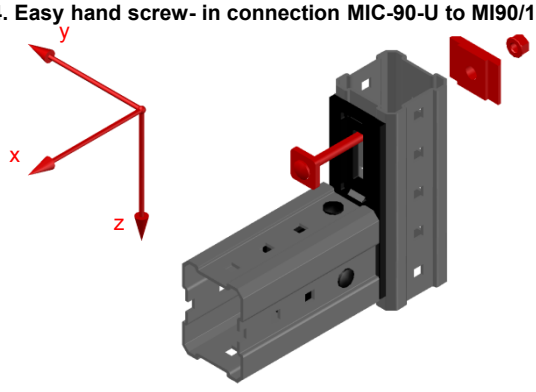
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.00	2.00	41.47	41.47	41.47	41.47
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.99	1.99	0.00	0.00	0.00	0.00

includes shear of the bolt, friction resistance, bearing resistance at connector plate and at channel MI90

Interaction:

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

4. Easy hand screw- in connection MIC-90-U to MI90/120-channel



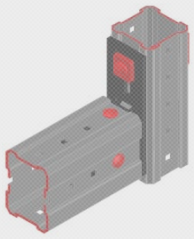
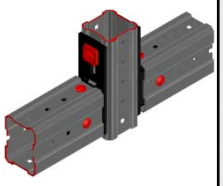
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.59	Not decisive	Not decisive	Not decisive	16.99	16.99
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
Not decisive	Not decisive	0.00	0.00	0.00	0.00

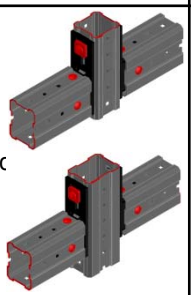
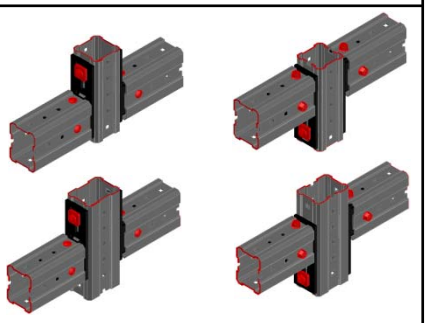
includes shear, bending and tension of the bolt, bearing resistance channel MI-90/120 and tooth plate, resistance of screw plate

Interaction:

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

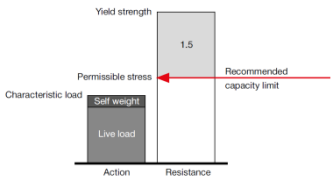
MIC-120-UH Connector

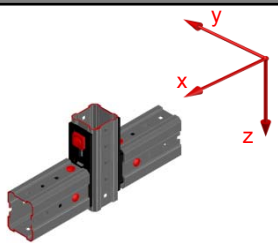
Standard	Double	
		

Loading case: Double	Combinations covered by loading case
Bill of Material for this loading case: For fixation on MI-90 girder Angle incl. all components **1x MIC-120-UH 2179534** **1x MIA-TP 305707** The backing plate MIA-EH-P remain unusec For fixation on MI-120 **1x MIC-90-UH 2179533** **1x MIA-TP 305707** **1x MIA-EH120 304888** The MIA-EH90 and MIA-EH-P remain unused 	Connector used for connecting 2xMI-120 girder on either MI-90 or MI-120 girder in a 90-degree angle 

Recommended loading capacity - simplified for most common applications

Method





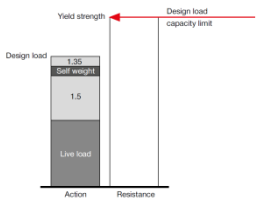
Individual connector capacity limit

±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.33	10.55	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 1/3

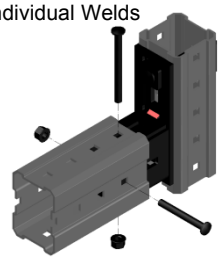
Method



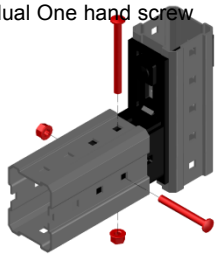
Limiting components of capacity evaluated in following tables:

1. Individual Steel connector

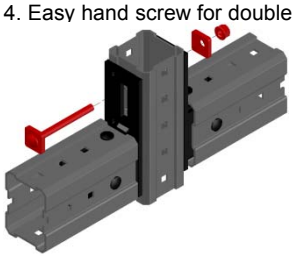
2. Individual Welds



3. Individual One hand screw



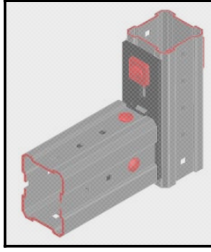
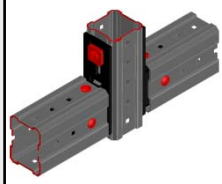
4. Easy hand screw for double



MIC-120-UH Connector

Validity:

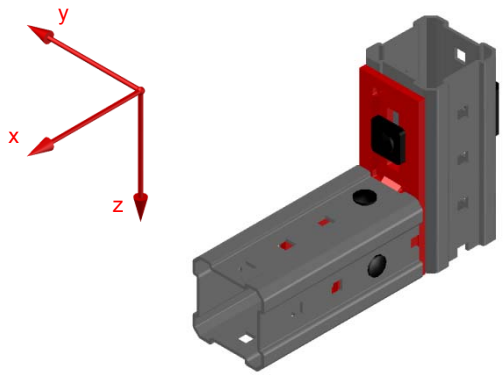
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double	
		

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. Individual Steel connector

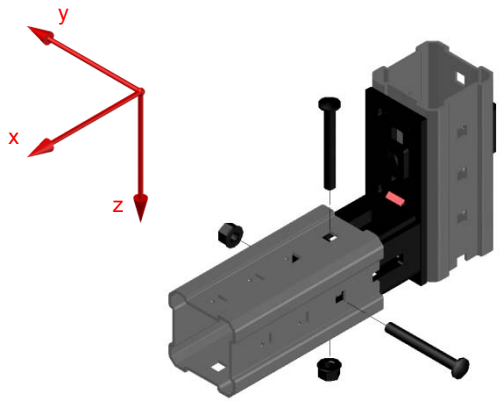


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.60	Not decisive	15.83	15.83	63.92	63.92
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.14	1.14	0.00	0.00	0.00	0.00

Interaction:

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

2. Individual Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
336.02	336.02	99.77	99.77	174.59	174.59
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
9.73	9.73	0.00	0.00	0.00	0.00

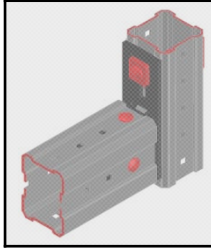
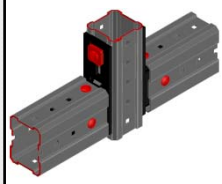
Interaction:

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

MIC-120-UH Connector

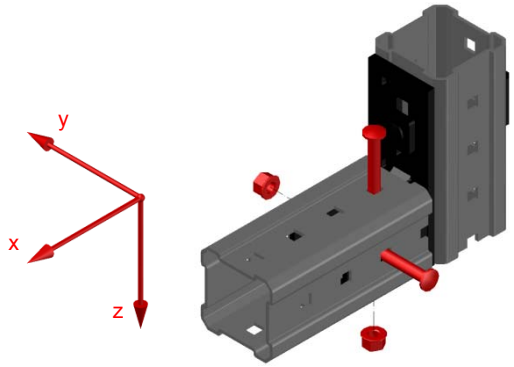
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard	Double	
		

Design loading capacity - 3D 3/3

3. Individual One hand screws -in connection to MIC-90-U and MI90-channel



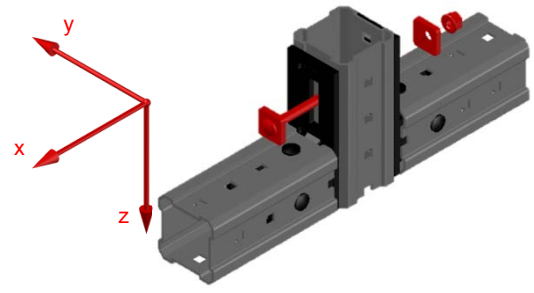
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.00	2.00	41.47	41.47	41.47	41.47
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.99	1.99	0.00	0.00	0.00	0.00

includes shear of the bolt, friction resistance, bearing resistance at connector plate and at channel MI90

Interaction:

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

4. Easy hand screw for double connection - resistance values for one connector* in connection MIC-90-U to MI90/120-channel



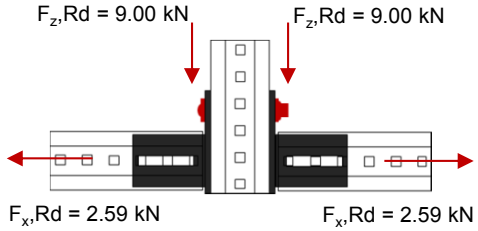
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.59*	Not decisive	Not decisive	Not decisive	9.00*	9.00*
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
Note decisive	Not decisive	0.00	0.00	0.00	0.00

includes shear, bending and tension of the bolt, bearing resistance channel MI-90/120 and tooth plate, resistance of screw plate

Interaction:

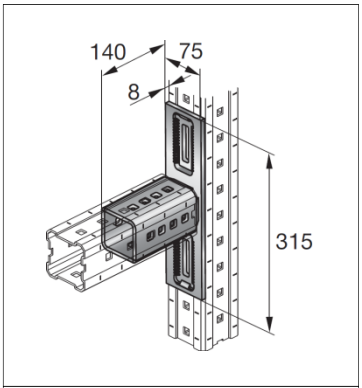
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} \le 1$$

* Explanation how to apply resistance values

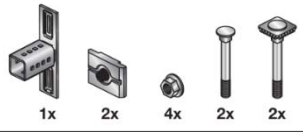


MIC-90-L Connector

Designation	Item number
MIC-90-L	**304805**



Hardware included per connector



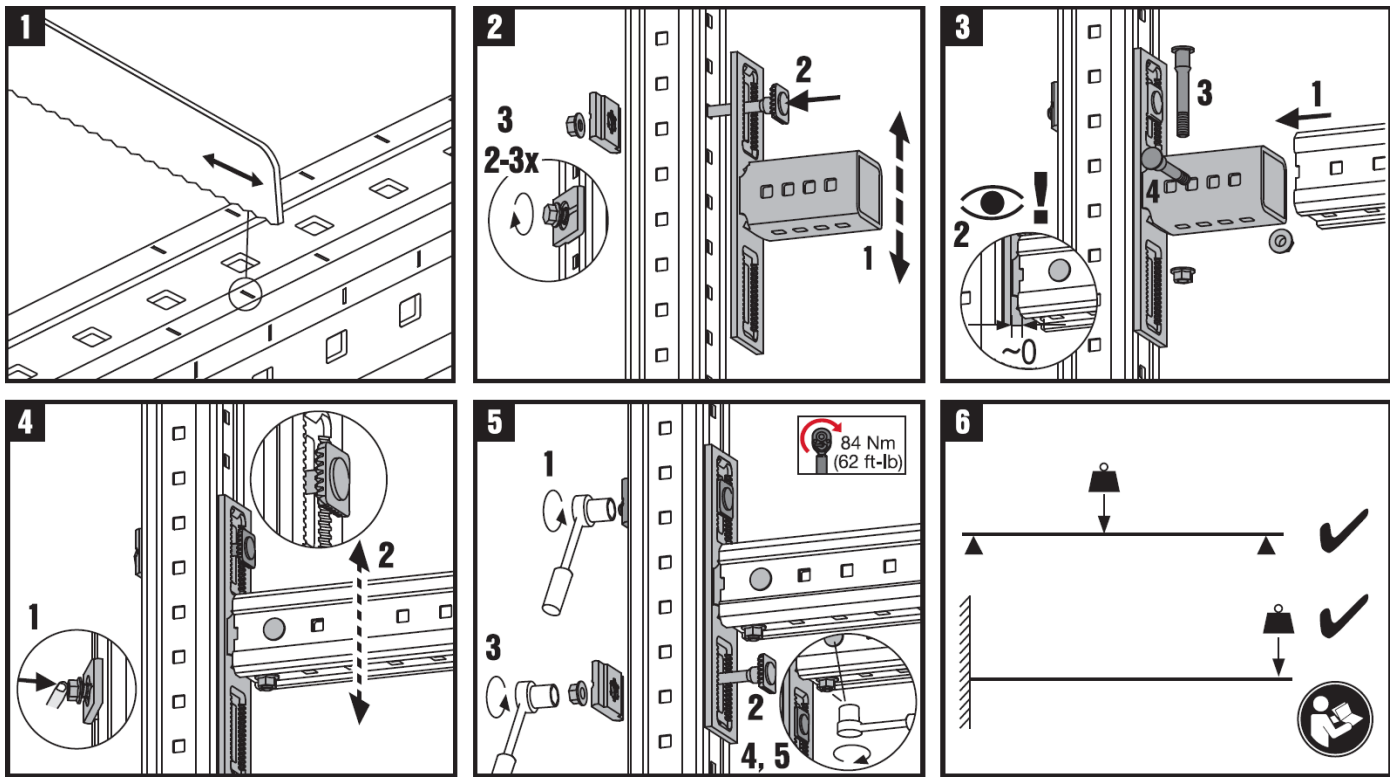
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Toothed Plate	**ISO 1461**	**45**
Backing Plate (Min.)	**ISO 1461**	**45**
Bolt; Nut	**ISO 1461**	**40; 45**

Weight:
4.05kg incl. components

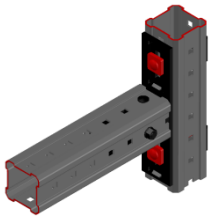
Submittal text:
Hot dipped galvanized, 90° Hilti MI angle connector, typically used for connecting two perpendicular MI girders. The baseplate has a serrated slot for improved shear loads and fine adjustment, and the connector is connected with fixed holes instead of an oblong hole. Suitable for cantilever applications.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Toothed Plate S235JR - (DIN EN10025-2)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Backing Plate (Min.) EN-GJMW-400-5 (DIN EN 1562)	$f_y = 220 \frac{N}{mm^2}$	$f_u = 400 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-90-L Connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

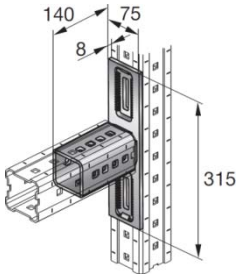
Standards and codes:

• 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

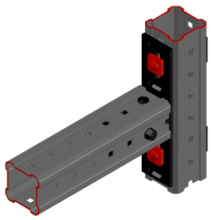
Software:
- Ansys 18.2
- Mathcad 15.0
- Microsoft Excel

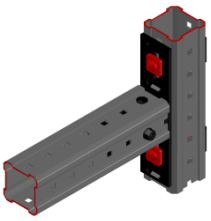
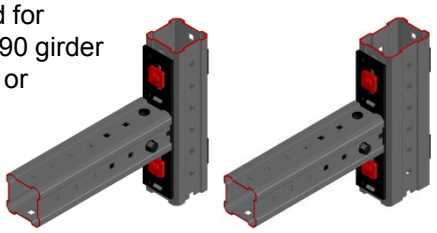
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



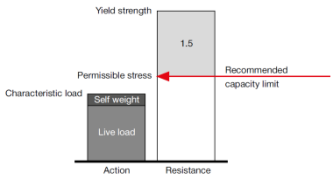
MIC-90-L Connector

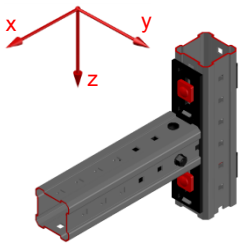
Standard		
		

Loading case: Standard	Combinations covered by loading case
Bill of Material for this loading case: For fixation on MI-90 girder Connector incl. all connecting hardware **1x MIC-90-L 304805** For fixation on MI-120 Connector incl. all connecting hardware **1x MIC-90-L 304804** **2x MIA-EH120 304888** The MIA-EH90 remain unused 	Connector used for Connecting MI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle 

Recommended loading capacity - simplified for most common applications

Method



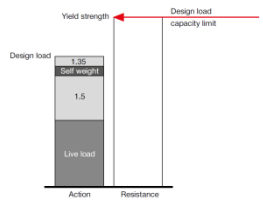


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
9.4	16.87	21.33
	±My,rec. [kNm]	
	0.87	

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

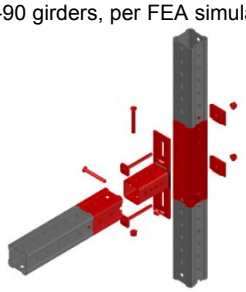
Design loading capacity - 3D 1/2

Method

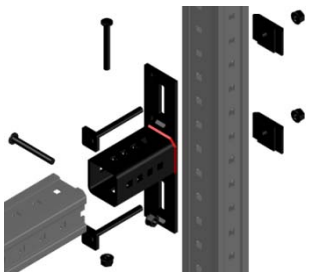


Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation

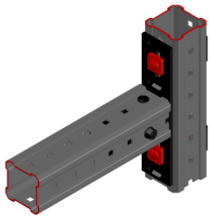


2. Welds – per analytical calculation



MIC-90-L Connector

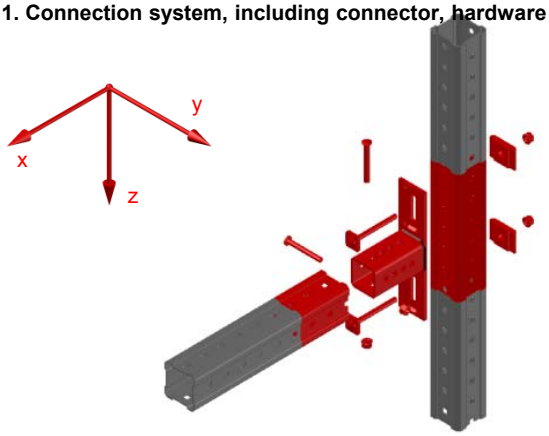
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation

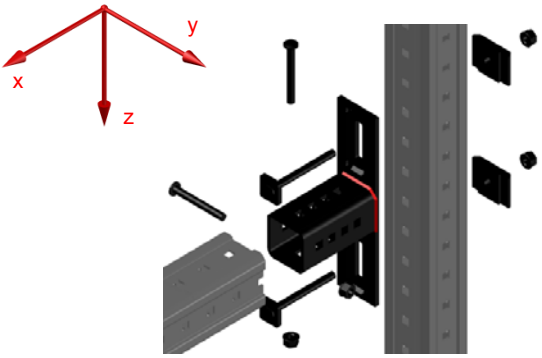


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
14.10	63.30	25.30	25.30	32.00	32.00
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.95	2.95	1.30	1.30	0.53	0.53

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. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
230.12	230.12	75.53	75.53	75.53	75.53
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.64	5.64	3.45	3.45	3.45	3.45

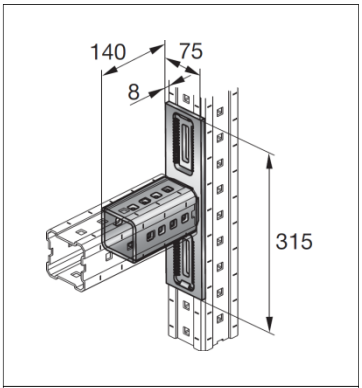
Interaction:

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

MIC-90-L-AP Connector

Designation	Item number
MIC-90-L-AP	**305710**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**



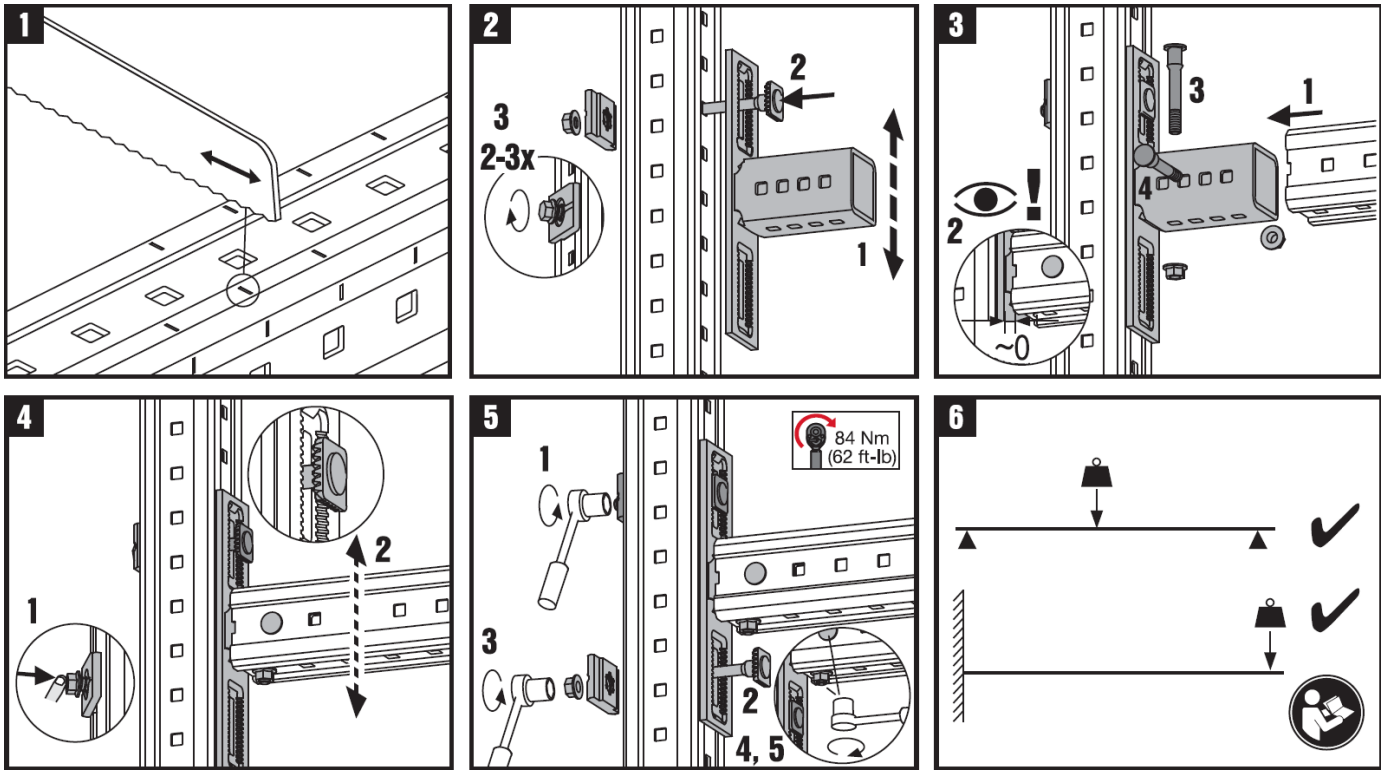
Hardware included per connector

Weight:
3.00kg without components

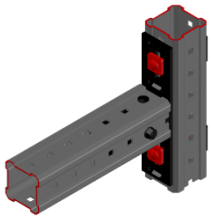
Submittal text:
Hot dipped galvanized, 90° Hilti MI angle connector, typically used for connecting two perpendicular MI girders. The baseplate has a serrated slot for improved shear loads and fine adjustment, and the connector is connected with fixed holes instead of an oblong hole. Suitable for cantilever applications.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	**$f_y = 235 \frac{N}{mm^2}$**	**$f_u = 360 \frac{N}{mm^2}$**	**$E = 210000 \frac{N}{mm^2}$**	**$G = 80769 \frac{N}{mm^2}$**
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-90-L-AP Connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

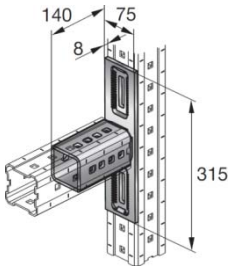
Methodology:
- Finite element analysis
- Analytic calculation

Standards and codes:
- EN 1990 03.2003 — Basics of structural design
- 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 18.2
- Mathcad 15.0
- Microsoft Excel

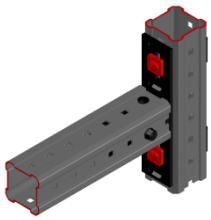
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



MIC-90-L-AP Connector

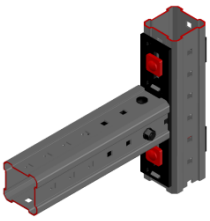
Standard



Loading case: Standard

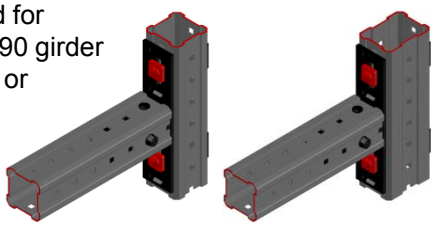
Bill of Material for this loading case:

1x MIC-90-L-AP	**305710**
Components not included	
2x MIA-EH-P	**304891**
2x M12-F-SL WS3/4	**382897**
2x MIA-OH90	**304889**
For fixation on MI-90 girder	
2x MIA-EH90	**304887**
For fixation on MI-120	
2x MIA-EH120	**304888**



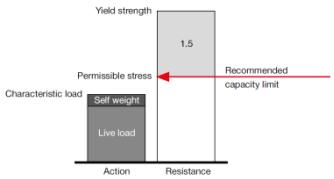
Combinations covered by loading case

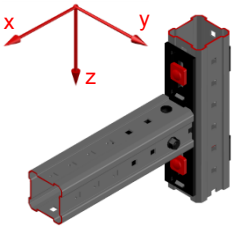
Connector used for Connecting MI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle



Recommended loading capacity - simplified for most common applications

Method



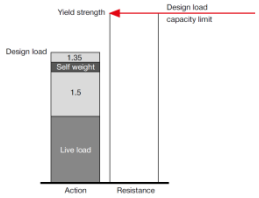


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
9.4	16.87	21.33
	±My,rec. [kNm]	
	0.87	

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

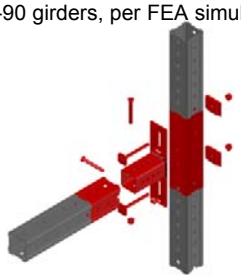
Design loading capacity - 3D 1/2

Method

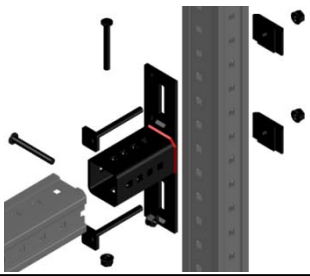


Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation

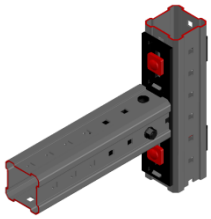


2. Welds – per analytical calculation



MIC-90-L-AP Connector

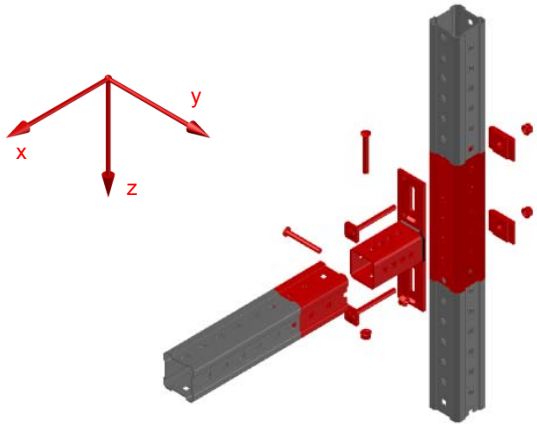
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation

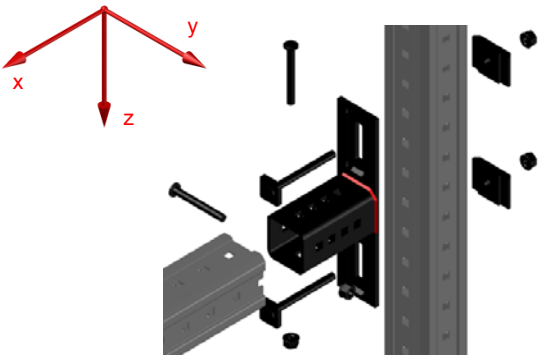


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
14.10	63.30	25.30	25.30	32.00	32.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
2.95	2.95	1.30	1.30	0.53	0.53

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. Welds – per analytical calculation



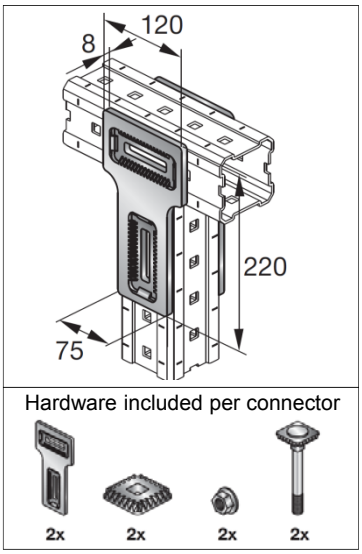
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
230.12	230.12	75.53	75.53	75.53	75.53
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
5.64	5.64	3.45	3.45	3.45	3.45

Interaction:

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

MIC-T Connector

Designation	Item number
MIC-T	**304807**



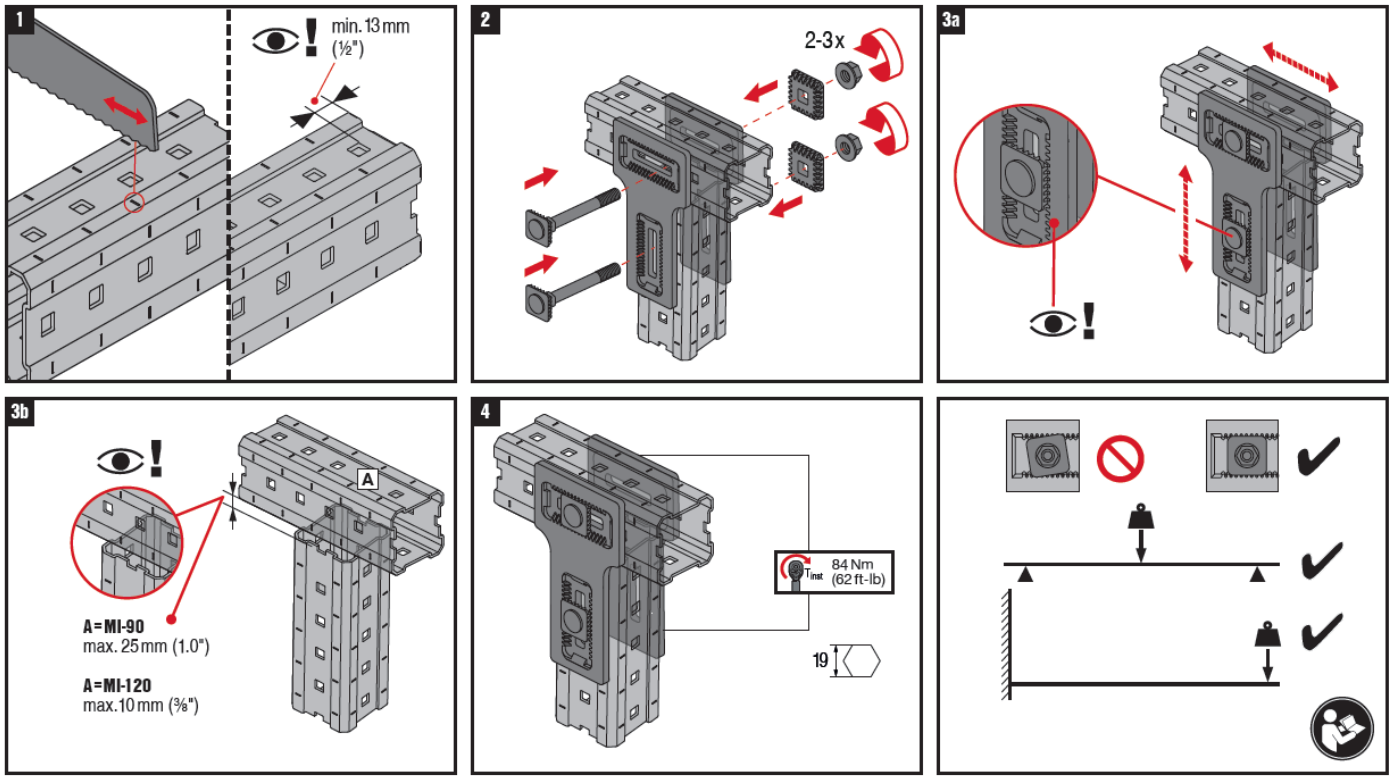
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Toothed Plate	**ISO 1461**	**45**
Backing Plate (Min.)	**ISO 1461**	**45**
Bolt; Nut	**ISO 1461**	**40; 45**

Weight:
2510 g incl. components

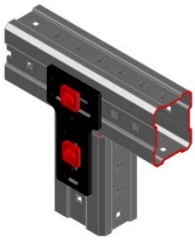
Descriptions:
Hot dipped galvanized, 90° Hilti MI angle connector, typically used for connecting two perpendicular MI girders, where the horizontal girder sits on top of the vertical girder. Oblong holes enable fine adjustment and are serrated to improve holding and load values. Connector is used on the side of the girders.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Toothed Plate S235JR - (DIN EN10025-2)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Backing Plate (Min.) EN-GJMW-400-5 (DIN EN 1562)	$f_y = 220 \frac{N}{mm^2}$	$f_u = 400 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-T Connector

Possible loading cases		
MIC-T 90-90	**MIC T 120-120**	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

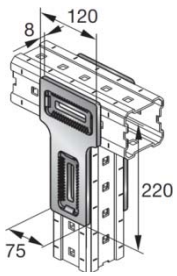
Standards and codes:

• EN 1990 03.2003	Basics of structural design	
• 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

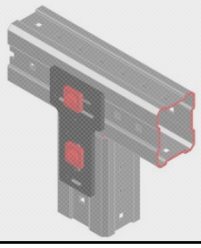
Software:
- Ansys 18.2
- Mathcad 15.0
- Microsoft Excel

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



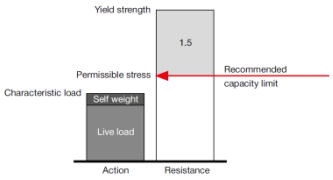
MIC-T Connector

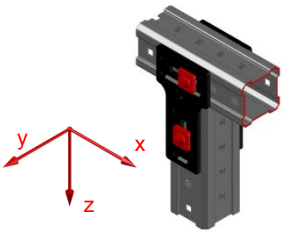
MIC-T 90-90	MIC-T 120-120	
		

Loading case: MIC-T 90-90	Combinations covered by loading case
Bill of Material for this loading case: Angle incl. all components **1x MIC-T (pair)** **304807** 	Connector used for perpendicular connections of two MI-90 girders, where Horizontal girder sits on top of the vertical girder 

Recommended loading capacity - simplified for most common applications

Method



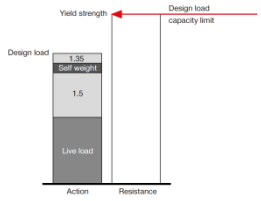


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
10.17	5.67	17.87

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

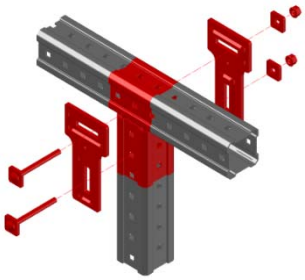
Design loading capacity - 3D 1/2

Method



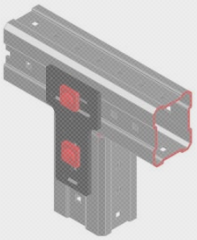
Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation



MIC-T Connector

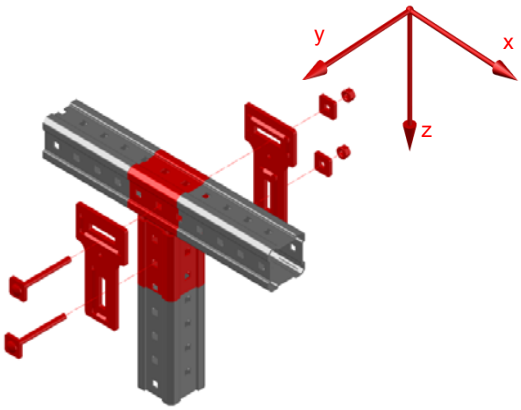
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

MIC-T 90-90	MIC-T 120-120	
		

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. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation

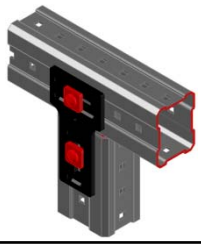


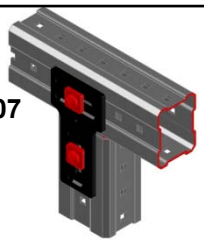
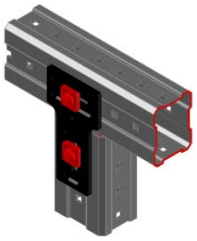
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
15.25	15.25	8.50	8.50	26.80	26.80
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.75	0.75	1.60	1.60	0.70	0.70

Interaction:

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

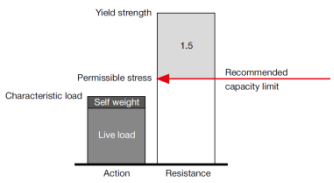
MIC-T Connector

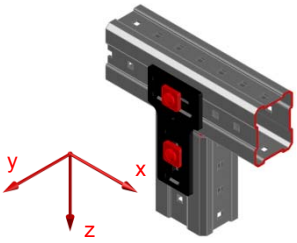
MIC-T 90-90	MIC-T 120-120	
		

Loading case: MIC-T 120-120	Combinations covered by loading case
Bill of Material for this loading case: Angle incl. all components **1x MIC-T (pair)** **304807** 	Connector used For perpendicular connections of two MI-120 girders, where Horizontal girder sits on top of the vertical girder 

Recommended loading capacity - simplified for most common applications

Method



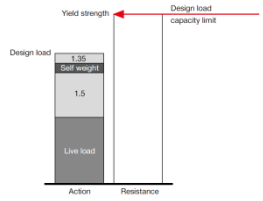


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
13.00	6.87	17.87

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

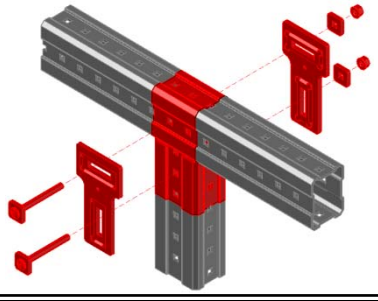
Design loading capacity - 3D 1/2

Method



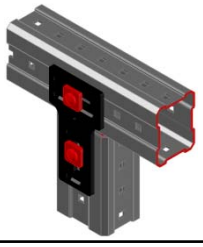
Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation



MIC-T Connector

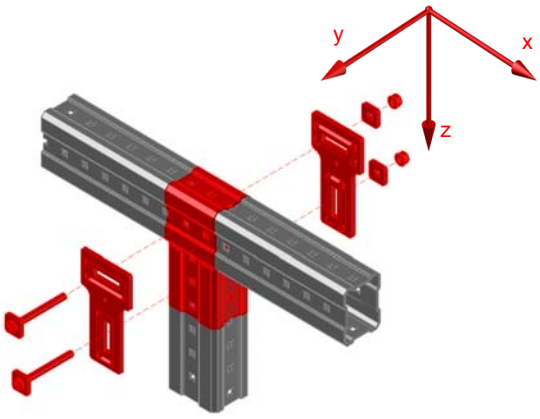
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

MIC-T 90-90	MIC-T 120-120	
		

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. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation



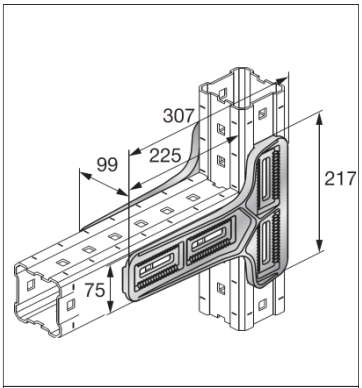
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
19.50	19.50	10.30	10.30	26.80	26.80
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.80	0.80	1.95	1.95	0.85	0.85

Interaction:

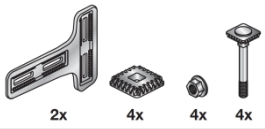
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \le 1$$

MIC-90-LH Connector

Designation	Item number
MIC-90-LH	**2165050**



Hardware included per connector



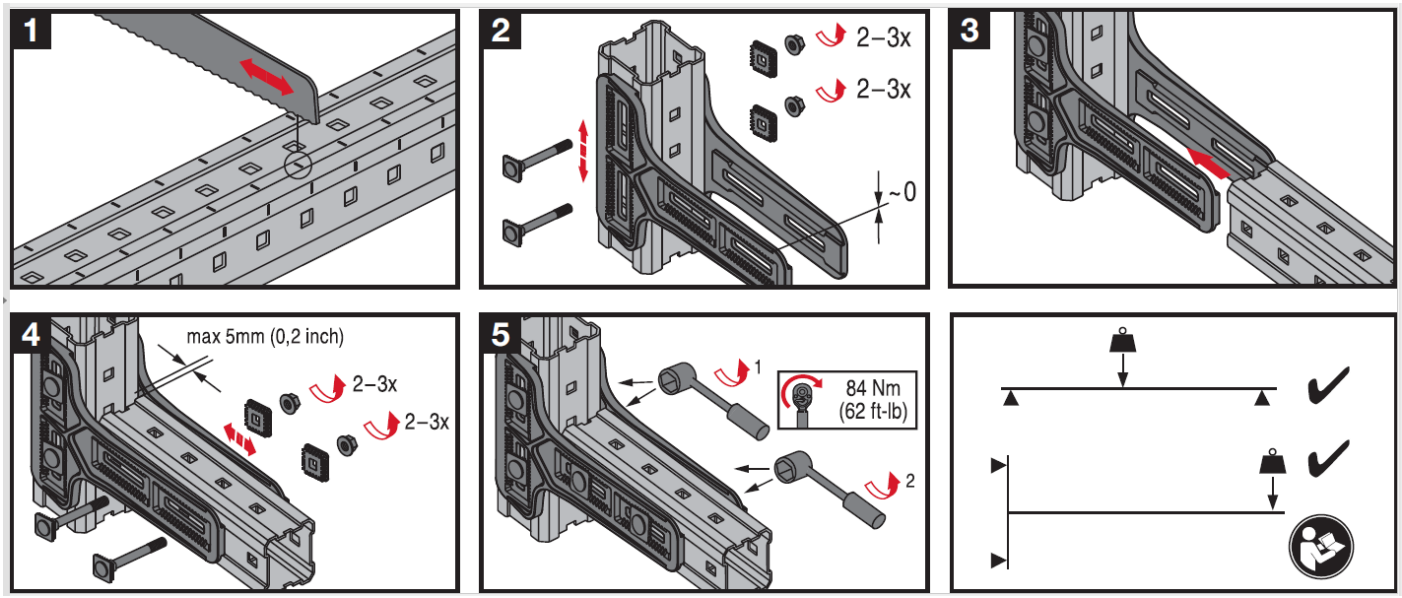
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Toothed Plate	**ISO 1461**	**45**
Bolt; Nut	**ISO 1461**	**40; 45**

Weight:
4840 g incl. components

Description:
Hot dipped galvanized, 90° Hilti MI angle connector, typically used for connecting two perpendicular MI 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

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate C30, 1.0528 (DIN EN 10250-2)	$f_y = 250 \frac{N}{mm^2}$	$f_u = 480 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Toothed Plate S235JR - (DIN EN10025-2)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-90-LH Connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation
- Finite element analysis
- Hardware tests

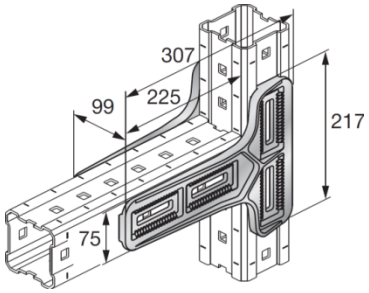
Standards and codes:

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

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



MIC-90-LH Connector

Standard

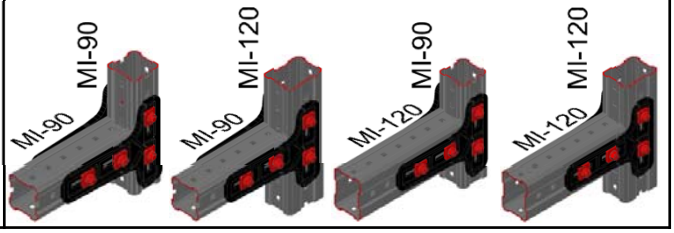
Loading case: Standard

Bill of Material for this loading case:

1x MIC-90-LH connector **2048107**
Connector incl. all connecting hardware

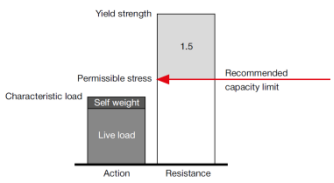
Combinations covered by loading case

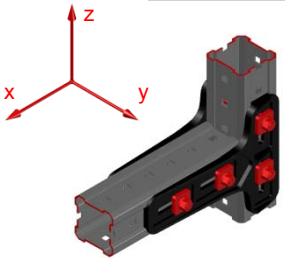
Connector used for perpendicular connections of various combinations two MI-90 or 120 girders, to enable a cantilever arm



Recommended loading capacity - simplified for most common applications

Method



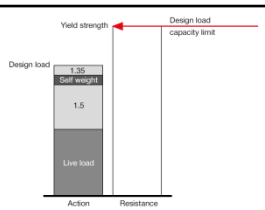


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
35.5	9.7	35.5
	±My,rec. [kNm]	
	3.83	

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

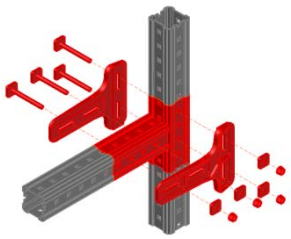
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI girders, per FEA simulation



MIC-90-LH Connector

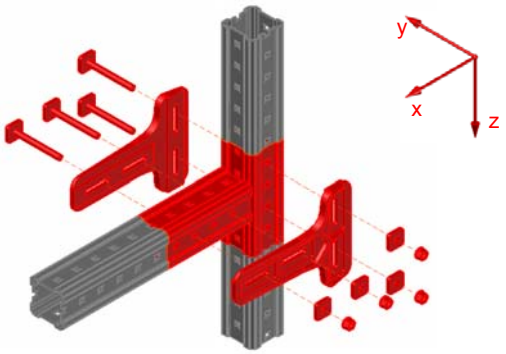
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI girders, per FEA simulation



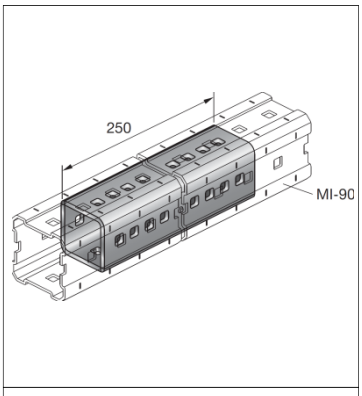
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
56.35	56.35	20.70	20.70	53.24	53.24
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
2.24	2.24	5.75	5.75	1.31	1.31

Interaction:

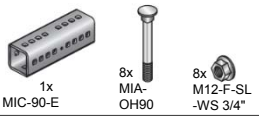
$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{y,Ed}}{F_{y,Rd}} + \frac{F_{z,Ed}}{F_{z,Rd}} + \frac{M_{x,Ed}}{M_{x,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$$

MIC-90-E Connector

Designation	Item number
MIC-90-E	**304809**



Hardware included per connector



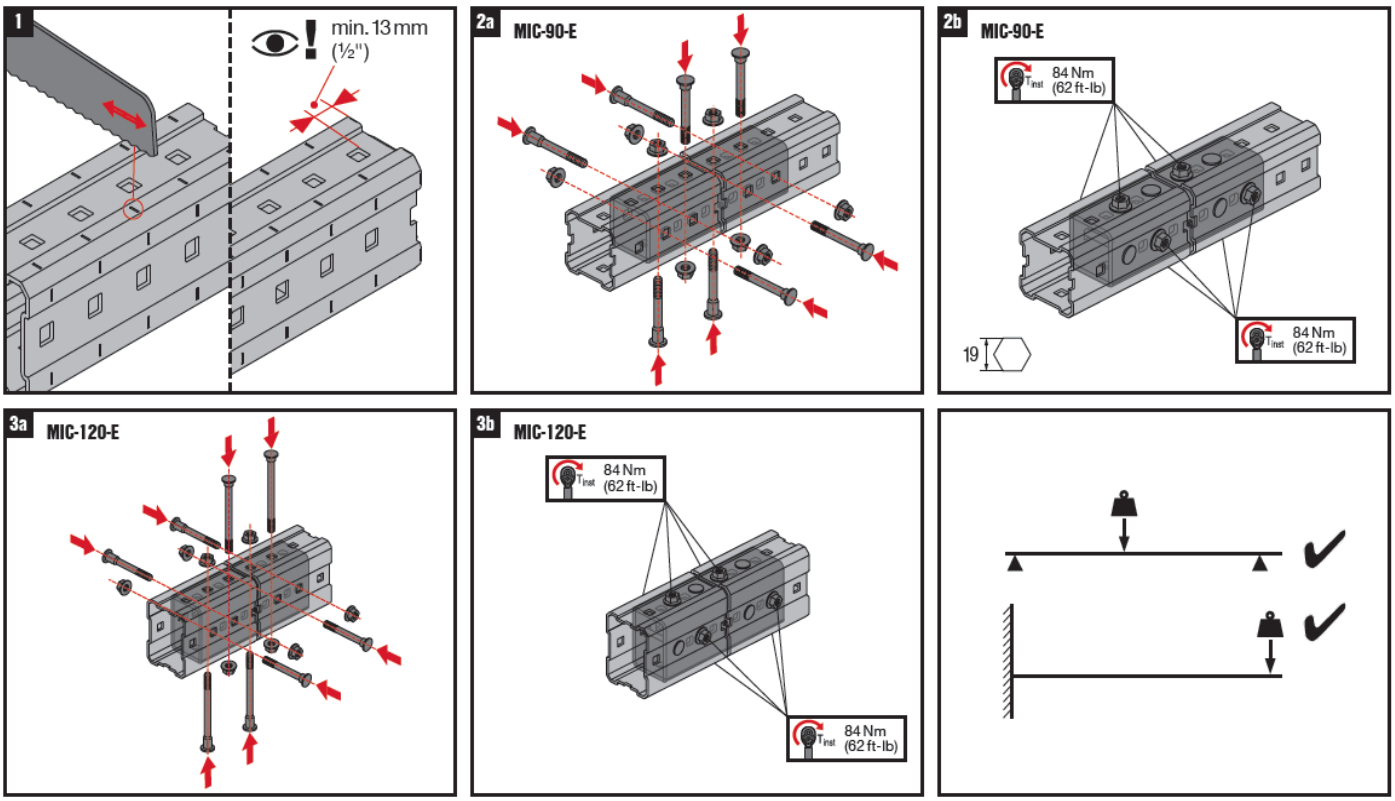
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**

Weight:
8.12 lb (3685 g) incl. components

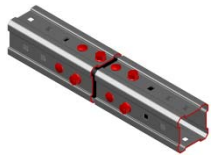
Description:
Hot dipped galvanized, Hilti MI extension connector typically used for connecting two MI-90 girders together to form a continuous girder. Fixed with 8 bolts and lock-nuts through the girder to enable a strong hold and vibration resistance.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-90-E Connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation
- Finite element analysis
- Hardware tests

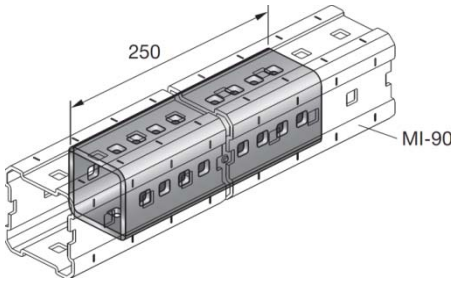
Standards and codes:

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

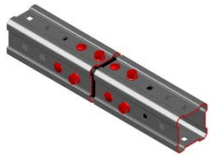
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



MIC-90-E Connector

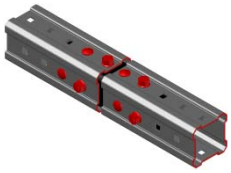
Standard



Loading case: Standard

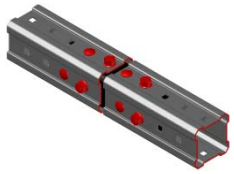
Bill of Material for this loading case:

1x MIC-90-E **304809**
Connector incl. all connecting hardware



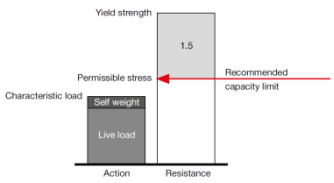
Combinations covered by loading case

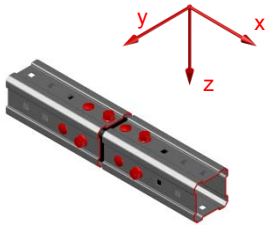
Connector used for extension of MI-90 girders



Recommended loading capacity - simplified for most common applications

Method



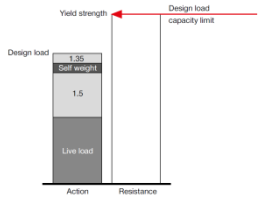


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
79.21	12.67	12.67
	±My,rec [kNm]	
	1.3	

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

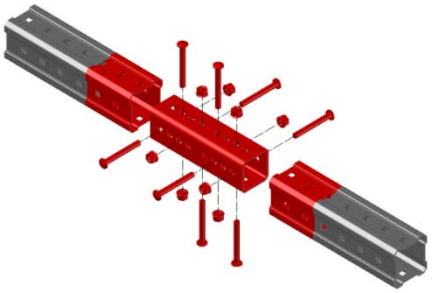
Design loading capacity - 3D 1/2

Method



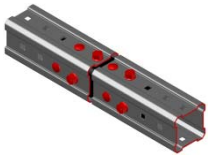
Limiting components of capacity evaluated in following tables:

Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation



MIC-90-E Connector

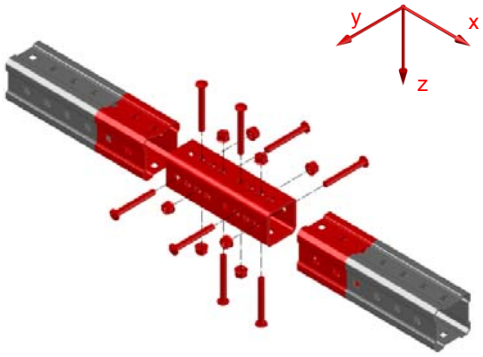
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard		
		

Design loading capacity - 3D 2/2

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

1. Steel connector



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
118.82	118.82	19.00	19.00	19.00	19.00
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.10	2.10	1.95	1.95	1.95	1.95

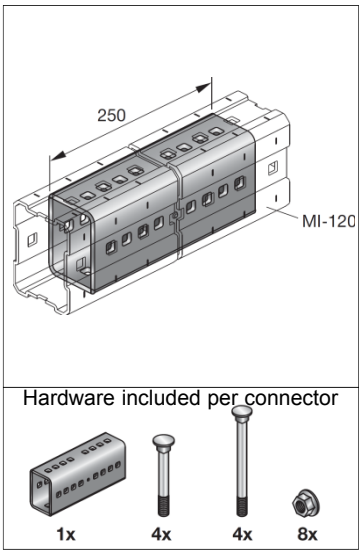
Interaction:

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

MIC-120-E Connector

Designation	Item number
MIC-120-E	**304810**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**

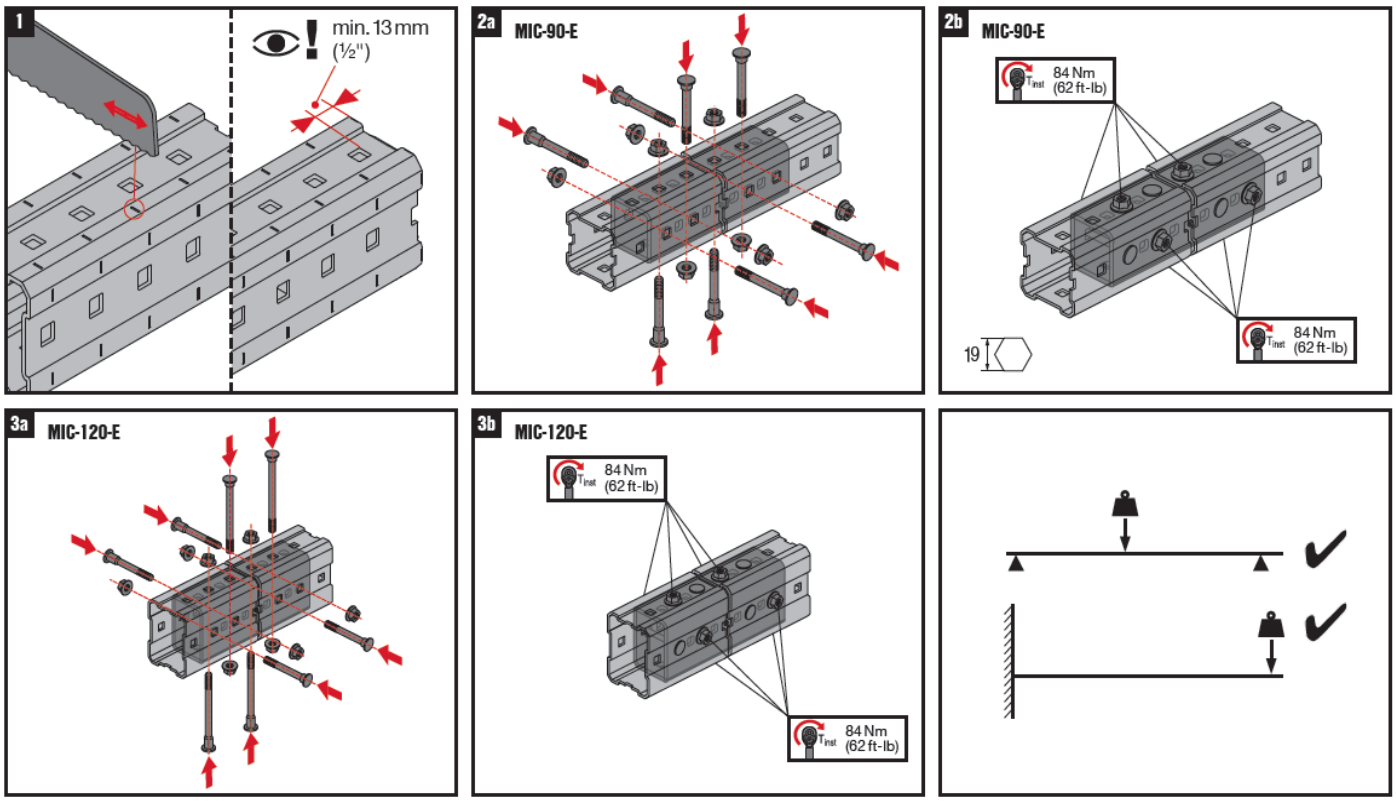


Weight:
4490 g incl. components

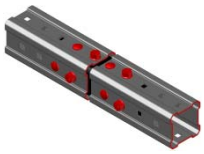
Description:
Hot dipped galvanized, Hilti MI extension connector typically used for connecting two MI-120 girders together to form a continuous girder. Fixed with 8 bolts and lock-nuts through the girder to enable a strong hold and vibration resistance.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-120-E Connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation
- Finite element analysis
- Hardware tests

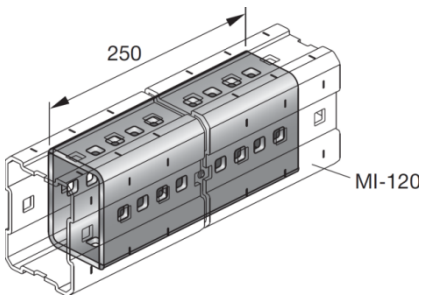
Standards and codes:

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

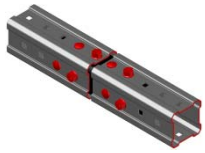
Software:
- Ansys 16.0
- Microsoft Excel
- Mathcad 15

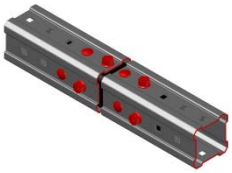
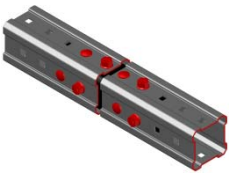
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



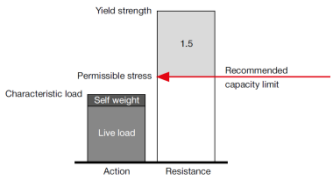
MIC-120-E Connector

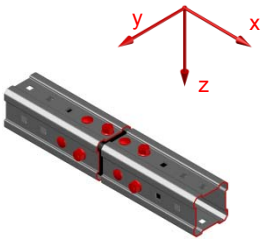
Standard		
		

Loading case: Standard	Combinations covered by loading case
Bill of Material for this loading case: **1x MIC-120-E** **304810** Connector incl. all connecting hardware 	Connector used for extension of MI-120 girder 

Recommended loading capacity - simplified for most common applications

Method



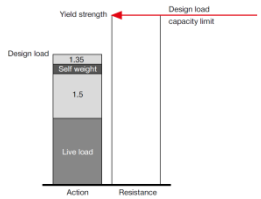


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
79.21	12.67	18.67
	±My,rec. [kNm]	
	2.0	

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

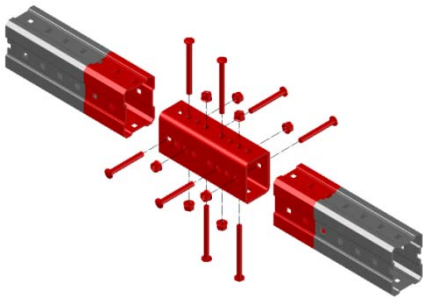
Design loading capacity - 3D 1/2

Method



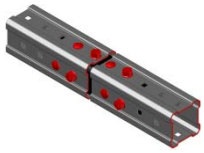
Limiting components of capacity evaluated in following tables:

Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation



MIC-120-E Connector

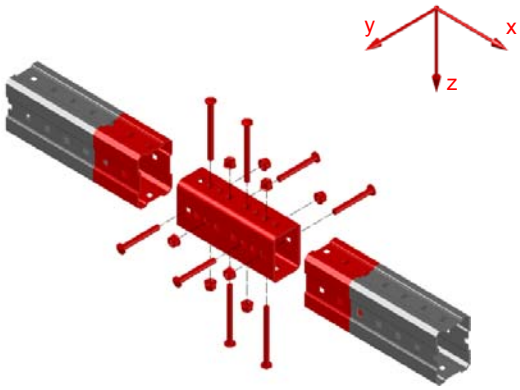
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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.

Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation



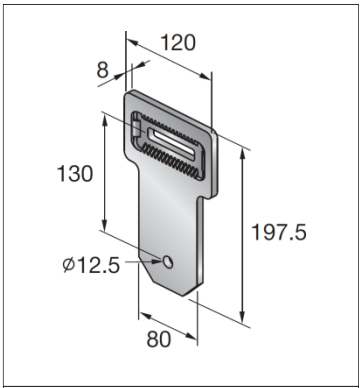
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
118.82	118.82	19.00	19.00	28.00	28.00
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
3.15	3.15	3.00	3.00	1.95	1.95

Interaction:

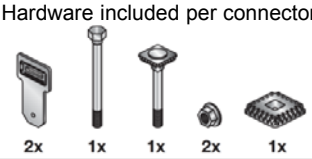
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \le 1$$

MIC-U-MA Connector

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



Hardware included per connector



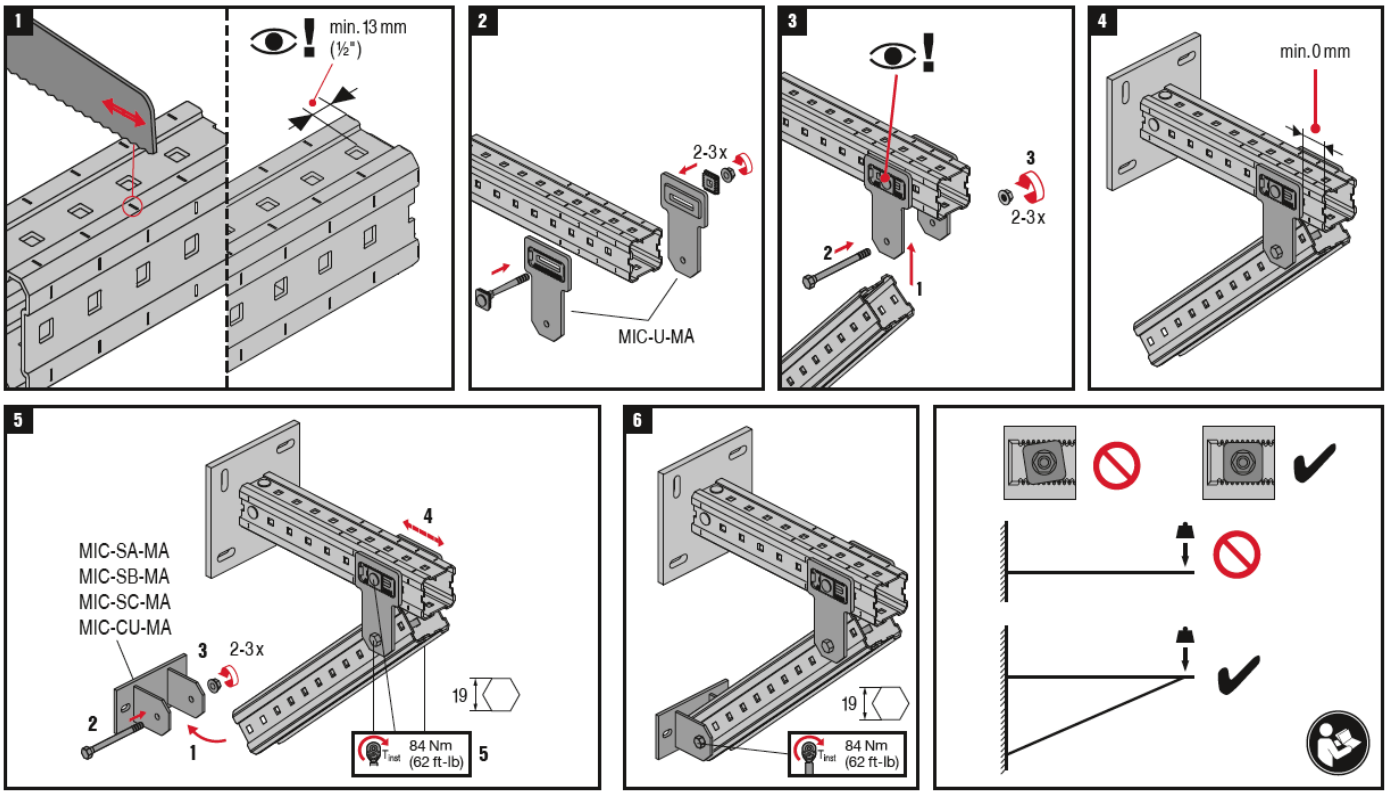
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Toothed Plate	**ISO 1461**	**45**
Bolt; Nut	**ISO 1461**	**40; 45**

Weight:
2630 g incl. components

Description:
Hot dipped galvanized Hilti MI connector, typically used for connecting two MI girders, where one girder is braced / supported by the other at 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

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Toothed Plate S235JR - (DIN EN10025-2)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-U-MA Connector

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

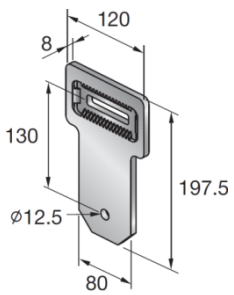
Standards and codes:

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
- Mathcad 15

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



MIC-U-MA Connector

Standard

Loading case: Standard

Bill of Material for this loading case:

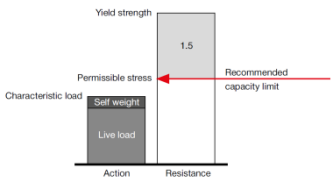
1x MIC-U-MA (pair) **304806**
Connector incl. all connecting hardware

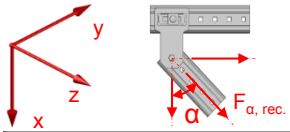
Combinations covered by loading case

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





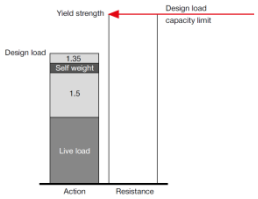
±Fy,rec. [kN]
4.47

α	0°	30°	45°	60°	90°
±$F_{α,rec.}$ [kN]	13.33	11.57	10.36	9.46	8.77

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

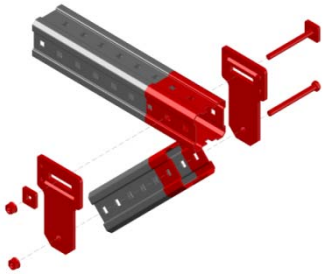
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation



MIC-U-MA Connector

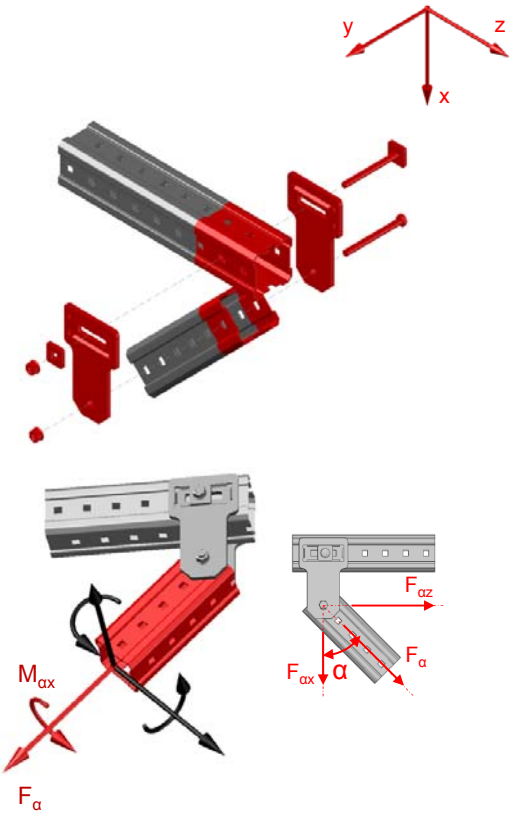
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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.

Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
20.00	20.00	6.70	6.70	13.15	13.15
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.75	0.75	0.00	0.00	0.00	0.00

Note: The torsional moment M_x is referred to the local x-direction of the inclined profile in plane x/z.

Interaction:

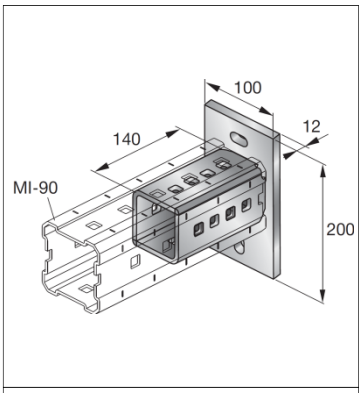
$$F_{x.Ed\alpha} := F_\alpha \cdot \cos(\alpha)$$
$$F_{z.Ed\alpha} := F_\alpha \cdot \sin(\alpha)$$

$$\left(\frac{F_{x.Ed\alpha}}{F_{x.Rd}}\right)^2 + \left(\frac{F_{z.Ed\alpha}}{F_{z.Rd}}\right)^2 + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \le 1$$

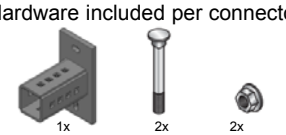
MIC-C90-AA Base Material Connector - Concrete

Designation	Item number
MIC-C90-AA	**304825**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**



Hardware included per connector

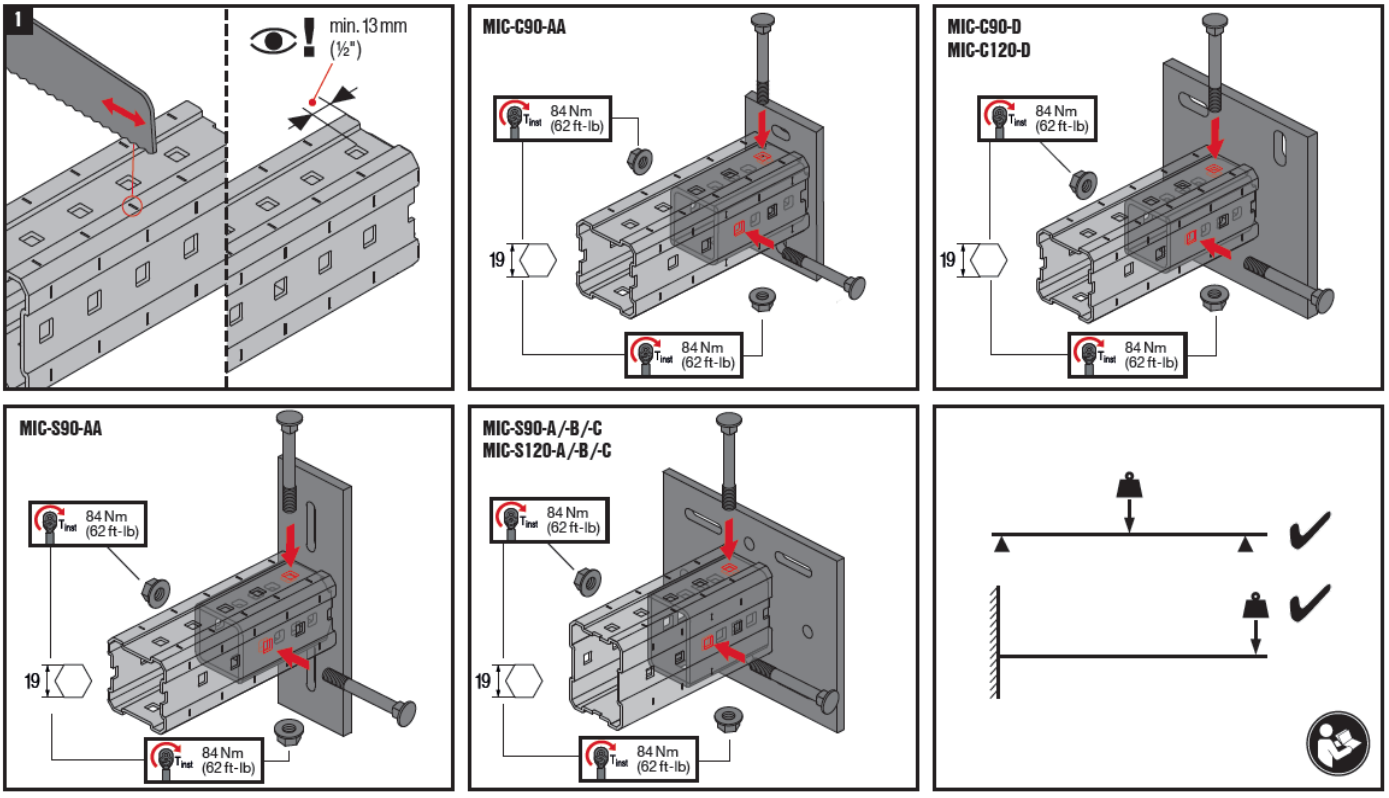


Weight:
3490 g incl. components

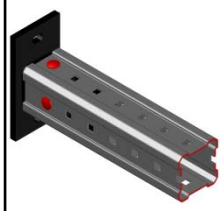
Description:
Hilti Hot-dipped galvanized baseplate connector, typically used for anchoring an MI-90 girder to concrete. Two oblong anchor holes enable fine tuning of baseplate position, and girder is connected using bolts through fixed holes.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-C90-AA Base Material Connector - Concrete

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

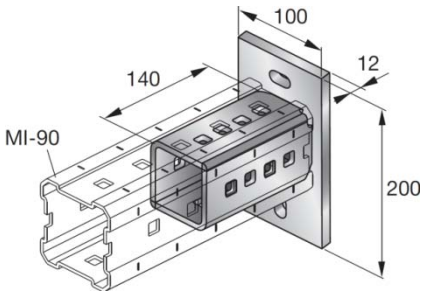
Standards and codes:

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
- Mathcad 15

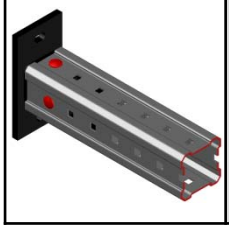
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



MIC-C90-AA Base Material Connector - Concrete

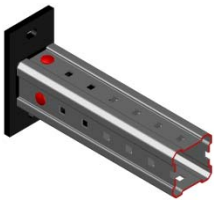
Standard



Loading case: Standard

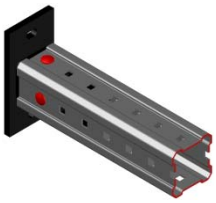
Bill of Material for this loading case:

1x MIC-C90-AA **304825**
Connector incl. all connecting hardware



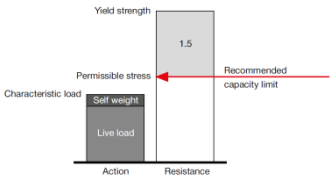
Combinations covered by loading case

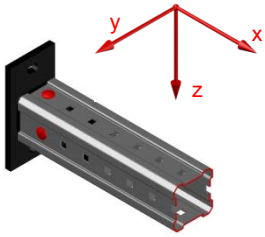
Baseplate connector used for a perpendicular connection of an MI-90 girder to concrete



Recommended loading capacity - simplified for most common applications

Method



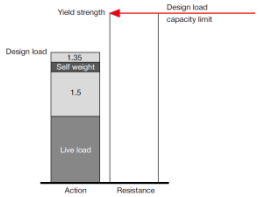


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
19.8	24.2	24.2

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

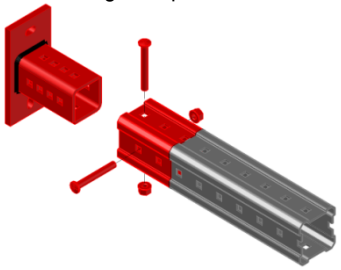
Design loading capacity - 3D 1/2

Method

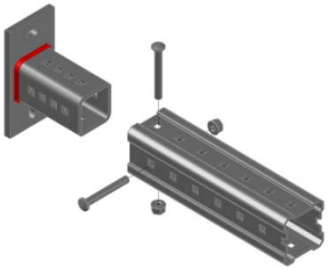


Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

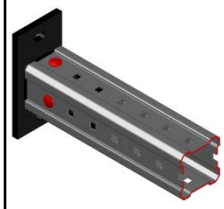


2. Welds – per analytical calculation



MIC-C90-AA Base Material Connector - Concrete

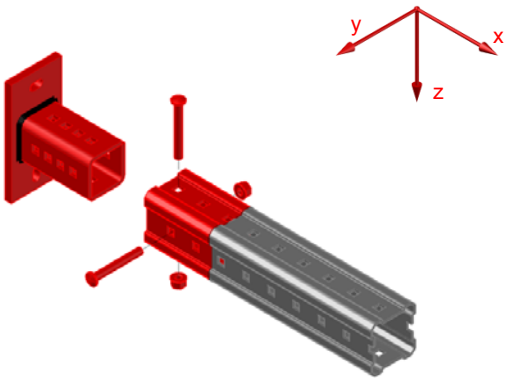
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

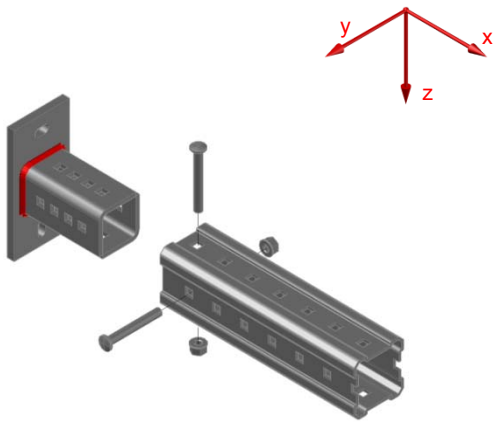


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
50.30	63.30	31.60	31.60	31.60	31.60
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.85	2.85	1.81	1.81	1.00	1.00

Interaction:

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

2. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
230.12	230.12	49.31	49.31	49.31	49.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.64	5.64	3.45	3.45	3.45	3.45

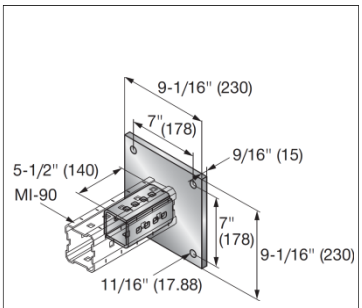
Interaction:

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

MIC-C90-DH Base Material Connector - Concrete

Designation	Item number
MIC-C90-DH	**2174661**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**



Hardware included per connector

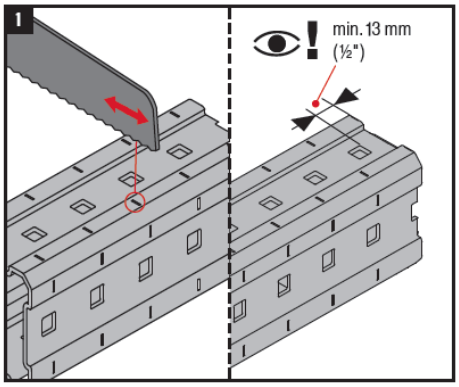
1x MIC-C90-DH | 4x MIA-OH90 | 4x M12-F-SL-WS ¾"

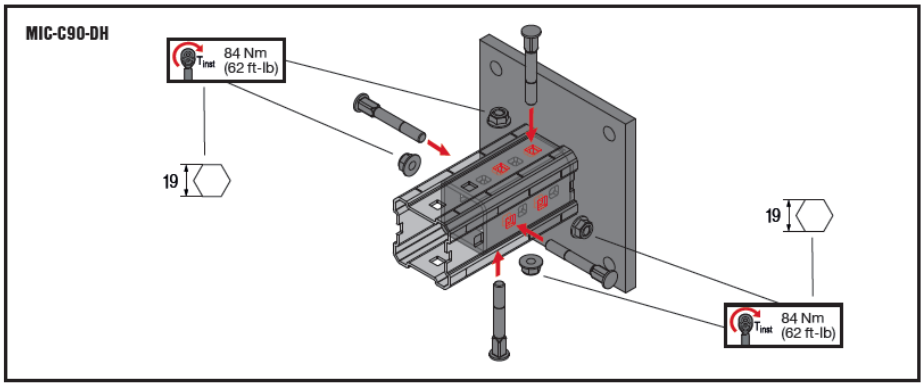
Weight:
8228g incl. components

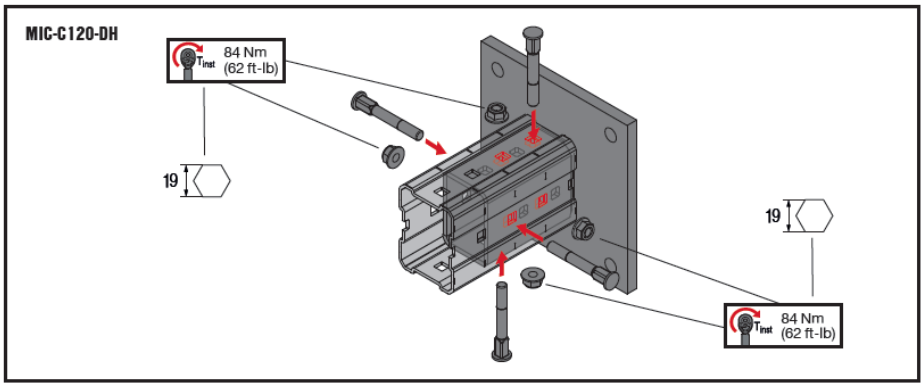
Description:
Hilti Hot-dipped galvanized baseplate connector, used for anchoring an MI-90 girder to concrete. Four round anchor holes of baseplate enable anchoring, and girder is connected using bolts through fixed holes.

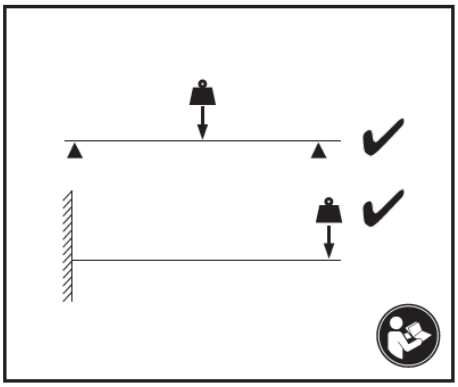
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

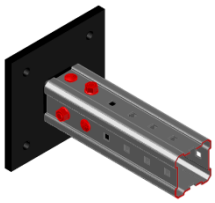








MIC-C90-DH Base Material Connector - Concrete

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

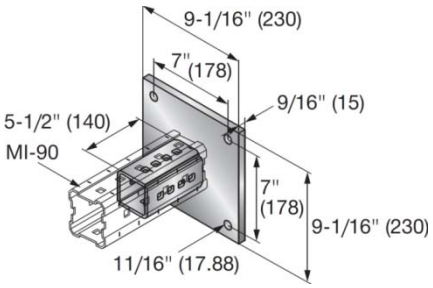
Standards and codes:

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
- Mathcad 15

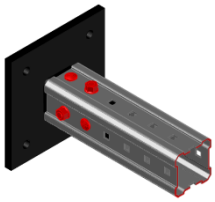
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



MIC-C90-DH Base Material Connector - Concrete

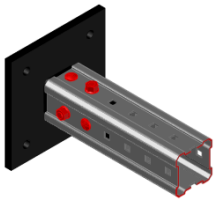
Standard



Loading case: Standard

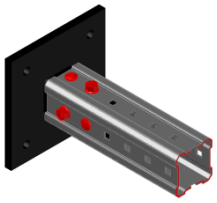
Bill of Material for this loading case:

1x MIC-C90-DH **2174661**
Connector incl. all connecting hardware



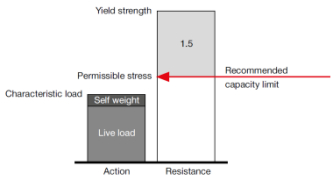
Combinations covered by loading case

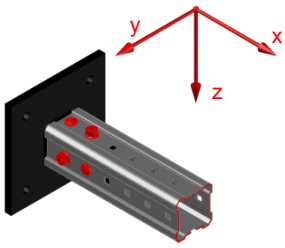
Baseplate connector used for a perpendicular connection of an MI-90 girder to concrete



Recommended loading capacity - simplified for most common applications

Method



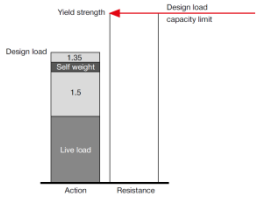


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
36.0	30.3	30.3

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

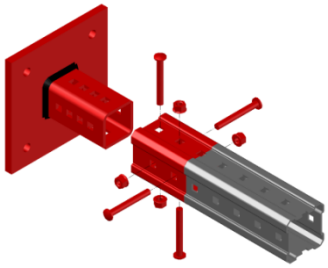
Design loading capacity - 3D 1/2

Method

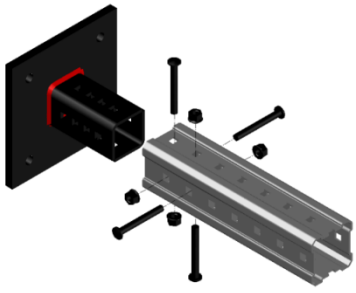


Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

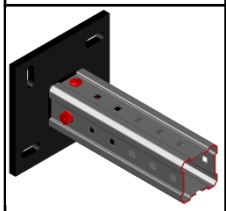


2. Welds – per analytical calculation



MIC-C90-DH Base Material Connector - Concrete

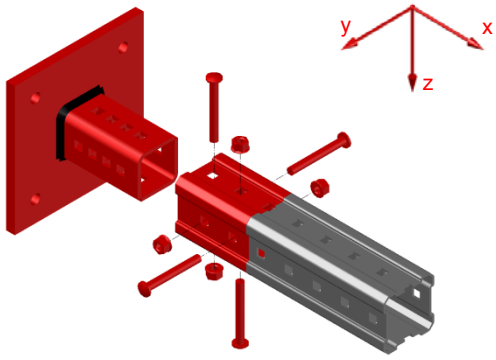
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

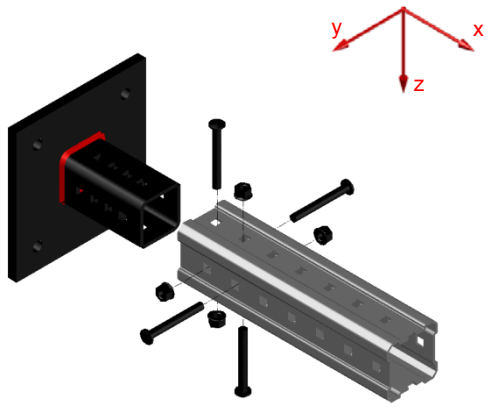


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
90.00	118.82	45.40	45.40	45.40	45.40
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
3.60	3.60	3.00	3.00	3.00	3.00

Interaction:

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

2. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
230.12	230.12	49.31	49.31	49.31	49.31
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
5.64	5.64	3.45	3.45	3.45	3.45

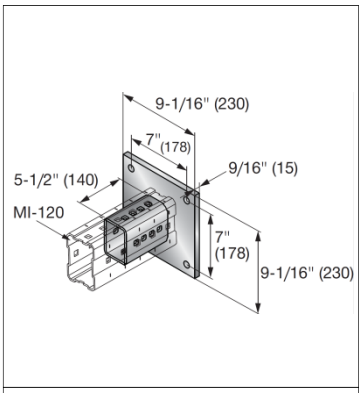
Interaction:

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

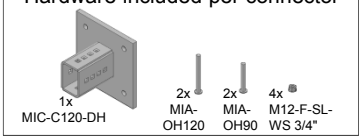
MIC-C120-DH Base Material Connector - Concrete

Designation	Item number
MIC-C120-DH	**2174662**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**



Hardware included per connector

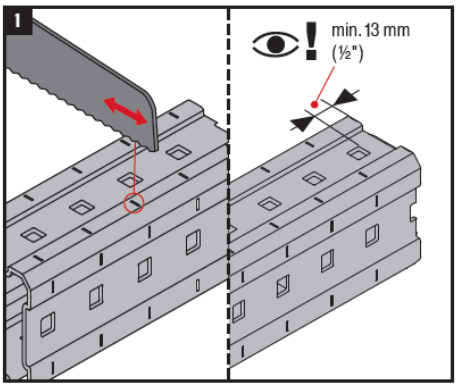


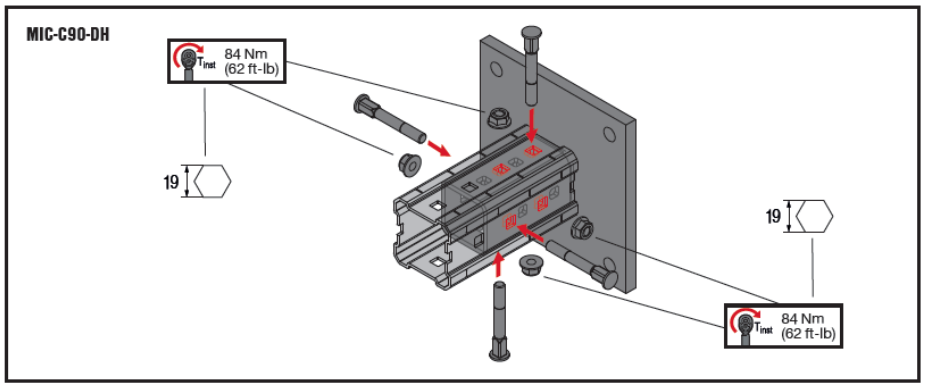
Weight:
8688 g incl. components

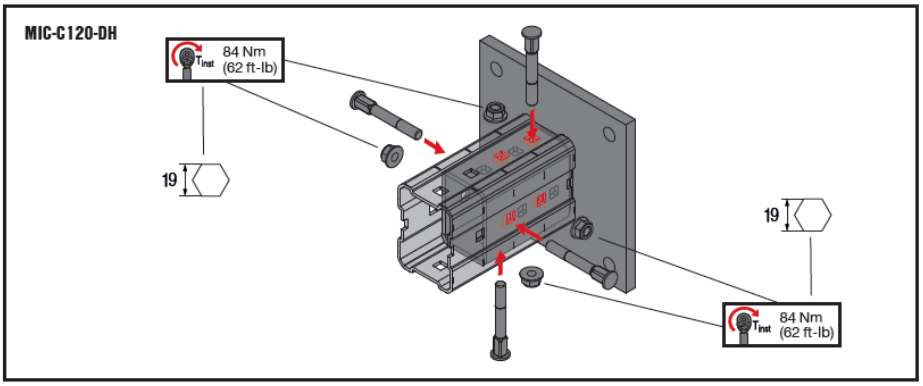
Description:
Hilti Hot-dipped galvanized baseplate connector, typically used for anchoring an MI-120 girder to concrete. Four round anchor holes in baseplate for attachment to concrete, and girder is connected using bolts through fixed holes.

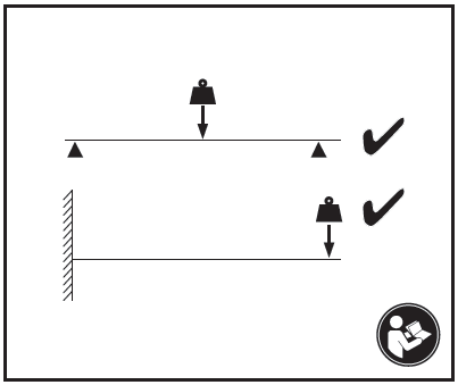
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	**$f_y = 235 \frac{N}{mm^2}$**	**$f_u = 360 \frac{N}{mm^2}$**	**$E = 210000 \frac{N}{mm^2}$**	**$G = 80769 \frac{N}{mm^2}$**
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	**$f_y = 640 \frac{N}{mm^2}$**	**$f_u = 800 \frac{N}{mm^2}$**	**$E = 210000 \frac{N}{mm^2}$**	**$G = 80769 \frac{N}{mm^2}$**
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

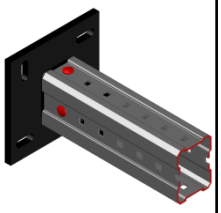








MIC-C120-DH Base Material Connector - Concrete

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

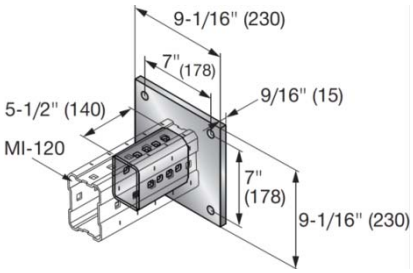
Standards and codes:

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
- Mathcad 15

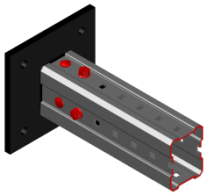
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



MIC-C120-DH Base Material Connector - Concrete

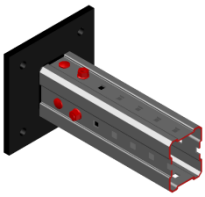
Standard



Loading case: Standard

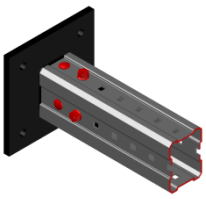
Bill of Material for this loading case:

Angle incl. all components
1x MIC-C120-DH **2174662**



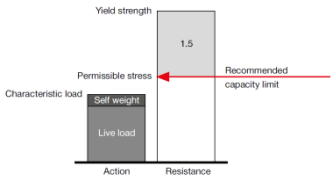
Combinations covered by loading case

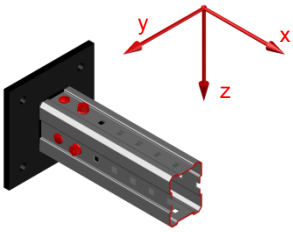
Baseplate connector used for a perpendicular connection of an MI-90 girder to concrete



Recommended loading capacity - simplified for most common applications

Method



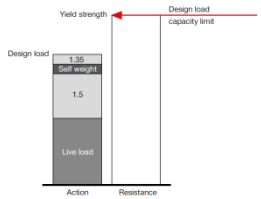


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
36.0	35.9	42.3

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

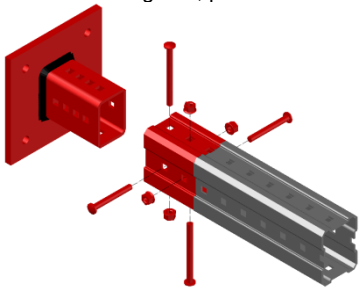
Design loading capacity - 3D 1/2

Method

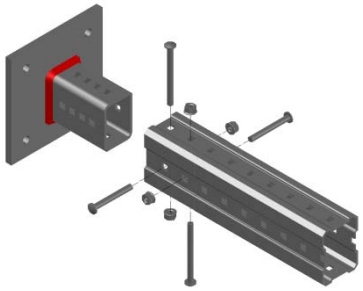


Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI-120 girder, per FEA simulation

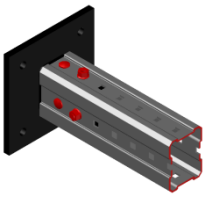


2. Welds – per analytical calculation



MIC-C120-DH Base Material Connector - Concrete

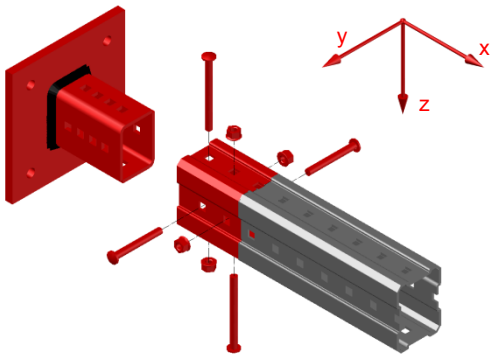
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-120 girder, per FEA simulation

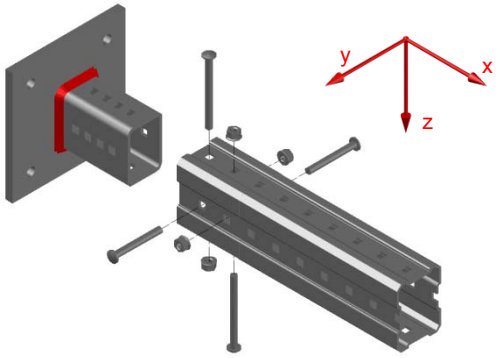


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
104.00	118.82	53.80	53.80	63.50	63.50
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.39	5.39	4.73	4.73	3.00	3.00

Interaction:

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

2. Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
316.42	316.42	81.16	81.16	100.68	100.68
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
9.16	9.16	5.18	5.18	6.04	6.04

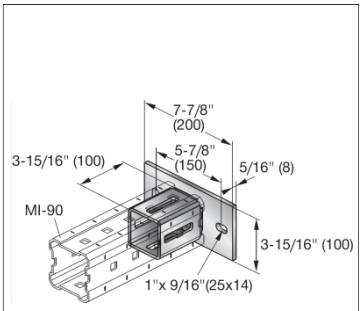
Interaction:

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

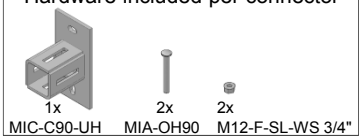
MIC-C90-UH Base Material Connector - Concrete

Designation	Item number
MIC-C90-UH	**2179535**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**



Hardware included per connector

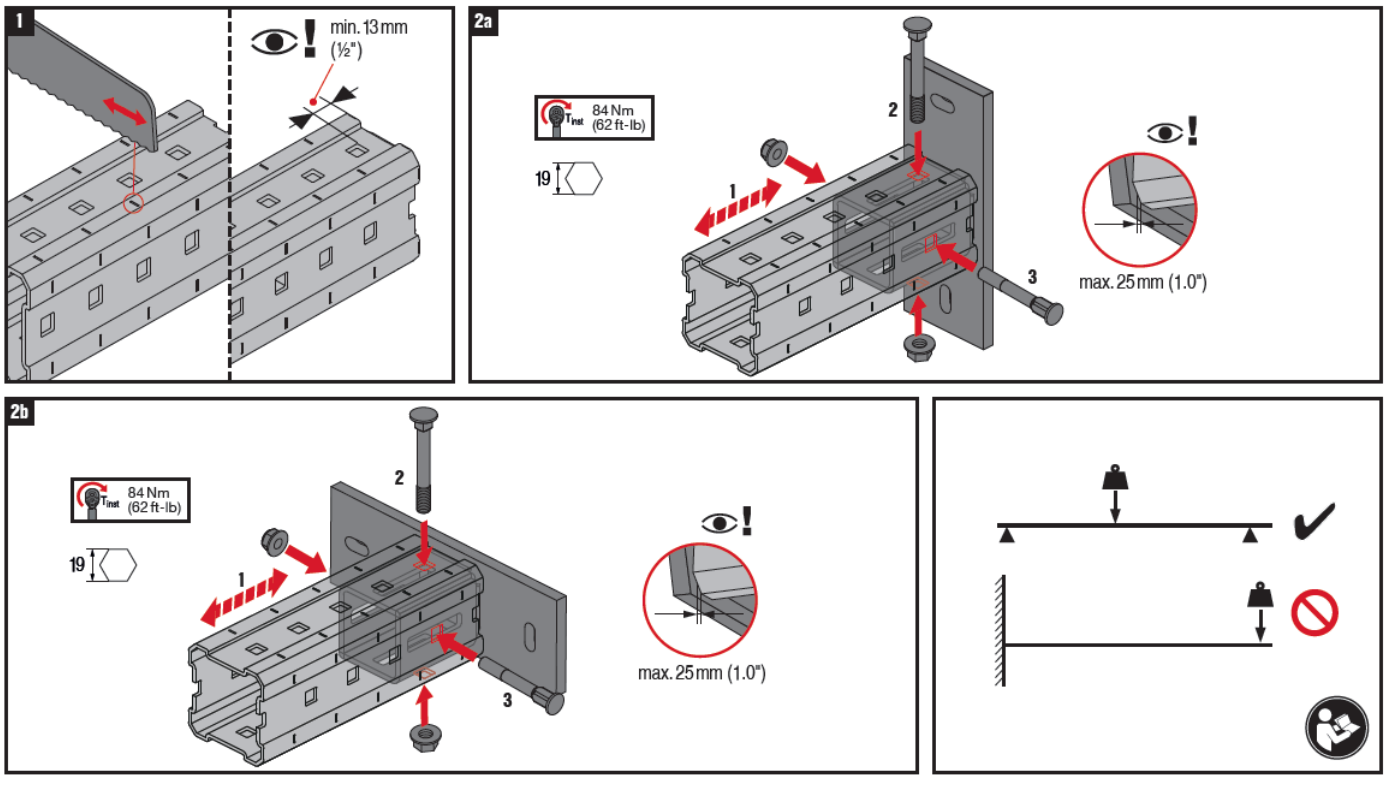


Weight:
2450 g incl. components

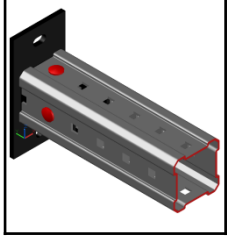
Description:
Hilti Hot-dipped galvanized baseplate connector, typically used for anchoring an MI-90 girder to concrete. Two oblong anchor holes enable fine tuning of baseplate position, and girder is connected using bolts through fixed holes.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-C90-UH Base Material Connector - Concrete

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation

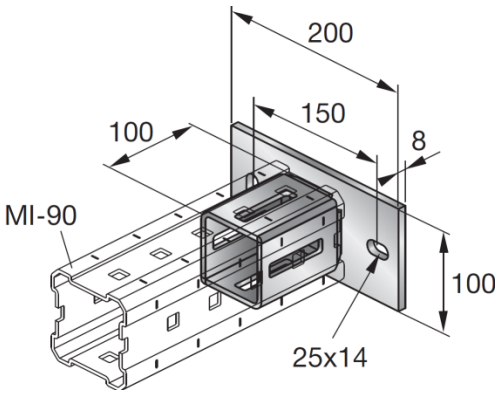
Standards and codes:

• 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

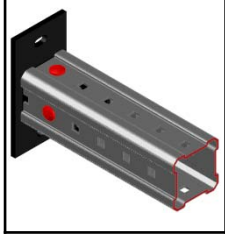
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



MIC-C90-UH Base Material Connector - Concrete

Standard



Loading case: Standard

Bill of Material for this loading case:

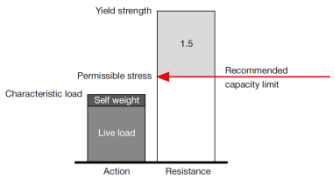
Angle incl. all components
1x MIC-C90-UH **2179535**

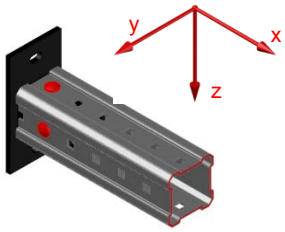
Combinations covered by loading case

Baseplate connector used for a perpendicular connection of an MI-90 girder to concrete

Recommended loading capacity - simplified for most common applications

Method



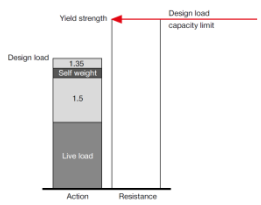


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.50	16.66	16.66

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

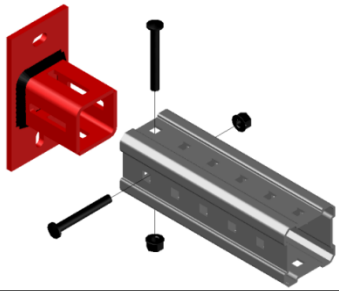
Design loading capacity - 3D 1/3

Method

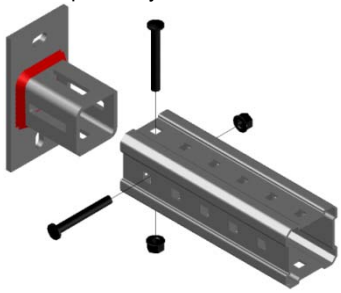


Limiting components of capacity evaluated in following tables:

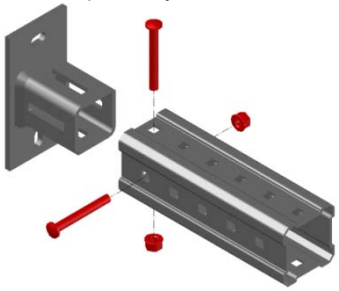
1. Connector body - per analytical calculation



2. Welds – per analytical calculation

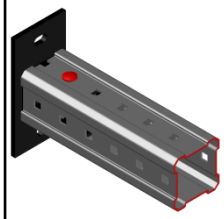


3. Screws – per analytical calculation



MIC-C90-UH Base Material Connector - Concrete

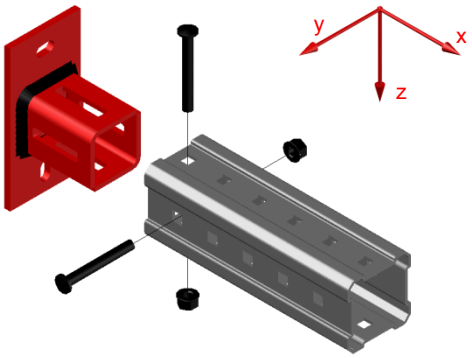
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 body - per analytical calculation

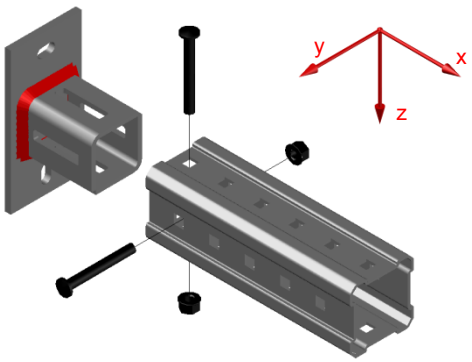


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
13.19	93.32	25.00	25.00	25.00	25.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
4.10	4.10	0.00	0.00	0.00	0.00

Interaction:

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

2. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
244.38	244.38	99.77	99.77	99.77	99.77
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
5.99	5.99	0.00	0.00	0.00	0.00

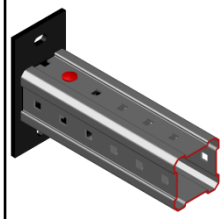
Interaction:

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

MIC-C90-UH Base Material Connector - Concrete

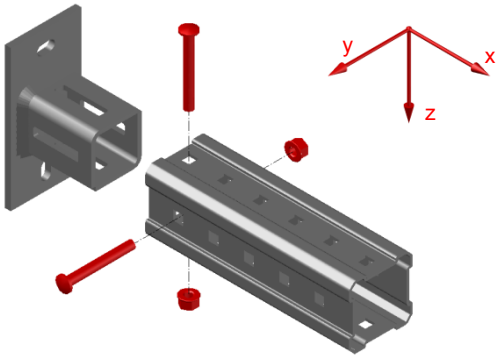
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard		
		

Design loading capacity - 3D 3/3

3. Screws – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.25	2.25	36.29	36.29	36.29	36.29
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.20	1.20	0.00	0.00	0.00	0.00

Interaction:

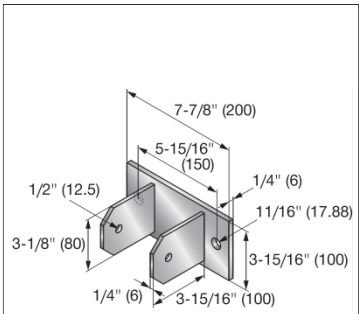
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \le 1$$

MIC-CU-MAH Base Material Connector - Concrete

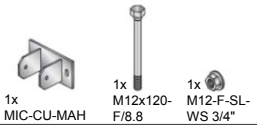
Designation	Item number
MIC-CU-MAH	**2174664**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**

Weight:
2261 g incl. components



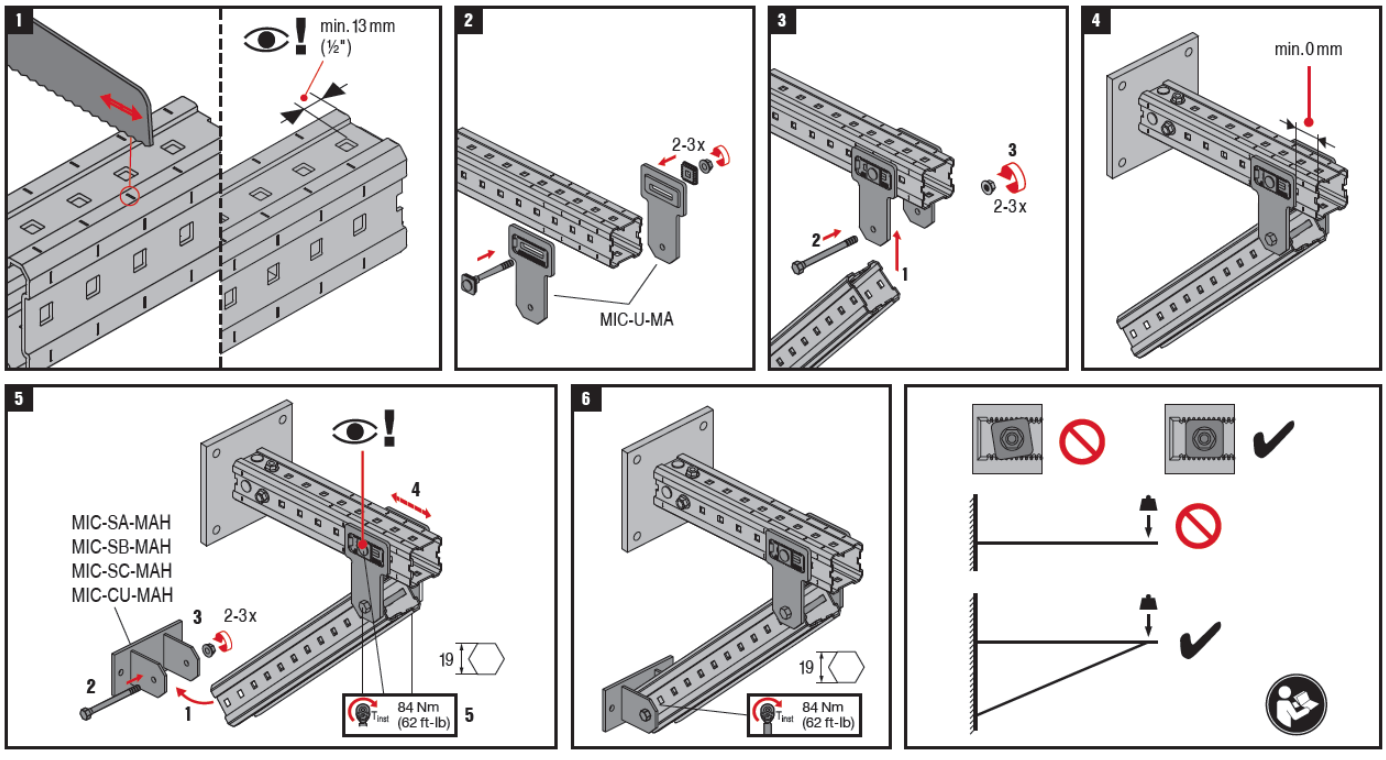
Hardware included per connector



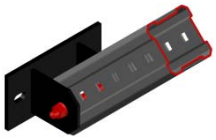
Description:
Hilti Hot-dipped galvanized baseplate connector, used for anchoring a MI-90 girder to concrete in an angle, usually when it's used as a brace for another girder. Two round anchor holes in baseplate for attachment to concrete, and girder is connected using one bolt through a hole, which enables various angles.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	**f_y = 235 $\frac{N}{mm^2}$**	**f_u = 360 $\frac{N}{mm^2}$**	**E = 210000 $\frac{N}{mm^2}$**	**G = 80769 $\frac{N}{mm^2}$**
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	**f_y = 640 $\frac{N}{mm^2}$**	**f_u = 800 $\frac{N}{mm^2}$**	**E = 210000 $\frac{N}{mm^2}$**	**G = 80769 $\frac{N}{mm^2}$**
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MIC-CU-MAH Base Material Connector - Concrete

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

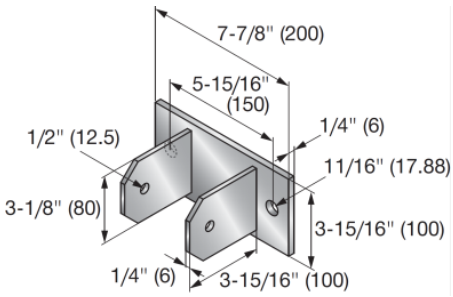
Standards and codes:

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
- Mathcad 15

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



MIC-CU-MAH Base Material Connector - Concrete

Standard

Loading case: Standard

Bill of Material for this loading case:

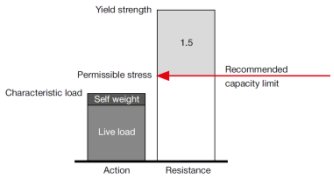
Angle incl. all components
1x MIC-CU-MAH **2174664**

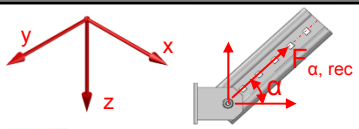
Combinations covered by loading case

Baseplate connector used for an angled connection of an MI-90 girder to concrete (bracing)

Recommended loading capacity - simplified for most common applications

Method





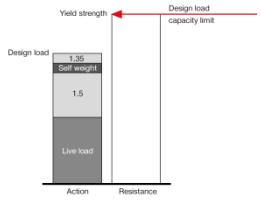
±Fy,rec. [kN]
4.4

α	0°	30°	45°	60°	90°
±$F_{α,rec.}$ [kN]	11.13	8.15	7.87	8.15	10.93

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

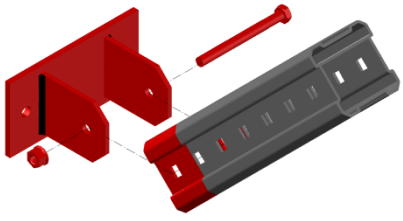
Design loading capacity - 3D 1/2

Method

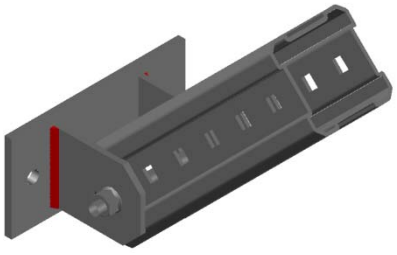


Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

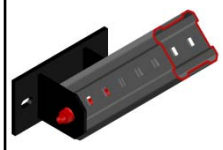


2. Welds – per analytical calculation



MIC-CU-MAH Base Material Connector - Concrete

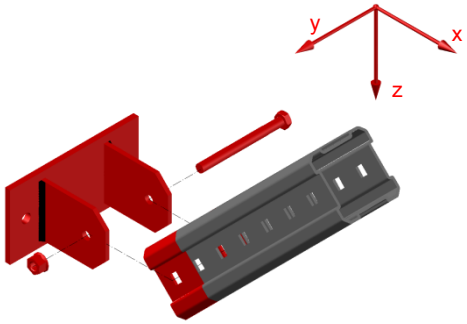
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

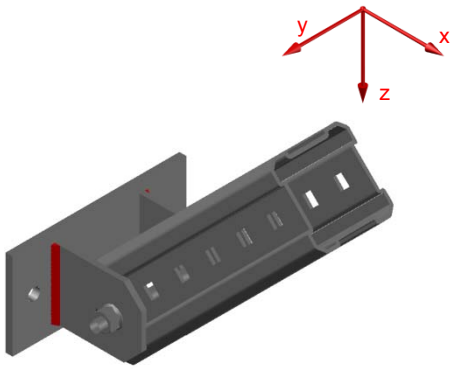


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
16.70	16.70	6.60	6.60	16.70	16.70
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.70	0.70	0.00	0.00	0.00	0.00

Interaction:

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

2. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
325.83	325.83	11.97	11.97	47.45	47.45
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
2.30	2.30	0.00	0.00	15.80	15.80

Interaction:

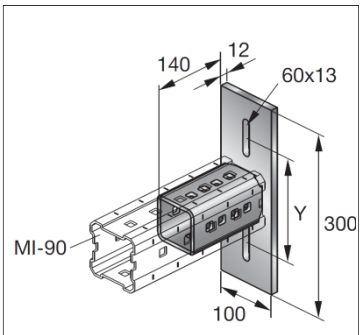
$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{y,Ed}}{F_{y,Rd}} + \frac{F_{z,Ed}}{F_{z,Rd}} + \frac{M_{x,Ed}}{M_{x,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$$

MIC-S90-AA Base Material Connector - Steel

Designation	Item number
MIC-S90-AA	**304811**

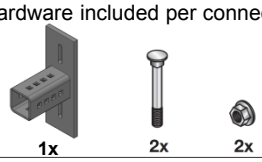
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**

Weight:
4370 g incl. components



Y = 170 mm

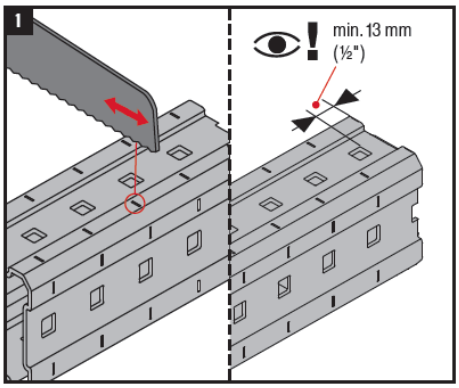
Hardware included per connector

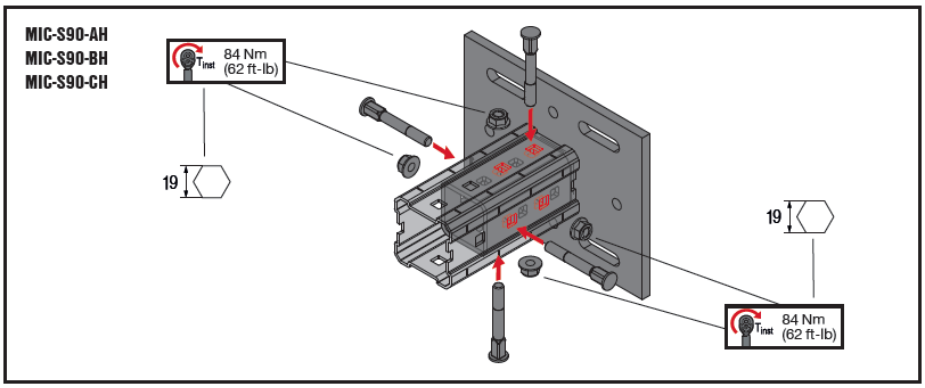


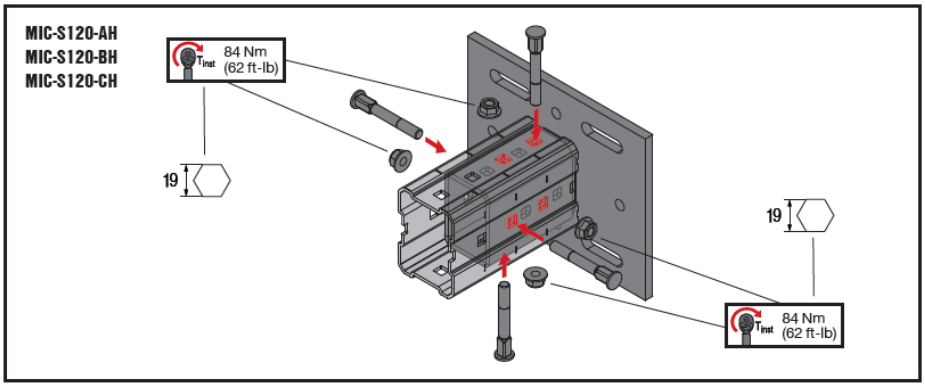
Submittal text:
Hilti Hot-dipped galvanized baseplate connector, typically used for anchoring an MI-90 girder to a steel beam. Two oblong anchor holes in perpendicular positions enable fine tuning of baseplate position, and girder is connected using bolts through fixed holes.

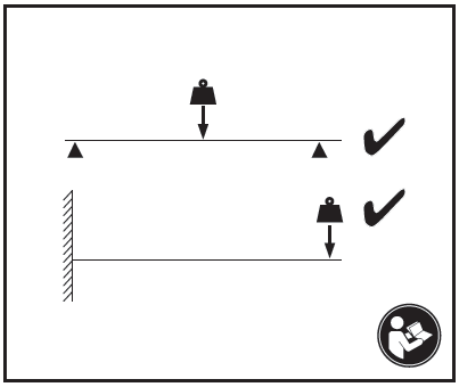
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	**$f_y = 235 \frac{N}{mm^2}$**	**$f_u = 360 \frac{N}{mm^2}$**	**$E = 210000 \frac{N}{mm^2}$**	**$G = 80769 \frac{N}{mm^2}$**
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	**$f_y = 640 \frac{N}{mm^2}$**	**$f_u = 800 \frac{N}{mm^2}$**	**$E = 210000 \frac{N}{mm^2}$**	**$G = 80769 \frac{N}{mm^2}$**
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

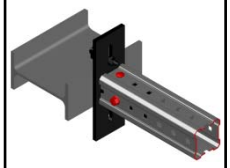








MIC-S90-AA Base Material Connector - Steel

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

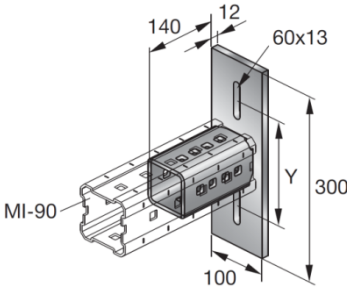
Standards and codes:

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
- Mathcad 15

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

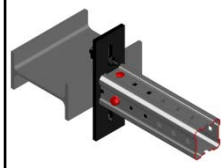
Simplified drawing:



Y = 170 mm

MIC-S90-AA Base Material Connector - Steel

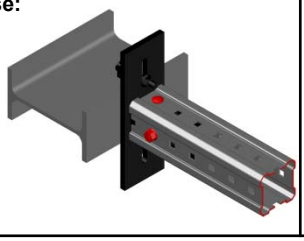
Standard



Loading case: Standard

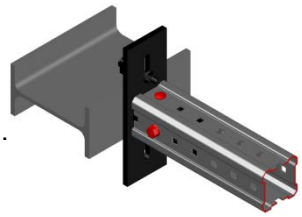
Bill of Material for this loading case:

Connector incl. all associated components
1x MIC-S90-AA **304811**
Beam clamps
2x MI-SGC M12 **233859**



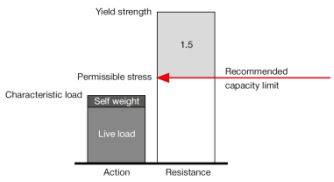
Combinations covered by loading case

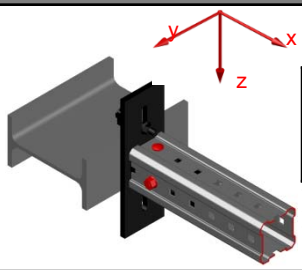
Connector used for a perpendicular connection of MI-90 girder to flange of structural steel profiles. For flange width 75-165mm.



Recommended loading capacity - simplified for most common applications

Method



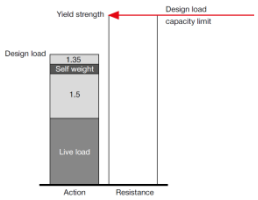


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
11.6	3.44	3.44

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

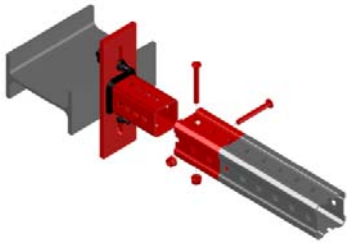
Design loading capacity - 3D 1/3

Method

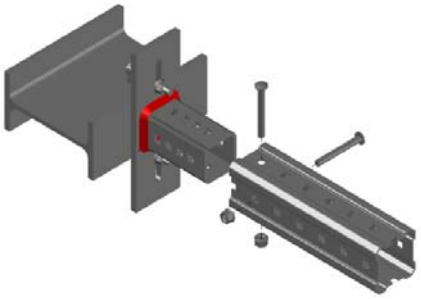


Limiting components of capacity evaluated in following tables:

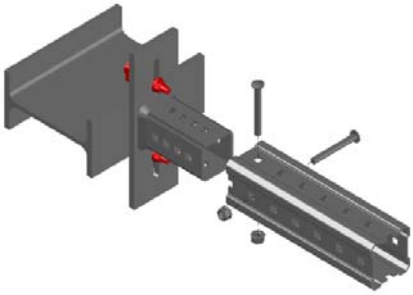
1. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation



2. Welds - per analytical calculation

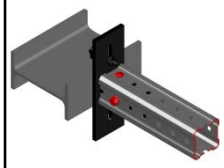


3. Beam Clamps - per analytical calculation



MIC-S90-AA Base Material Connector - Steel

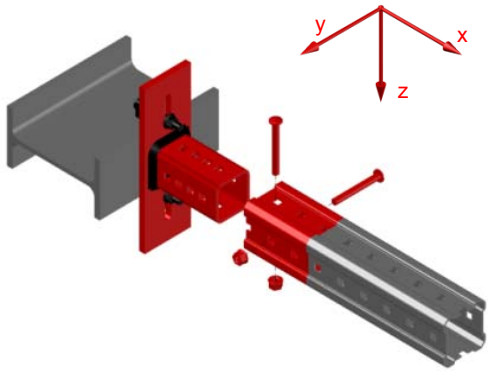
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

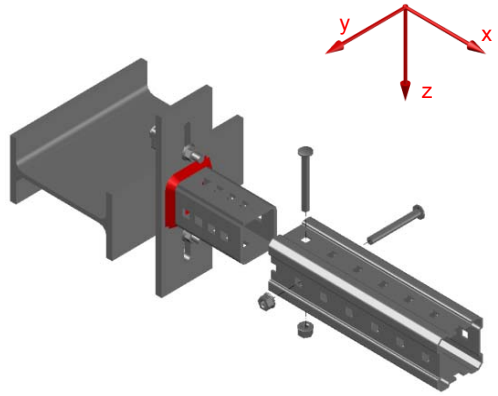


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
24.40	63.30	31.60	31.60	31.60	31.60
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.85	2.85	1.81	1.81	1.00	1.00

Interaction:

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

2. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
230.12	230.12	49.13	49.13	49.13	49.13
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.64	5.64	3.45	3.45	3.45	3.45

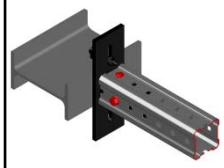
Interaction:

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

MIC-S90-AA Base Material Connector - Steel

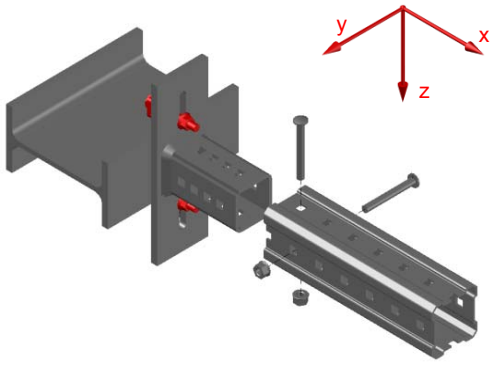
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Standard		
		

Design loading capacity - 3D 3/3

3. Beam Clamps - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
17.40	Not decisive	5.16	5.16	5.16	5.16
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.32	0.32	0.90	0.90	0.78	0.78

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

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

Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

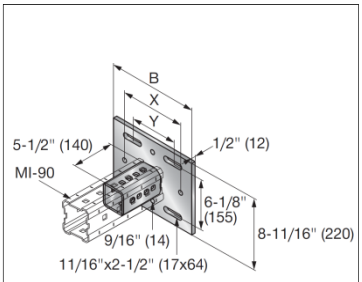
MIC-S90-AH Base Material Connector - Steel

Designation	Item number
MIC-S90-AH	**2174665**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**

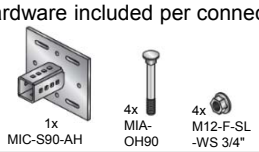
Weight:
7511 g incl. components

Description:
Hilti Hot-dipped galvanized baseplate connector, used for connecting a MI-90 girder to a steel beam using M16 mounting hardware. Four slotted holes enable fine tuning of baseplate position, and girder is connected using beam clamps or threaded rod. Comes in different plate sizes to fit various steel beam sizes.



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

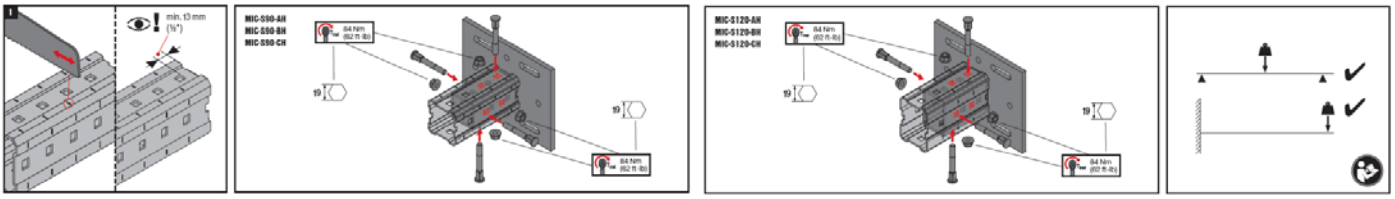
Hardware included per connector



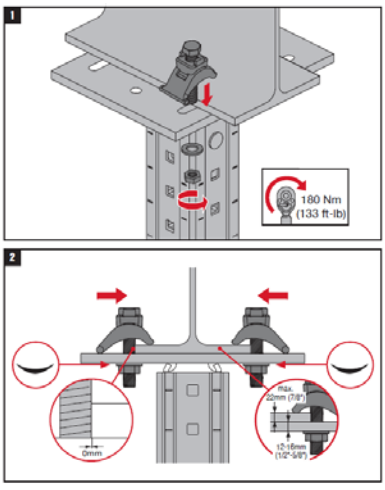
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

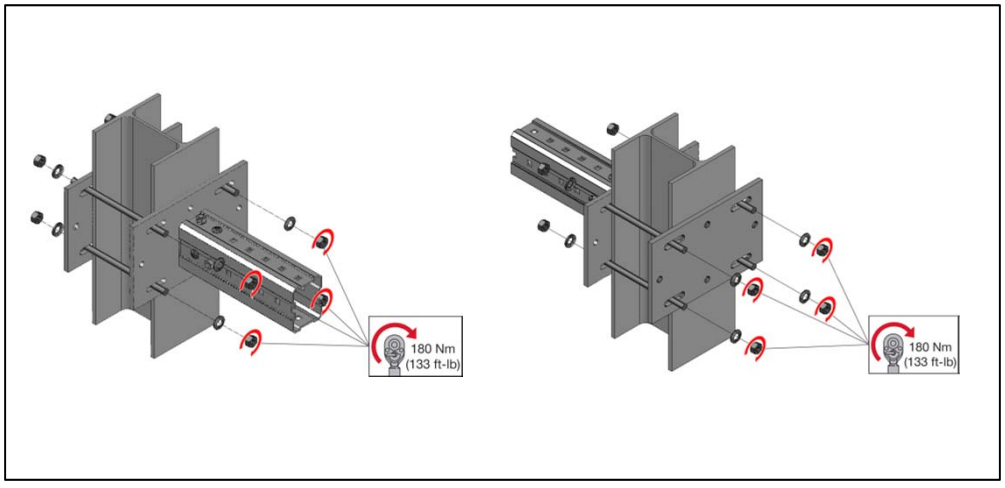
For both loading cases



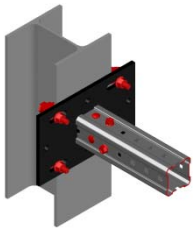
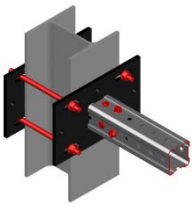
For clamped loading case



For boxed loading case (not attached to the packaging)



MIC-S90-AH Base Material Connector - Steel

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

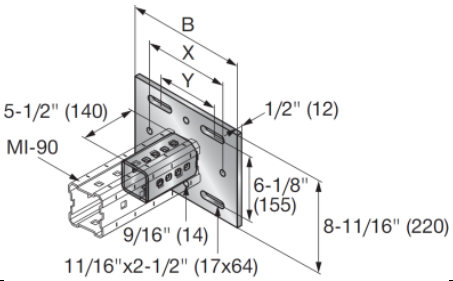
Standards and codes:

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
- Mathcad 15

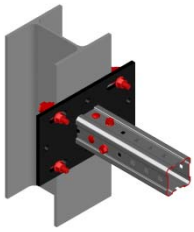
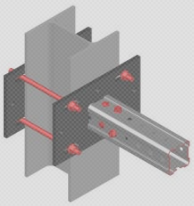
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

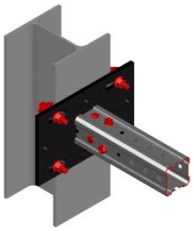
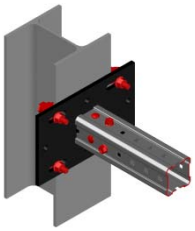
Simplified drawing:



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

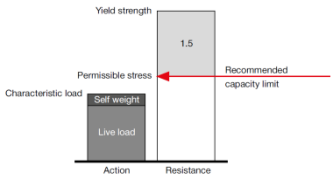
MIC-S90-AH Base Material Connector - Steel

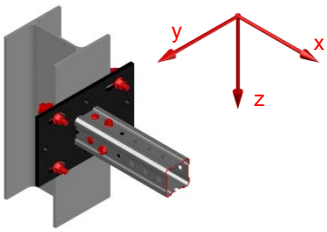
Clamped	Boxed	
		

Loading case: Clamped	Combinations covered by loading case
Bill of Material for this loading case: Connector incl. all associated components **1x MIC-S90-AH 2174665** **Beam clamps** **4x MI-SGC M16 387398** 	Connector used for a perpendicular connection of MI-90 girder to flange of structural steel profiles. For flange width 75-165mm. 

Recommended loading capacity - simplified for most common applications

Method



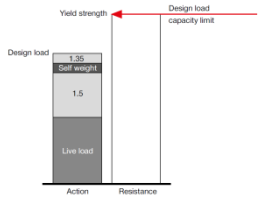


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
36.53	6.87	6.87

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

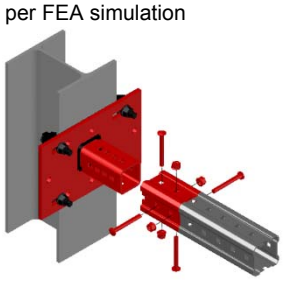
Design loading capacity - 3D 1/3

Method

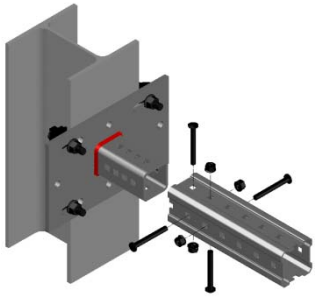


Limiting components of capacity evaluated in following tables:

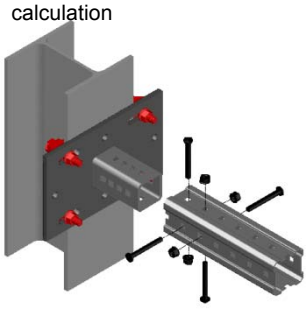
1. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation



2. Welds – per analytical calculation

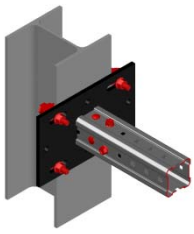
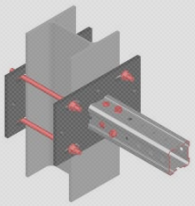


3. Beam Clamps - per analytical calculation



MIC-S90-AH Base Material Connector - Steel

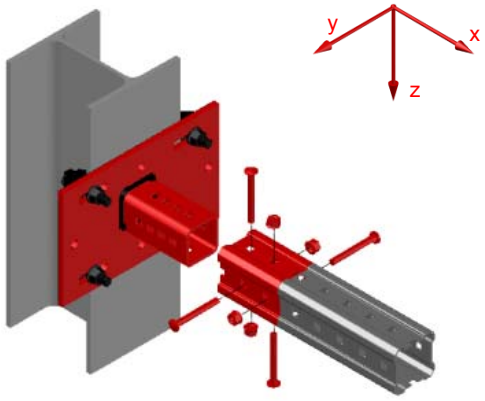
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

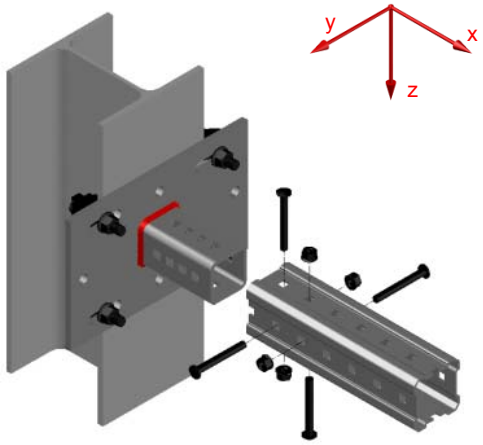


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
54.80	118.82	45.40	45.40	45.40	45.40
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
3.60	3.60	3.00	3.00	3.00	3.00

Interaction:

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

2. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
230.12	230.12	49.31	49.31	49.31	49.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.64	5.64	3.45	3.45	3.45	3.45

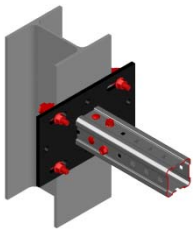
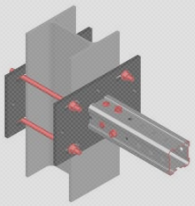
Interaction:

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

MIC-S90-AH Base Material Connector - Steel

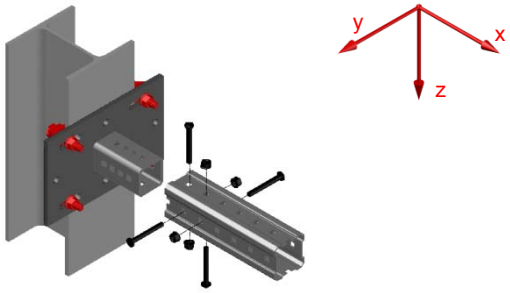
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

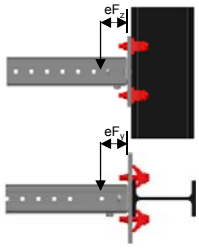
Clamped	Boxed	
		

Design loading capacity - 3D 3/3

3. Beam Clamps - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.84	0.84	6.66	6.66	4.51	4.51



with $e_y=e_z=0.070$ m

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

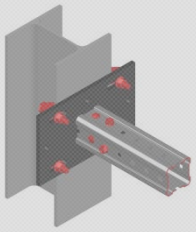
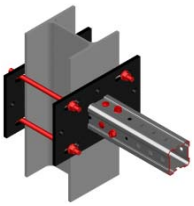
$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{y,Ed}*ey}{M_{z,Rd}} + \frac{F_{z,Ed}*ez}{M_{y,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$$

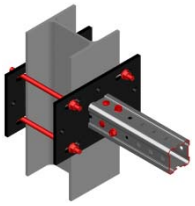
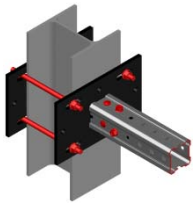
Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

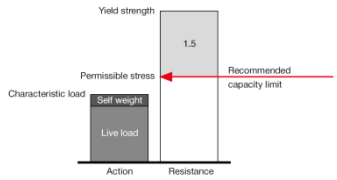
MIC-S90-AH Base Material Connector - Steel

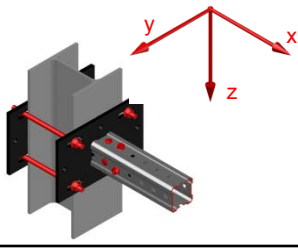
Clamped	Boxed	
		

Loading case: Boxed	Combinations covered by loading case
Bill of Material for this loading case: Connector incl. all associated components **1x MIC-S90-AH 2174665** **Base plate** **1x MIB-SAH 2174674** **Threaded rods cut to particular length** **4x AM16x1000 8.8 HDG…m 419104** **Lock washer** **8x LW M16 HDG plus washer 2185343** **Nut** **8x M16-F nut 304767** 	Connector used for a perpendicular connection of MI-90 girder to flange of structural steel profiles. For flange width 75-165mm. 

Recommended loading capacity - simplified for most common applications

Method



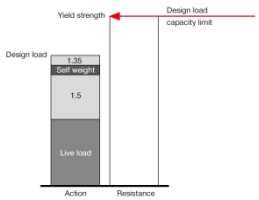


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
38.47	13.77	13.77

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

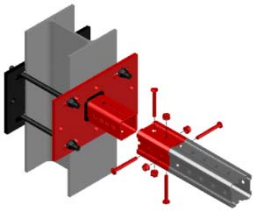
Design loading capacity - 3D 1/3

Method

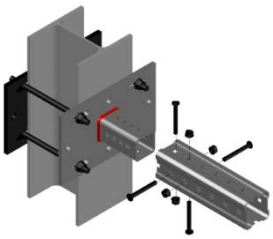


Limiting components of capacity evaluated in following tables:

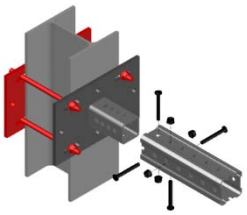
1. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation



2. Welds - per analytical calculation

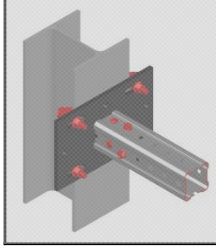
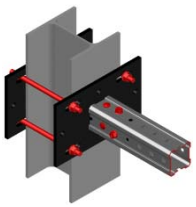


3. Base plate and through bolts - per analytical calculation



MIC-S90-AH Base Material Connector - Steel

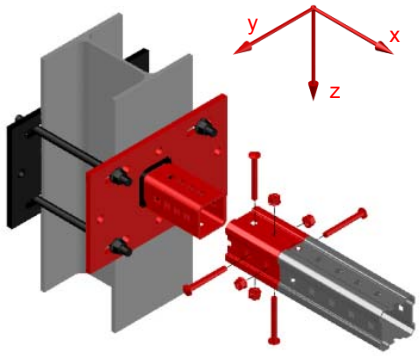
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

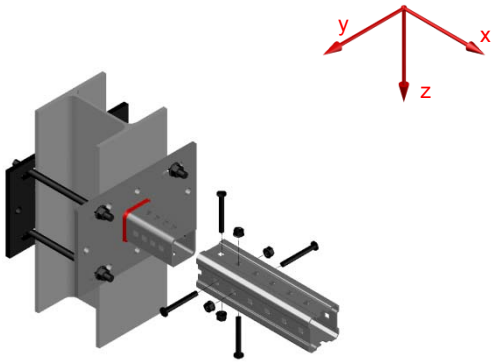


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
57.70	118.82	45.40	45.40	45.40	45.40
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
3.60	3.60	3.00	3.00	3.00	3.00

Interaction:

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

2. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
230.12	230.12	49.31	49.31	49.31	49.31
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
5.64	5.64	3.45	3.45	3.45	3.45

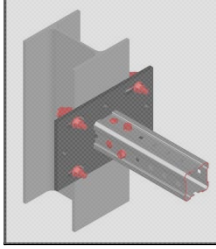
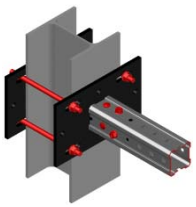
Interaction:

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

MIC-S90-AH Base Material Connector - Steel

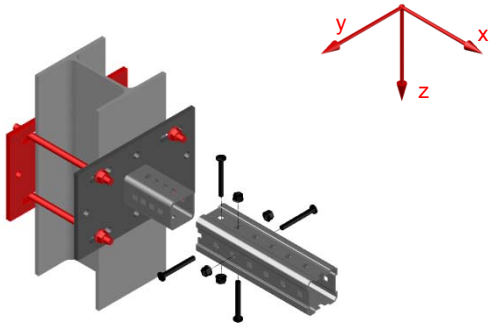
Validity:

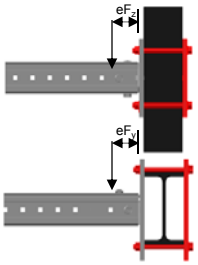
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

3. Base plate and through bolts - per analytical calculation





with e_y=e_z=0.070 m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
164.00	Not decisive	20.66	20.66	20.66	20.66
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.67	1.67	8.61	8.61	7.22	7.22

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

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

Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

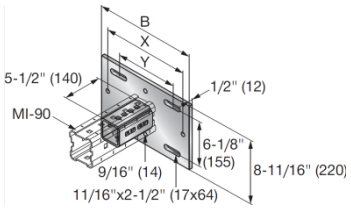
MIC-S90-BH Base Material Connector - Steel

Designation	Item number
MIC-S90-BH	**2174666**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**

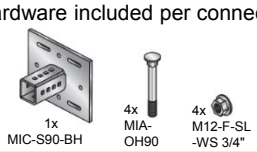
Weight:
8964 g incl. components

Description:
Hilti Hot-dipped galvanized baseplate connector, used for connecting a MI-90 girder to a steel beam using M16 mounting hardware. Four slotted holes enable fine tuning of baseplate position, and girder is connected using beam clamps or threaded rod. Comes in different plate sizes to fit various steel beam sizes.



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

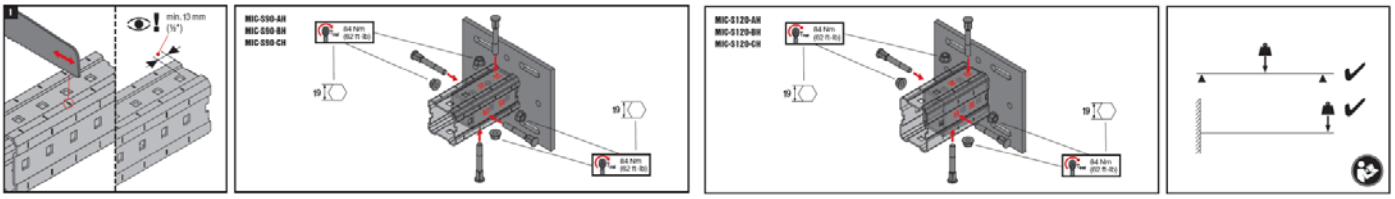
Hardware included per connector



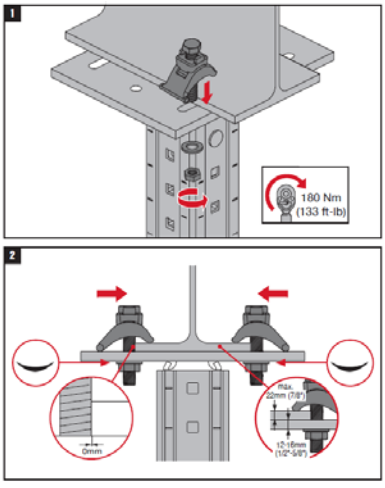
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

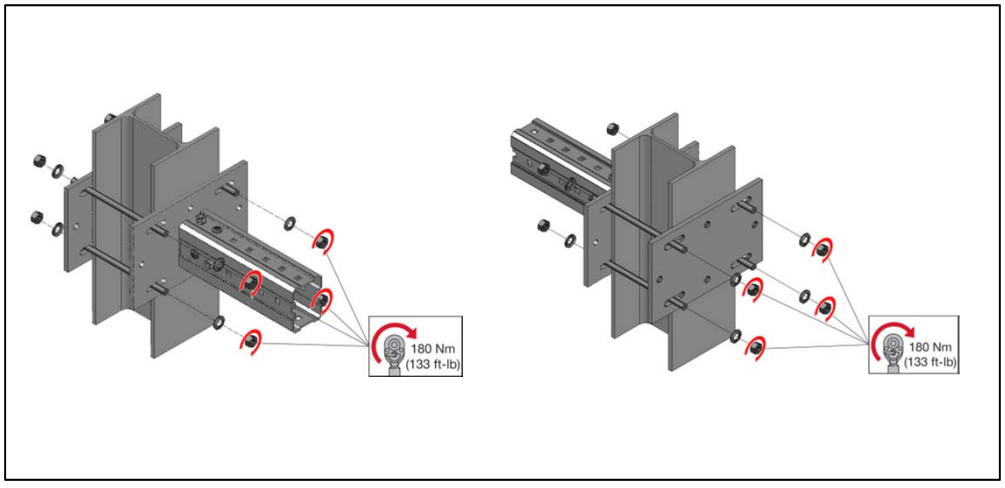
For both loading cases



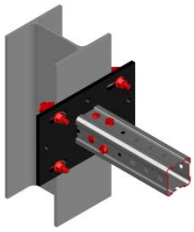
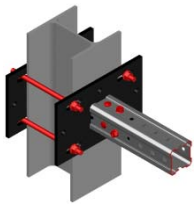
For clamped loading case



For boxed loading case (not attached to the packaging)



MIC-S90-BH Base Material Connector - Steel

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

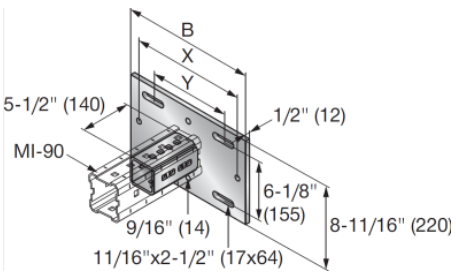
Standards and codes:

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
- Mathcad 15

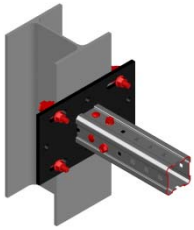
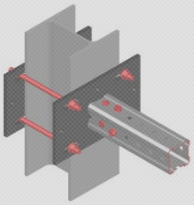
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



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

MIC-S90-BH Base Material Connector - Steel

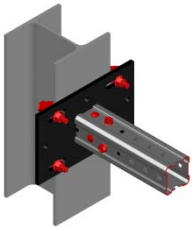
Clamped	Boxed	
		

Loading case: Clamped

Bill of Material for this loading case:

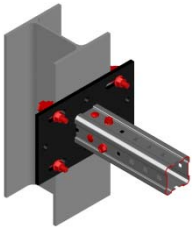
Connector incl. all associated components

1x MIC-S90-BH	**2174666**
Beam clamps	
4x MI-SGC M16	**387398**



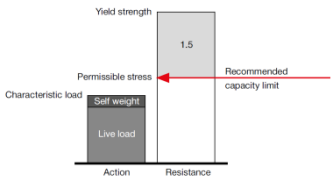
Combinations covered by loading case

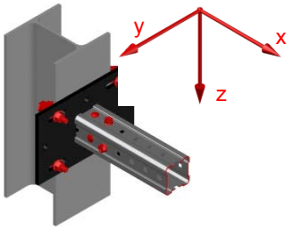
Connector used for a perpendicular connection of MI-90 girder to flange of structural steel profiles. For flange width 165-235mm.



Recommended loading capacity - simplified for most common applications

Method



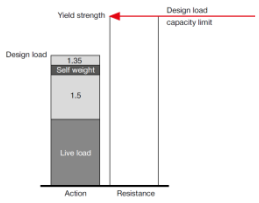


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
26.73	6.87	6.87

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

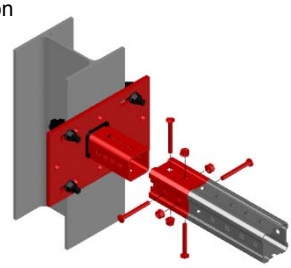
Design loading capacity - 3D 1/3

Method

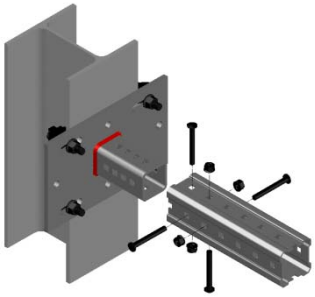


Limiting components of capacity evaluated in following tables:

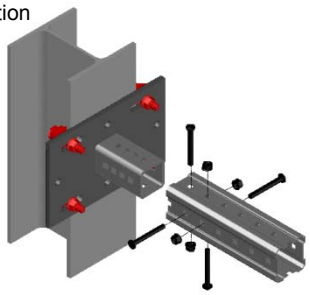
1. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation



2. Welds – per analytical calculation

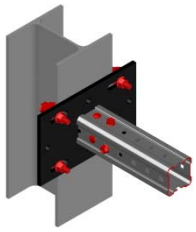
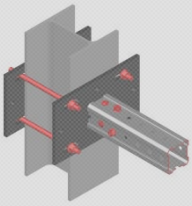


3. Beam Clamps - per analytical calculation



MIC-S90-BH Base Material Connector - Steel

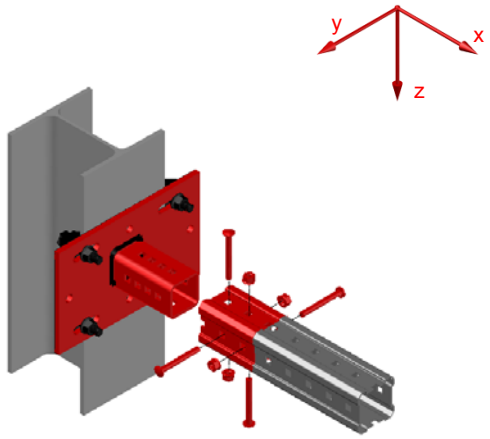
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

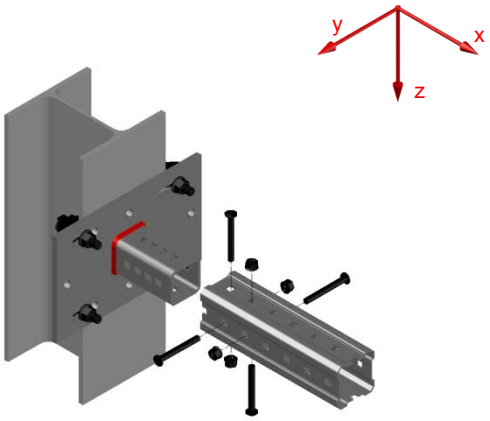


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
40.10	118.82	45.40	45.40	45.40	45.40
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
3.60	3.60	3.00	3.00	3.00	3.00

Interaction:

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

2. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
230.12	230.12	49.31	49.31	49.31	49.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.64	5.64	3.45	3.45	3.45	3.45

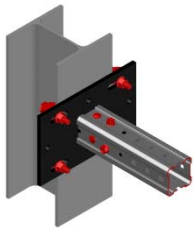
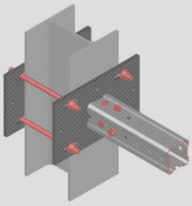
Interaction:

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

MIC-S90-BH Base Material Connector - Steel

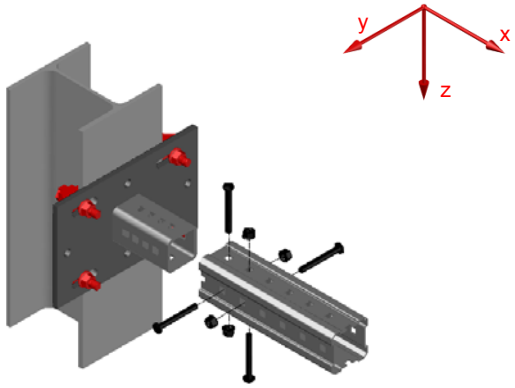
Validity:

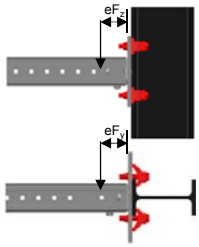
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

3. Beam Clamps - per analytical calculation





with e_y=e_z=0.070 m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.12	1.12	6.66	6.66	6.66	6.66

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

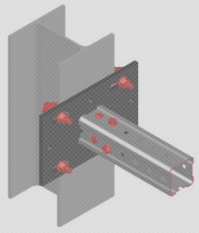
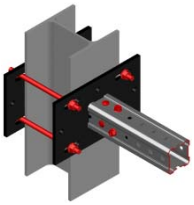
$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{y,Ed} * ey}{M_{z,Rd}} + \frac{F_{z,Ed} * ez}{M_{y,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$$

Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

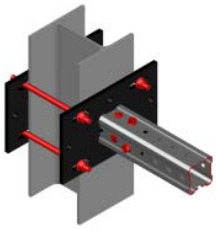
MIC-S90-BH Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Boxed

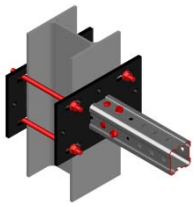
Bill of Material for this loading case:

1x MIC-S90-B H 2174666
Hardware not included in packaging:
Base plate
1x MIB-SBH 2174675
Threaded rods cut to particular length
4x AM16x1000 8.8 HDG…m 419104
Lock washer
8x LW M16 HDG plus washer 2185343
Nut
8x M16-F nut 304767



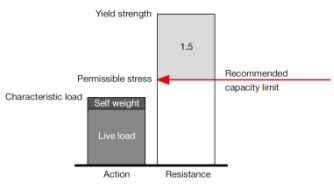
Combinations covered by loading case

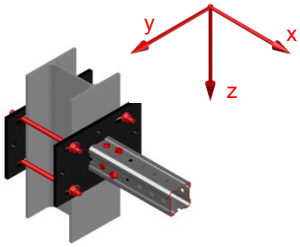
Connector used for a perpendicular connection of MI-90 girder to flange of structural steel profiles.
For flange width 165-235mm.



Recommended loading capacity - simplified for most common applications

Method



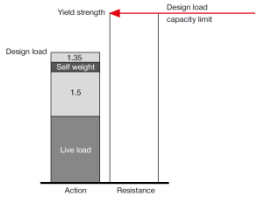


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
26.73	13.34	13.34

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

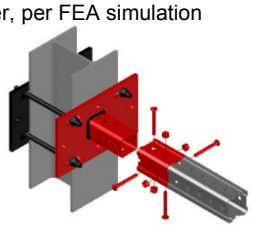
Design loading capacity - 3D 1/3

Method

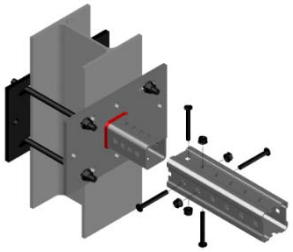


Limiting components of capacity evaluated in following tables:

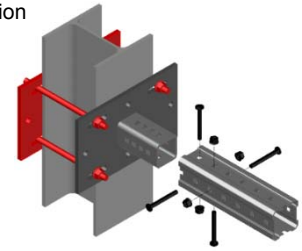
1. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation



2. Welds - per analytical calculation



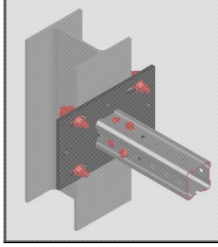
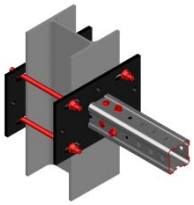
3. Base plate and through bolts - per analytical calculation



MIC-S90-BH Base Material Connector - Steel

Validity:

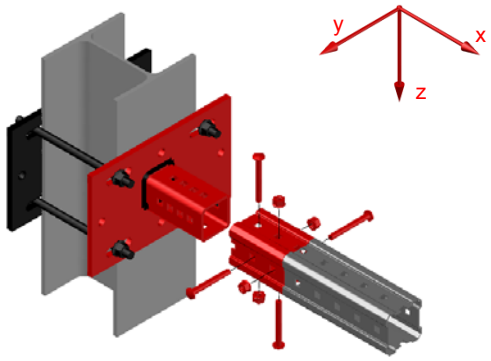
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

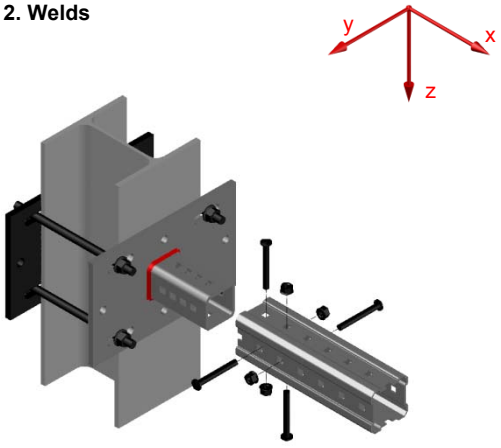


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
40.10	80.50	45.40	45.40	45.40	45.40
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
3.60	3.60	3.00	3.00	3.00	3.00

Interaction:

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

2. Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
230.12	230.12	49.31	49.31	49.31	49.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.64	5.64	3.45	3.45	3.45	3.45

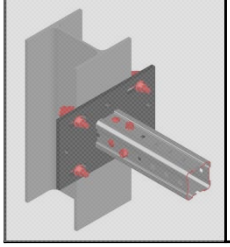
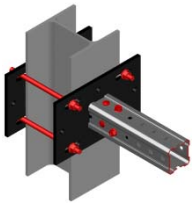
Interaction:

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

MIC-S90-BH Base Material Connector - Steel

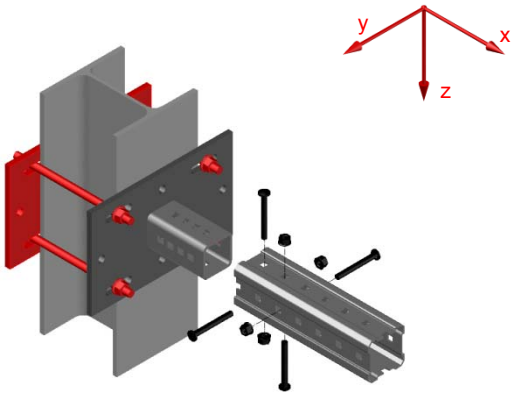
Validity:

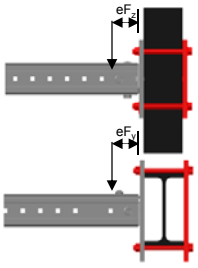
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

3. 2x bolt in MI channel





with e_y=e_z=0.070 m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
158.80	Not decisive	20.01	20.01	20.01	20.01
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.06	2.06	8.81	8.81	9.77	9.77

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

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

Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

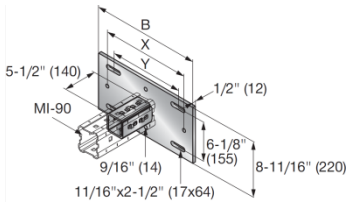
MIC-S90-CH Base Material Connector - Steel

Designation	Item number
MIC-S90-CH	**2174667**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**

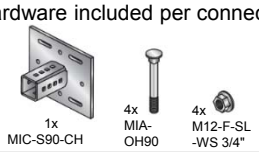
Weight:
10624 g incl. components

Description:
Hilti Hot-dipped galvanized baseplate connector, used for connecting a MI-90 girder to a steel beam using M16 mounting hardware. Four slotted holes enable fine tuning of baseplate position, and girder is connected using beam clamps or threaded rod. Comes in different plate sizes to fit various steel beam sizes.



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

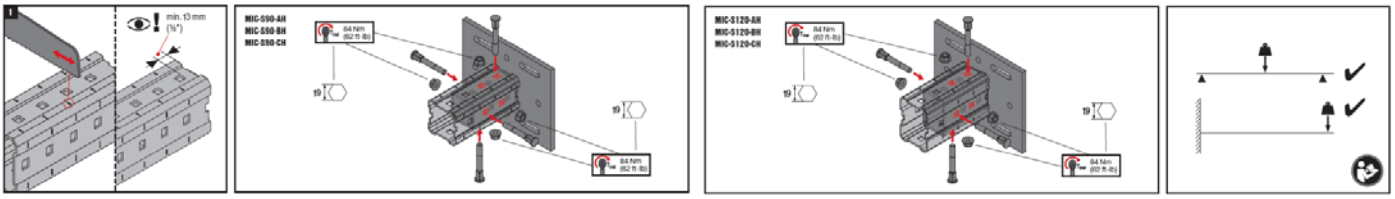
Hardware included per connector



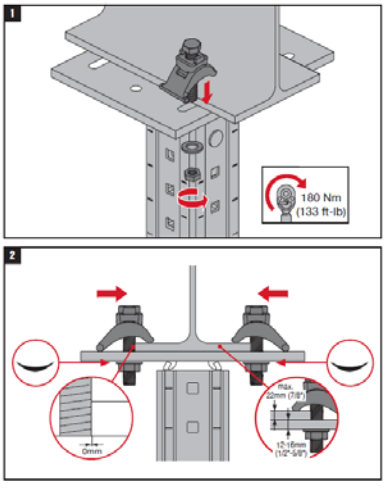
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

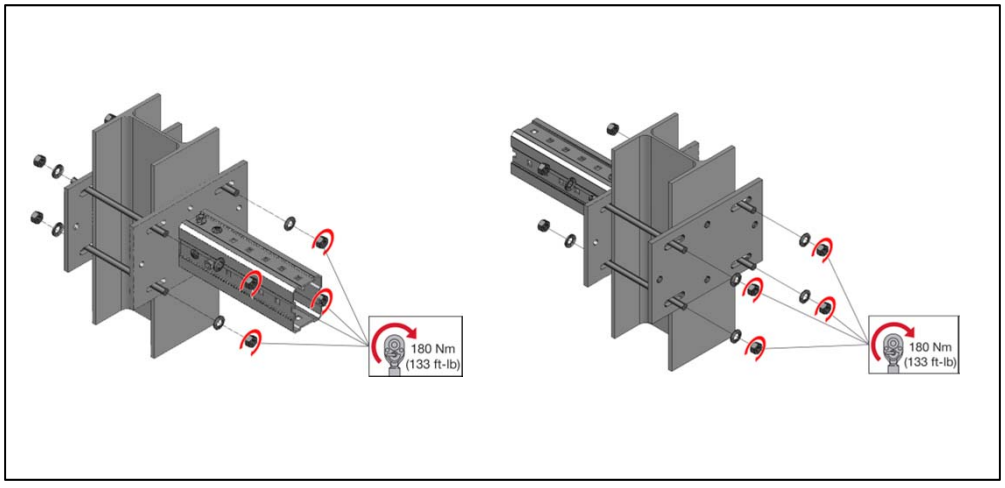
For both loading cases



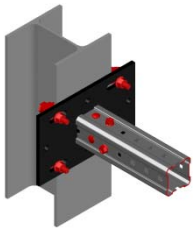
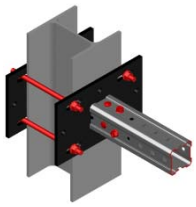
For clamped loading case



For boxed loading case (not attached to the packaging)



MIC-S90-CH Base Material Connector - Steel

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

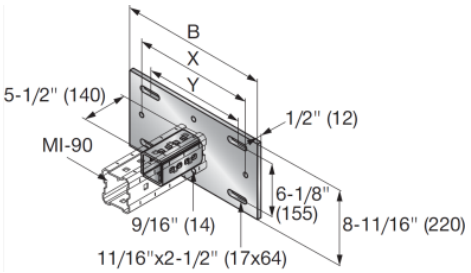
Standards and codes:

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
- Mathcad 15

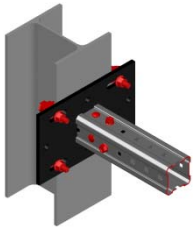
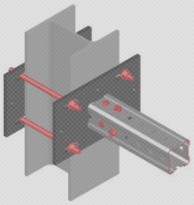
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



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

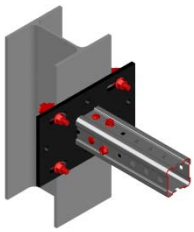
MIC-S90-CH Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Clamped

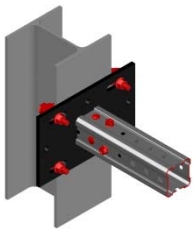
Bill of Material for this loading case:

1x MIC-S90-CH **2174667**
Hardware not included in packaging:
Beam clamps
4x MI-SGC M16 **387398**



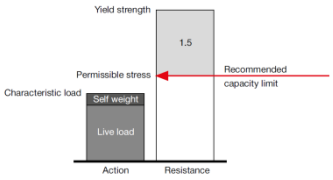
Combinations covered by loading case

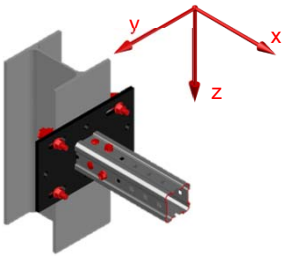
Connector used for a perpendicular connection of MI-90 girder to flange of structural steel profiles.
For flange width 235-300mm.



Recommended loading capacity - simplified for most common applications

Method



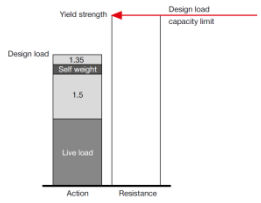


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
17.93	6.87	6.87

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

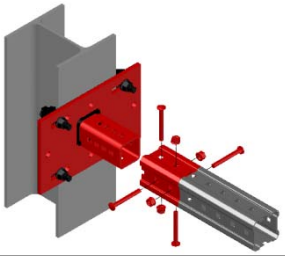
Design loading capacity - 3D 1/3

Method

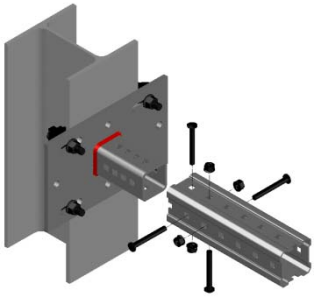


Limiting components of capacity evaluated in following tables:

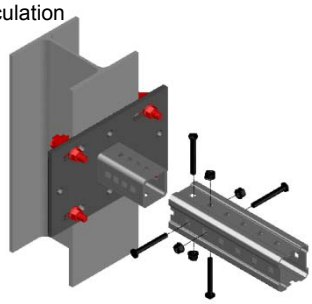
1. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation



2. Welds – per analytical calculation

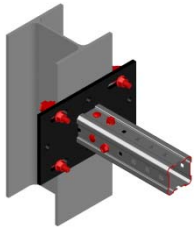
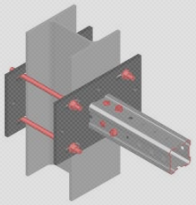


3. Beam Clamps - per analytical calculation



MIC-S90-CH Base Material Connector - Steel

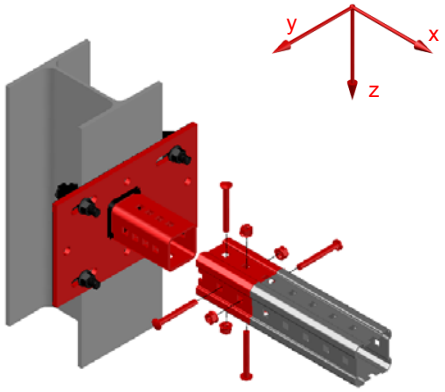
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

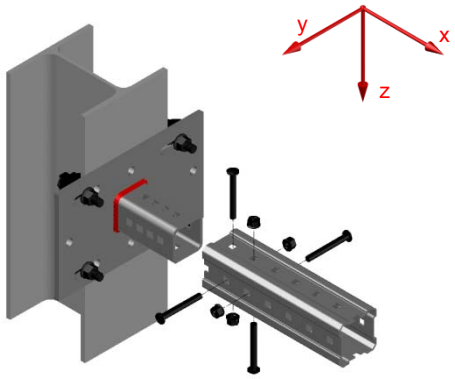


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
26.90	118.82	45.40	45.40	45.40	45.40
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
3.60	3.60	3.00	3.00	3.00	3.00

Interaction:

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

2. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
230.12	230.12	49.31	49.31	49.31	49.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.64	5.64	3.45	3.45	3.45	3.45

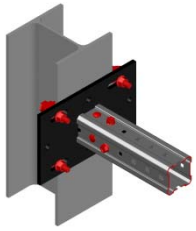
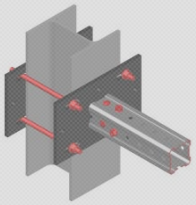
Interaction:

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

MIC-S90-CH Base Material Connector - Steel

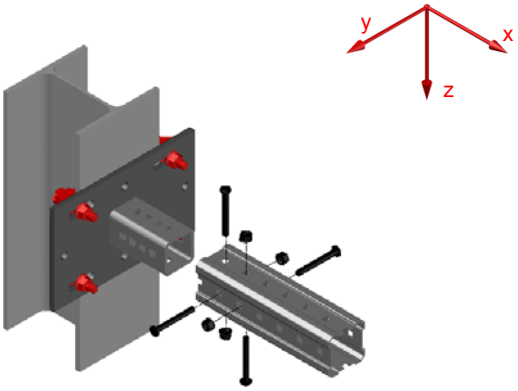
Validity:

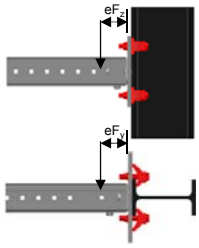
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

3. Beam Clamps - per analytical calculation





with e_y=e_z=0.070 m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.41	1.41	6.66	6.66	8.45	8.45

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

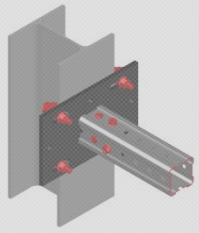
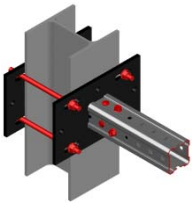
$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{y,Ed} * ey}{M_{z,Rd}} + \frac{F_{z,Ed} * ez}{M_{y,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$$

Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

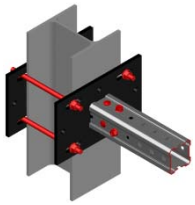
MIC-S90-CH Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Boxed

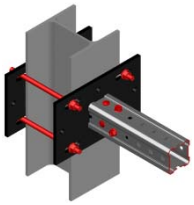
Bill of Material for this loading case:

1x MIC-S90-CH 2174667
Hardware not included in packaging:
Base plate
1x MIB-SCH 2174676
Threaded rods cut to particular length
4x AM16x1000 8.8 HDG…m 419104
Lock washer
8x LW M16 HDG plus washer 2185343
Nut
8x M16-F nut 304767



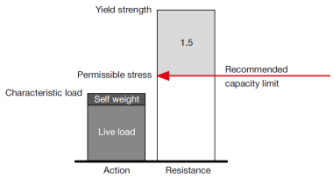
Combinations covered by loading case

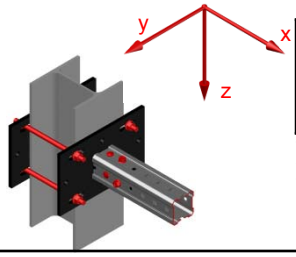
Connector used for a perpendicular connection of MI-90 girder to flange of structural steel profiles.
For flange width 235-300mm.



Recommended loading capacity - simplified for most common applications

Method



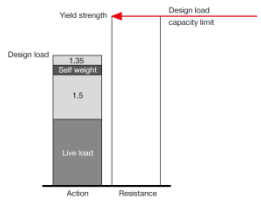


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
17.00	12.67	12.67

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

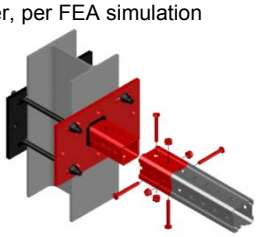
Design loading capacity - 3D 1/3

Method

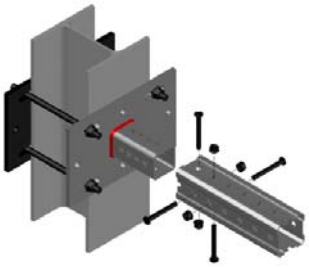


Limiting components of capacity evaluated in following tables:

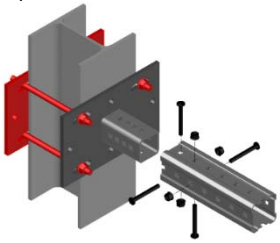
1. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation



2. Welds - per analytical calculation

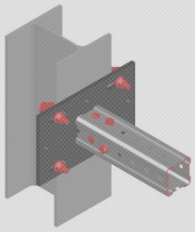
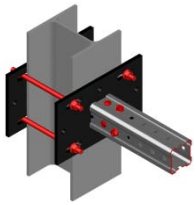


3. Base plate and through bolts - per analytical calculation



MIC-S90-CH Base Material Connector - Steel

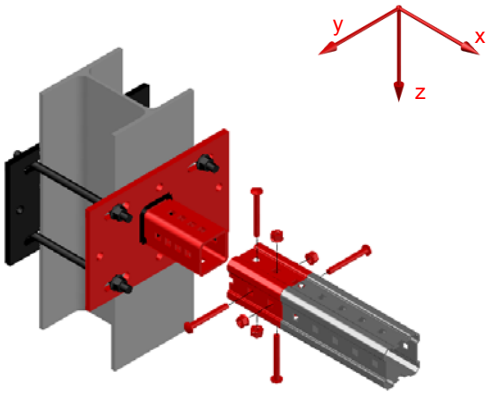
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation

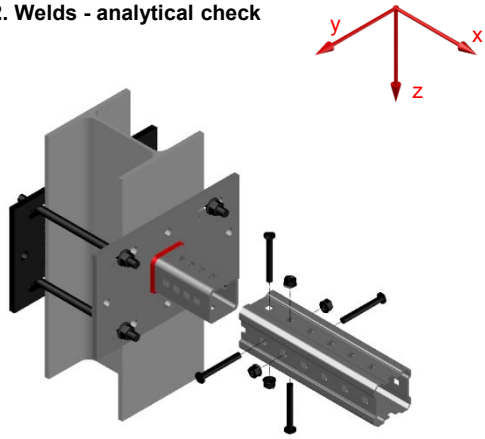


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
25.50	52.30	45.40	45.40	45.40	45.40
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
3.60	3.60	3.00	3.00	3.00	3.00

Interaction:

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

2. Welds - analytical check



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
230.12	230.12	49.31	49.31	49.31	49.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.64	5.64	3.45	3.45	3.45	3.45

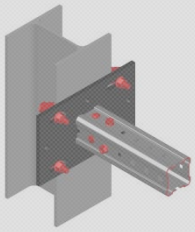
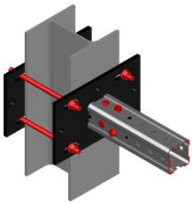
Interaction:

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

MIC-S90-CH Base Material Connector - Steel

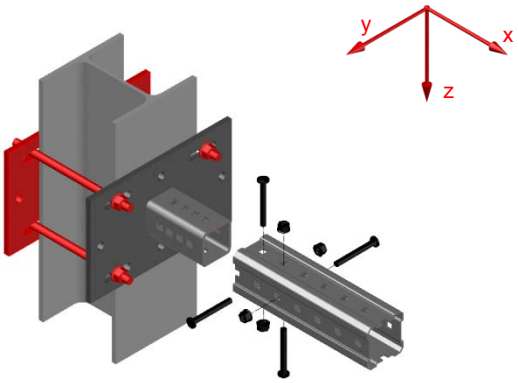
Validity:

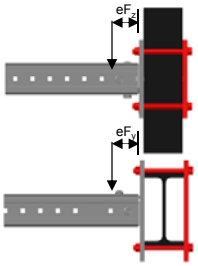
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

3. Base plate and through bolts - per analytical calculation





with e_y=e_z=0.070 m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
150.80	Not decisive	19.00	19.00	19.00	19.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
2.57	2.57	8.82	8.82	12.29	12.29

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

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

Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

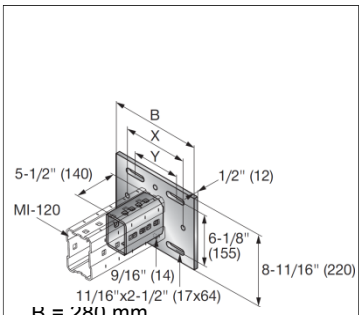
$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

MIC-S120-AH Base Material Connector - Steel

Designation	Item number
MIC-S120-AH	**2174668**

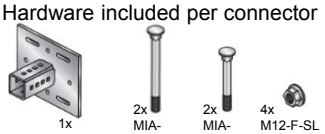
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**

Weight:
7911 g incl. components



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

Hardware included per connector

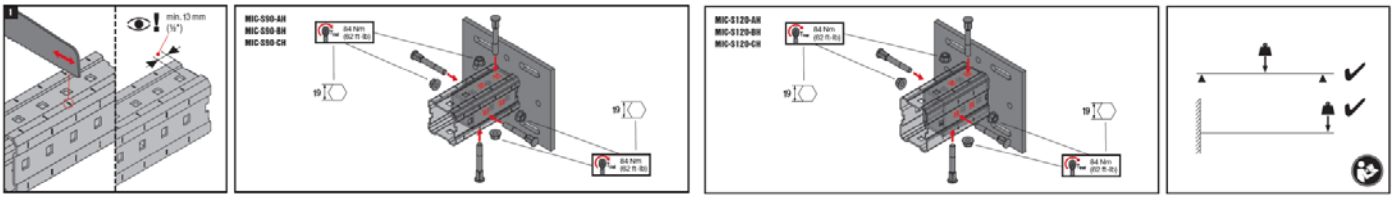


Description:
Hilti Hot-dipped galvanized baseplate connector, used for connecting a MI-120 girder to a steel beam using M16 mounting hardware. Four slotted holes enable fine tuning of baseplate position, and girder is connected using beam clamps or threaded rod. Comes in different plate sizes to fit various steel beam sizes.

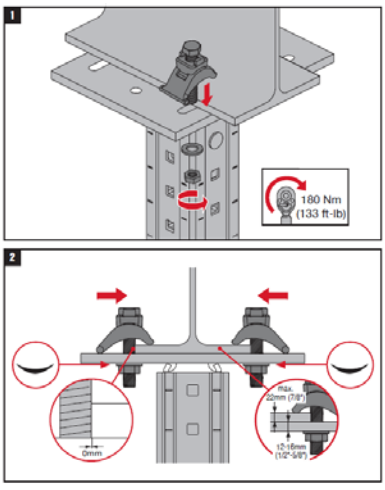
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

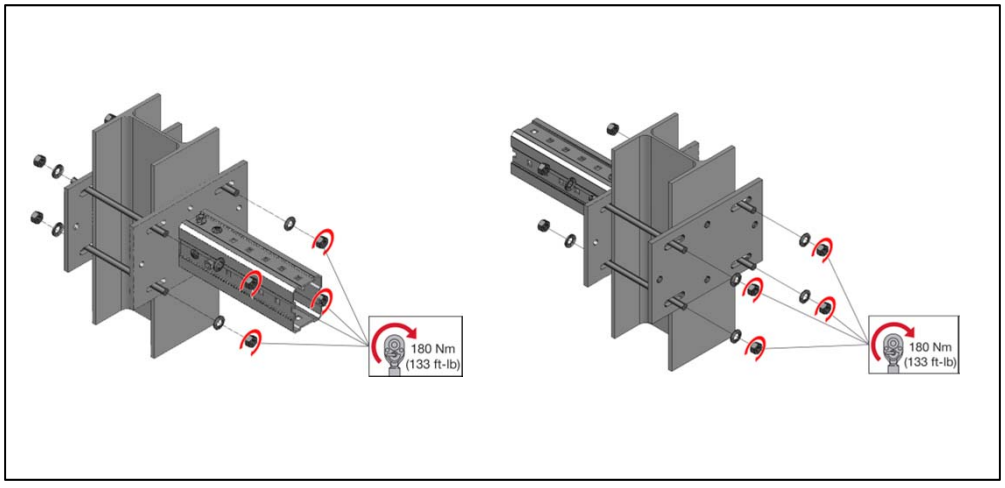
Instruction For Use:

For both loading cases:

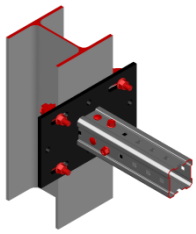
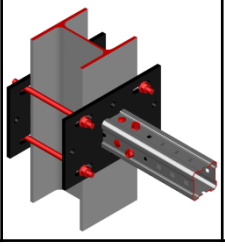


For clamped loading case **For boxed loading case** (not attached to the packaging)





MIC-S120-AH Base Material Connector - Steel

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

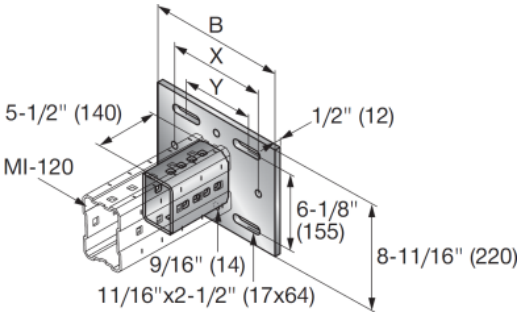
Standards and codes:

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
- Mathcad 15

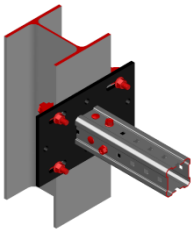
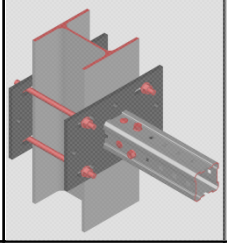
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



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

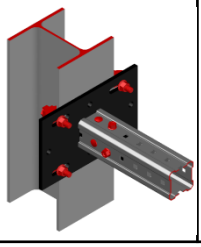
MIC-S120-AH Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Clamped

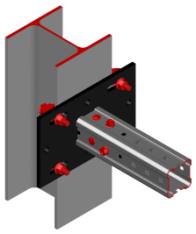
Bill of Material for this loading case:

1x MIC-S120-AH **2174668**
Hardware not included in packaging:
Beam clamps
4x MI-SGC M16 **387398**



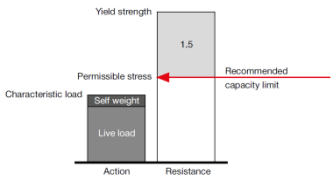
Combinations covered by loading case

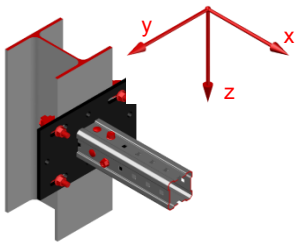
Connector used for a perpendicular connection of MI-120 girder to flange of structural steel profiles.
For flange width 75-165mm.



Recommended loading capacity - simplified for most common applications

Method



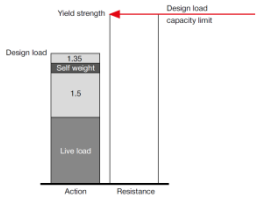


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
37.87	6.87	6.87

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

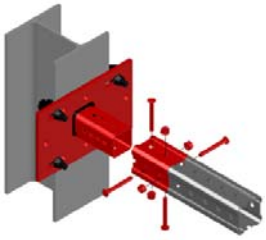
Design loading capacity - 3D 1/3

Method

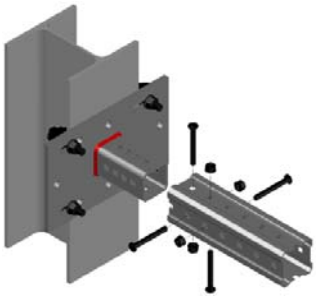


Limiting components of capacity evaluated in following tables:

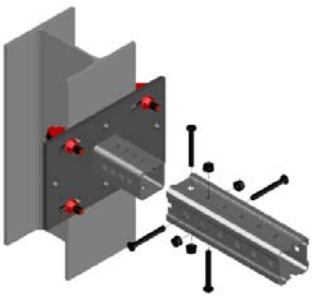
1. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation



2. Welds - per analytical calculation

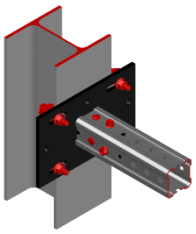
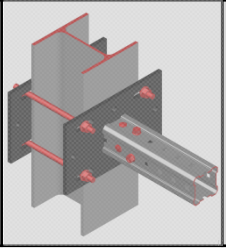


3. Beam Clamps - per analytical calculation



MIC-S120-AH Base Material Connector - Steel

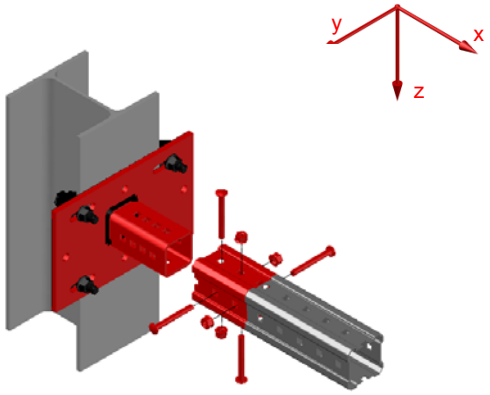
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation

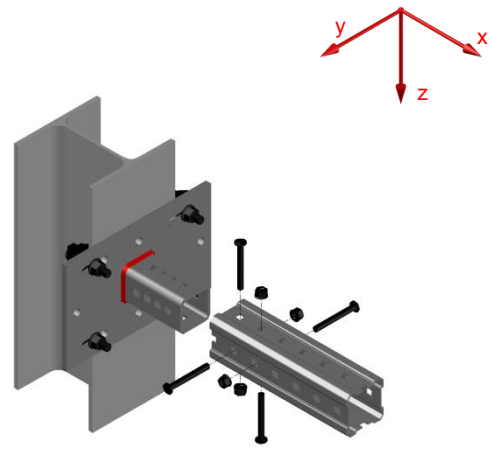


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
56.80	118.82	53.80	53.80	63.50	63.50
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
5.39	5.39	4.73	4.73	3.00	3.00

Interaction:

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

2. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
316.42	316.42	81.16	81.16	100.68	100.68
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
9.16	9.16	5.18	5.18	6.04	6.04

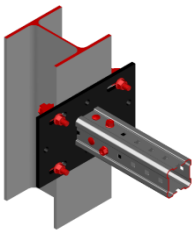
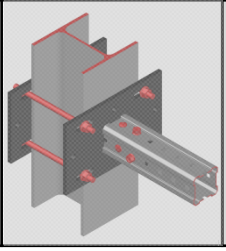
Interaction:

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

MIC-S120-AH Base Material Connector - Steel

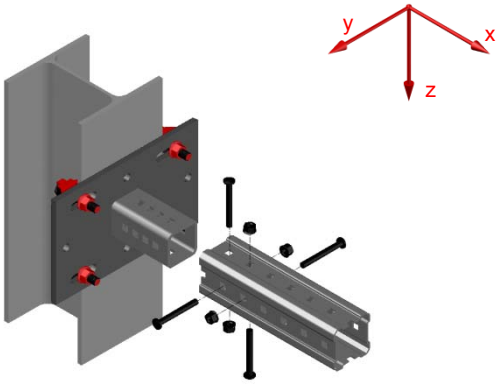
Validity:

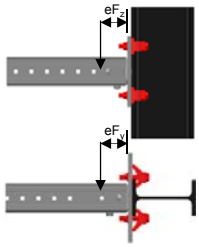
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

3. Beam Clamps - per analytical calculation





with e_y=e_z=0.070 m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.84	0.84	7.48	7.48	4.51	4.51

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

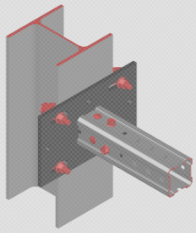
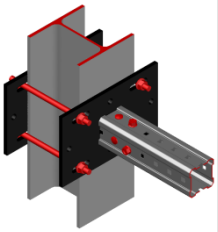
$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{y,Ed}*ey}{M_{z,Rd}} + \frac{F_{z,Ed}*ez}{M_{y,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$$

Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

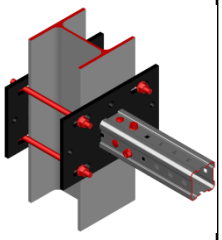
MIC-S120-AH Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Boxed

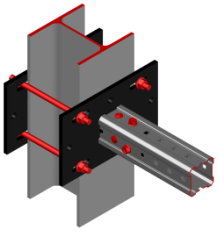
Bill of Material for this loading case:

1x MIC-S120-AH 2174668
Hardware not included in packaging:
Base plate
1x MIB-SAH 2174674
Threaded rods cut to particular length
4x AM16x1000 8.8 HDG…m 419104
Lock washer
8x LW M16 HDG plus washer 2185343
Nut
8x M16-F nut 304767



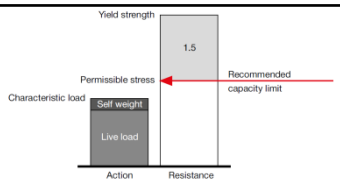
Combinations covered by loading case

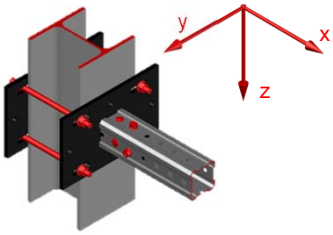
Connector used for a perpendicular connection of MI-120 girder to flange of structural steel profiles.
For flange width 75-165mm.



Recommended loading capacity - simplified for most common applications

Method



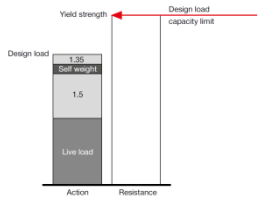


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
39.00	13.77	13.77

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

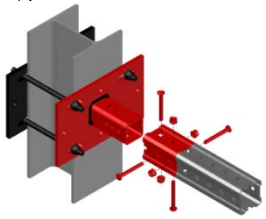
Design loading capacity - 3D 1/3

Method

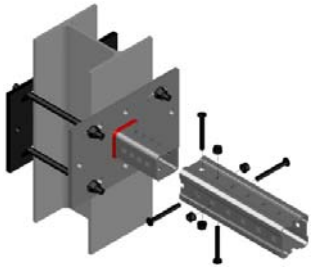


Limiting components of capacity evaluated in following tables:

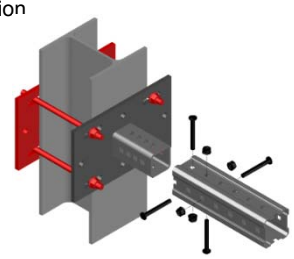
1. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation



2. Welds - per analytical calculation

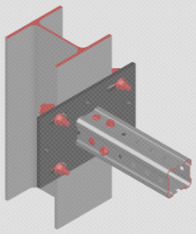
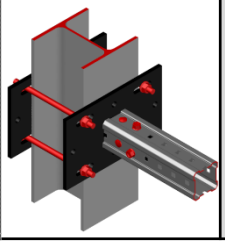


3. Base plate and through bolts - per analytical calculation



MIC-S120-AH Base Material Connector - Steel

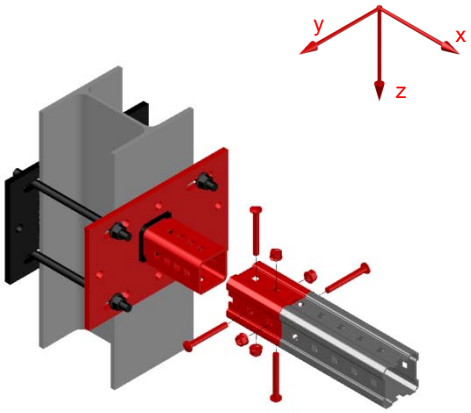
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation

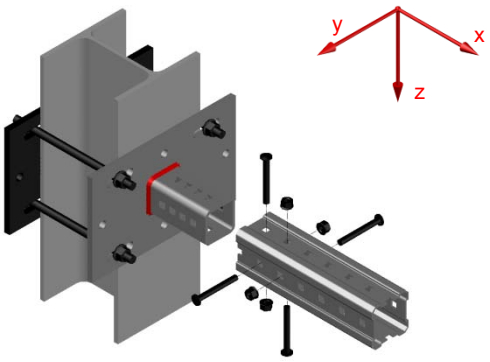


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
58.50	118.82	53.80	53.80	63.50	63.50
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.39	5.39	4.73	4.73	3.00	3.00

Interaction:

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

2. Welds - per analytical calculation



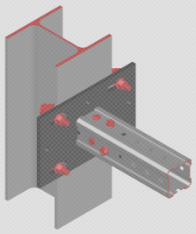
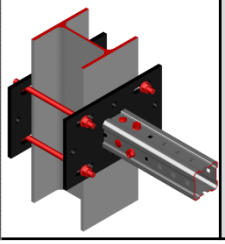
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
316.42	316.42	81.16	81.16	100.68	100.68
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
9.16	9.16	5.18	5.18	6.04	6.04

Interaction:

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

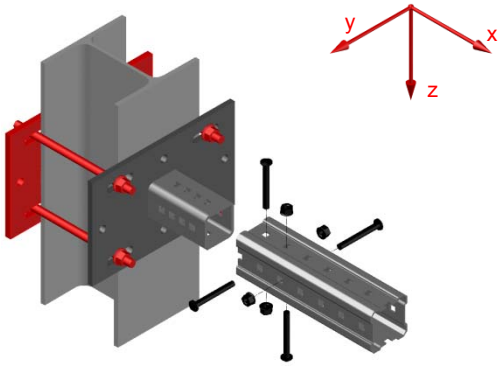
MIC-S120-AH Base Material Connector - Steel

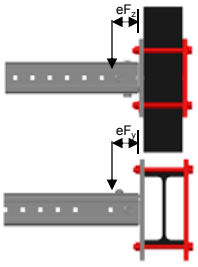
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

3. Base plate and through bolts - per analytical calculation





with e_y=e_z=0.070 m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
164.00	Not decisive	20.66	20.66	20.66	20.66
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.67	1.67	10.99	10.99	7.22	7.22

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

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

Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

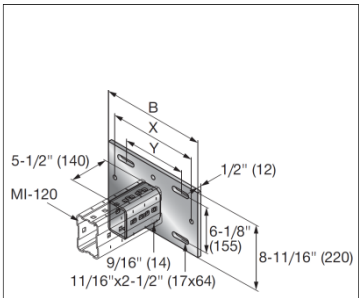
MIC-S120-BH Base Material Connector - Steel

Designation	Item number
MIC-S120-BH	**2174669**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**

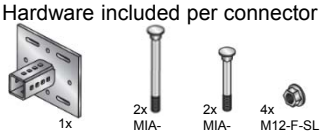
Weight:
9364 g incl. components

Description:
Hilti Hot-dipped galvanized baseplate connector, used for connecting a MI-120 girder to a steel beam using M16 mounting hardware. Four slotted holes enable fine tuning of baseplate position, and girder is connected using beam clamps or threaded rod. Comes in different plate sizes to fit various steel beam sizes.



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

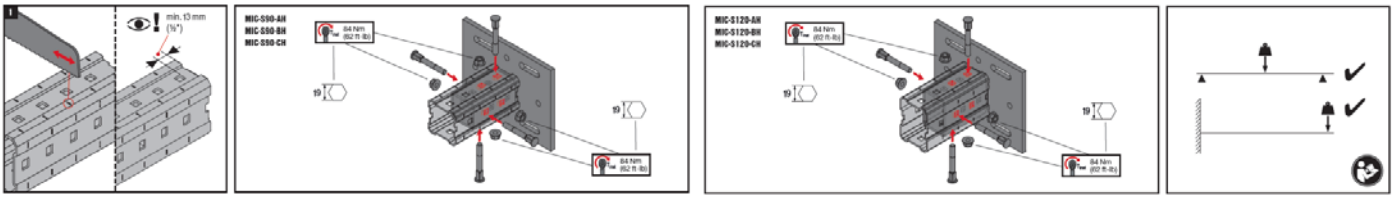
Hardware included per connector



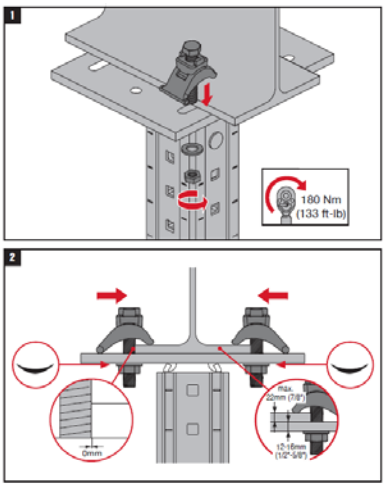
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

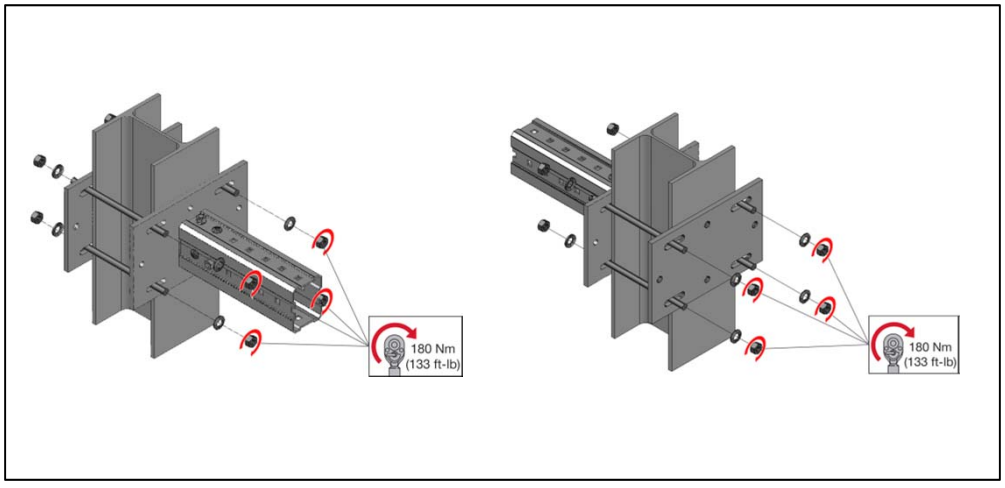
Instruction For Use:

For both loading cases:

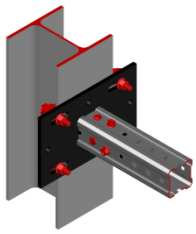
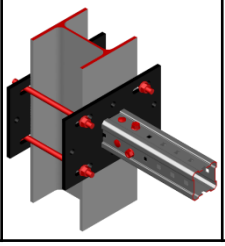


For clamped loading case **For boxed loading case** (not attached to the packaging)





MIC-S120-BH Base Material Connector - Steel

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

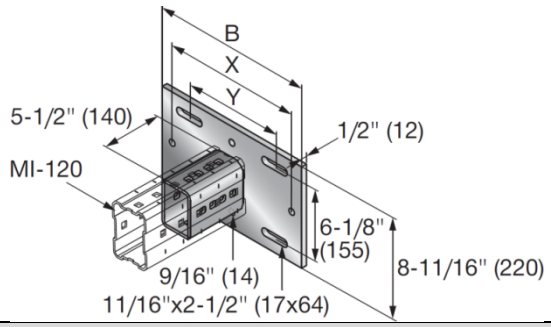
Standards and codes:

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
- Mathcad 15

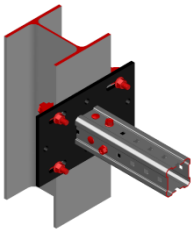
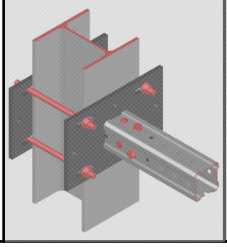
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



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

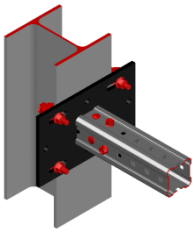
MIC-S120-BH Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Clamped

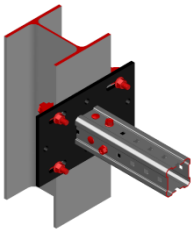
Bill of Material for this loading case:

1x MIC-S120-BH **2174669**
Hardware not included in packaging:
Beam clamps
4x MI-SGC M16 **387398**



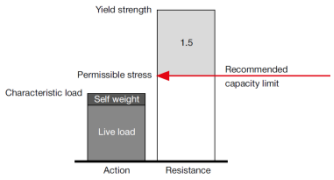
Combinations covered by loading case

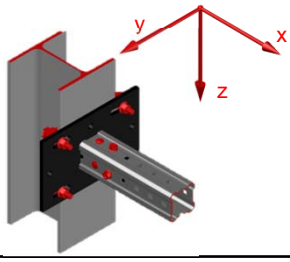
Connector used for a perpendicular connection of MI-120 girder to flange of structural steel profiles.
For flange width 165-235mm.



Recommended loading capacity - simplified for most common applications

Method



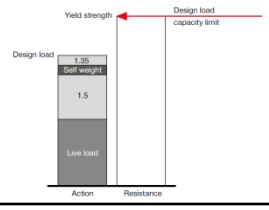


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
27.07	6.87	6.87

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

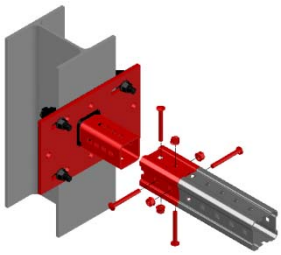
Design loading capacity - 3D 1/3

Method

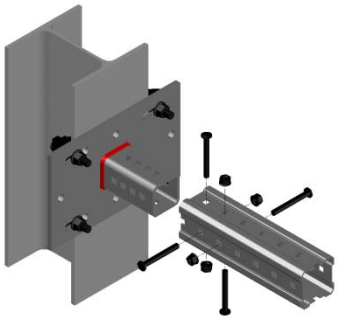


Limiting components of capacity evaluated in following tables:

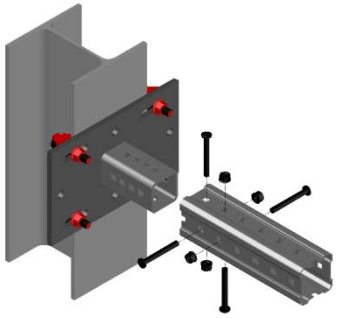
1. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation



2. Welds - per analytical calculation

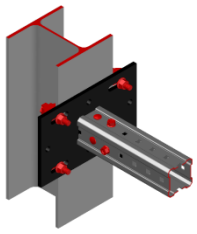
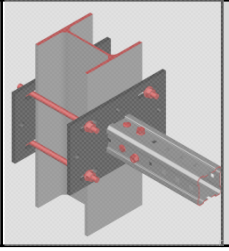


3. Beam Clamps - per analytical calculation



MIC-S120-BH Base Material Connector - Steel

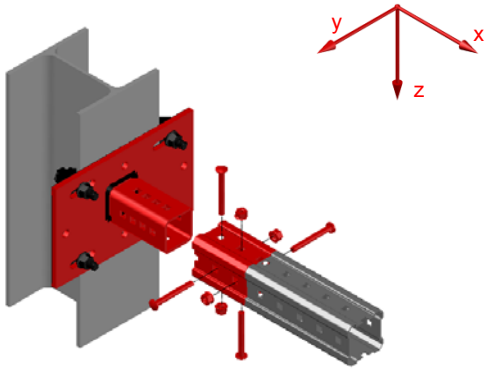
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation

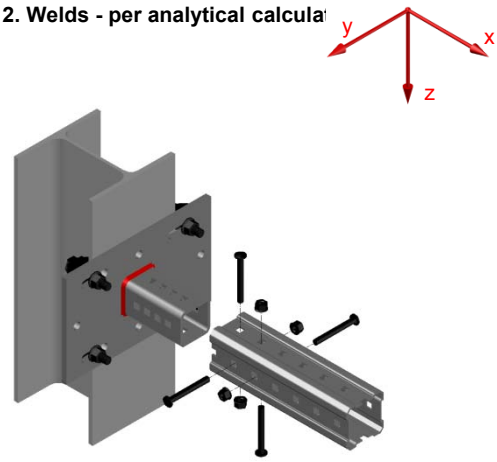


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
40.60	118.82	53.80	53.80	63.50	63.50
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.39	5.39	4.45	4.45	3.00	3.00

Interaction:

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

2. Welds - per analytical calcula



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
316.42	316.42	81.16	81.16	100.68	100.68
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
9.16	9.16	5.18	5.18	6.04	6.04

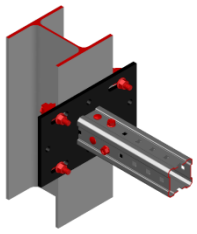
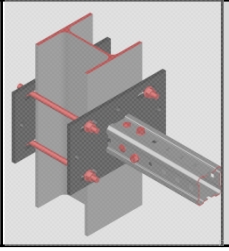
Interaction:

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

MIC-S120-BH Base Material Connector - Steel

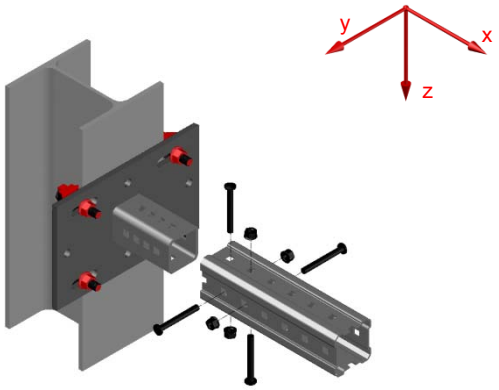
Validity:

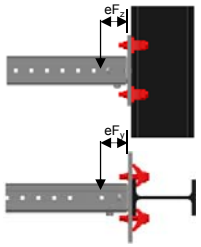
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

3. Beam Clamps - per analytical Calculation





with e_y=e_z=0.070 m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.12	1.12	7.48	7.48	6.66	6.66

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

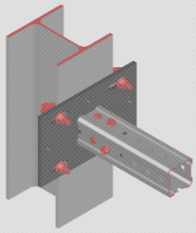
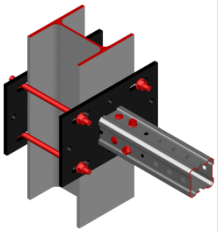
$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{y,Ed}*ey}{M_{z,Rd}} + \frac{F_{z,Ed}*ez}{M_{y,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$$

Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

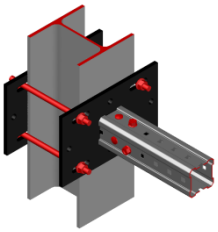
MIC-S120-BH Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Boxed

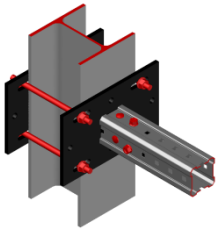
Bill of Material for this loading case:

1x MIC-S120-BH 2174669
Hardware not included in packaging:
Base plate
1x MIB-SBH 2174675
Threaded rods cut to particular length
4x AM16x1000 8.8 HDG...m 419104
Lock washer
8x LW M16 HDG plus washer 2185343
Nut
8x M16-F nut 304767



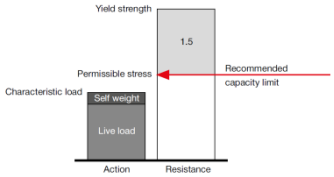
Combinations covered by loading case

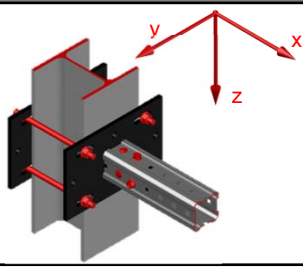
Connector used for a perpendicular connection of MI-120 girder to flange of structural steel profiles.
For flange width 165-235mm.



Recommended loading capacity - simplified for most common applications

Method



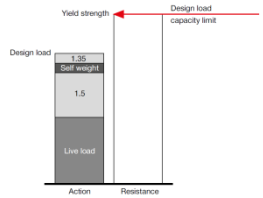


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
27.07	13.34	13.34

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

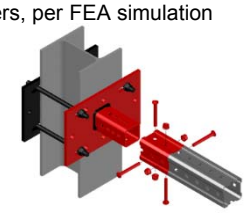
Design loading capacity - 3D 1/3

Method

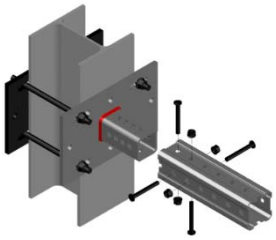


Limiting components of capacity evaluated in following tables:

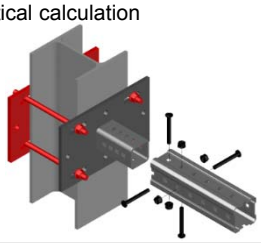
1. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation



2. Welds - per analytical calculation

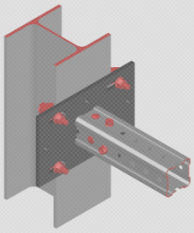
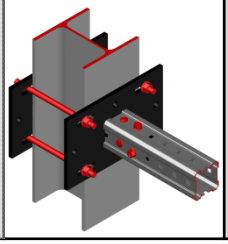


3. Base plate and through bolts - per analytical calculation



MIC-S120-BH Base Material Connector - Steel

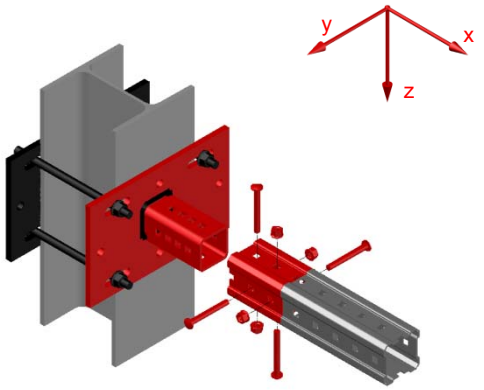
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation

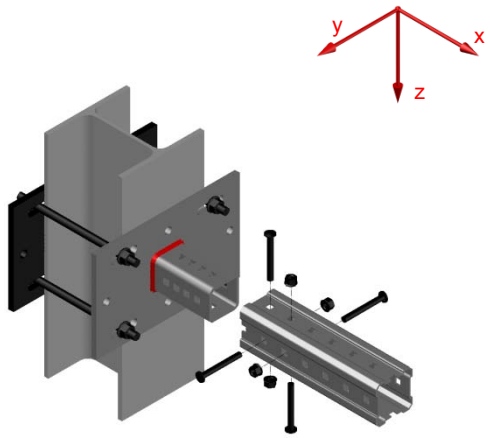


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
40.60	85.90	53.80	53.80	63.50	63.50
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.39	5.39	4.45	4.45	3.00	3.00

Interaction:

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

2. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
316.42	316.42	81.16	81.16	100.68	100.68
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
9.16	9.16	5.18	5.18	6.04	6.04

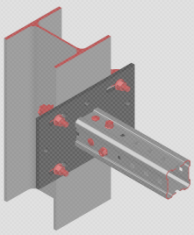
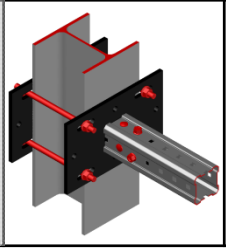
Interaction:

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

MIC-S120-BH Base Material Connector - Steel

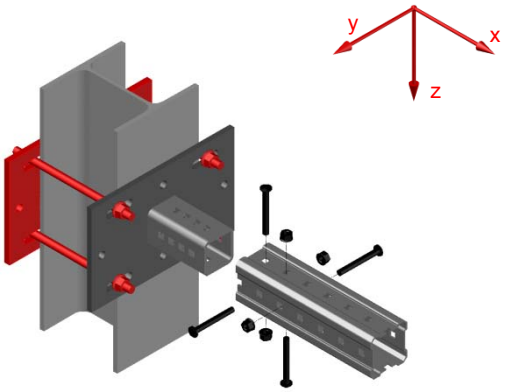
Validity:

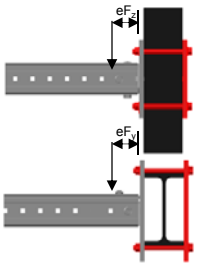
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

3. Base plate and through bolts - per analytical calculation





with e_y=e_z=0.070 m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
158.80	Not decisive	20.01	20.01	20.01	20.01
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.06	2.06	11.20	11.20	9.77	9.77

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

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

Shear force interaction:

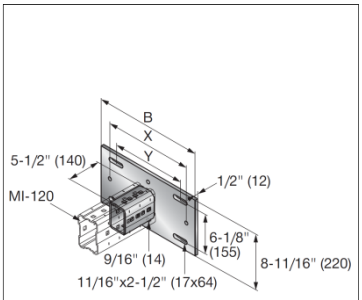
- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

MIC-S120-CH Base Material Connector - Steel

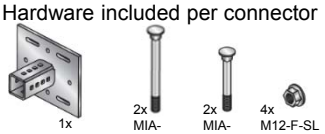
Designation	Item number
MIC-S120-CH	**304820**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**



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

Hardware included per connector



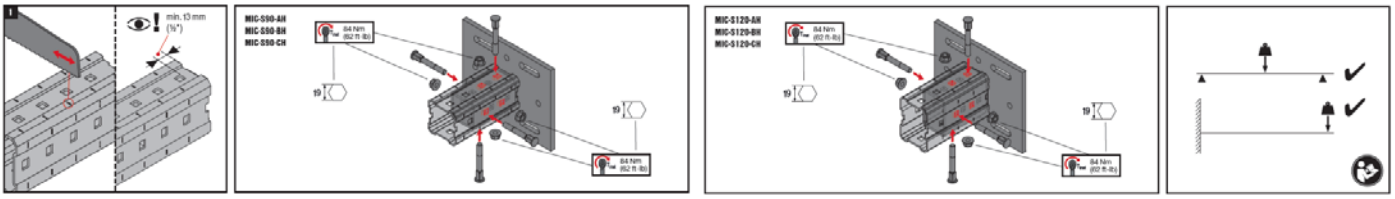
Weight:
11024 g incl. components

Description:
Hilti Hot-dipped galvanized baseplate connector, used for connecting a MI-120 girder to a steel beam using M16 mounting hardware. Four slotted holes enable fine tuning of baseplate position, and girder is connected using beam clamps or threaded rod. Comes in different plate sizes to fit various steel beam sizes.

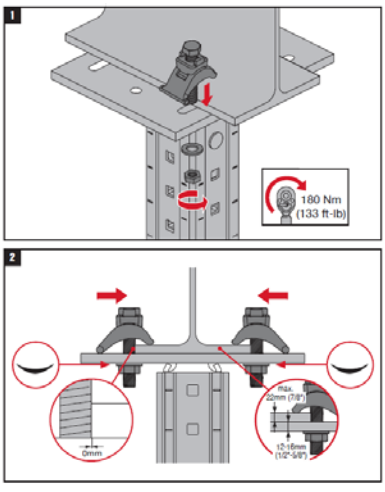
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

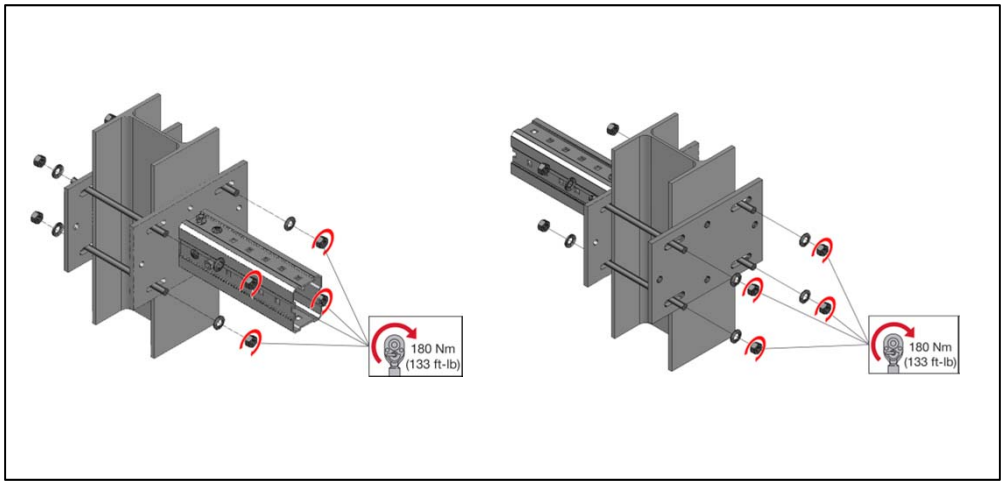
For both loading cases:



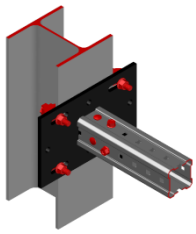
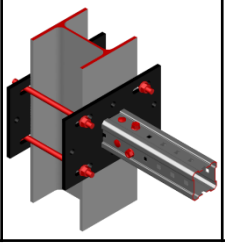
For clamped loading case



For boxed loading case (not attached to the packaging)



MIC-S120-CH Base Material Connector - Steel

Possible loading cases		
Clamped	Boxed	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

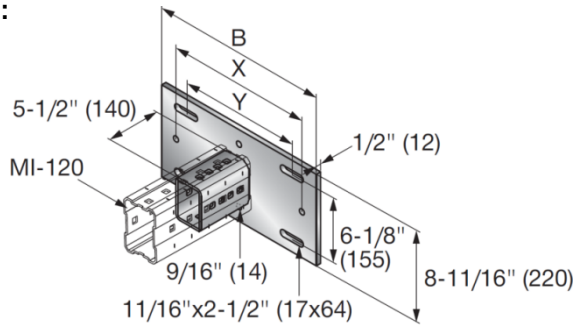
Standards and codes:

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
- Mathcad 15

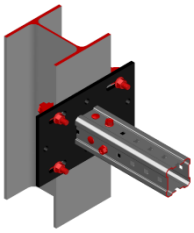
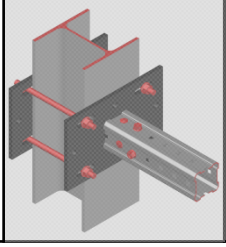
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

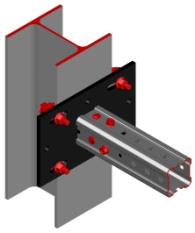
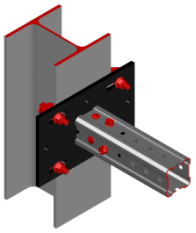
Simplified drawing:



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

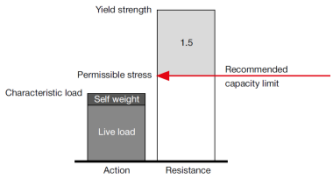
MIC-S120-CH Base Material Connector - Steel

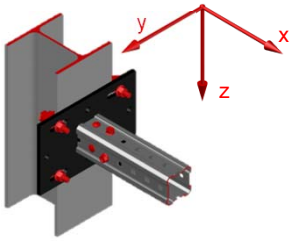
Clamped	Boxed	
		

Loading case: Clamped	Combinations covered by loading case
Bill of Material for this loading case: **1x MIC-S120-CH 2174670** Hardware not included in packaging: **Beam clamps** **4x MI-SGC M16 387398** 	Connector used for a perpendicular connection of MI-120 girder to flange of structural steel profiles. For flange width 235-300mm. 

Recommended loading capacity - simplified for most common applications

Method



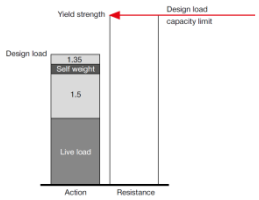


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
18.67	6.87	6.87

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

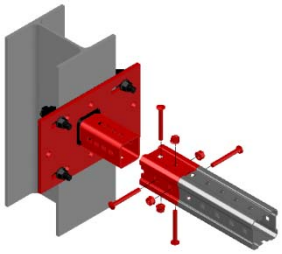
Design loading capacity - 3D 1/3

Method

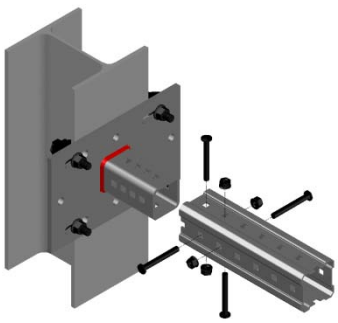


Limiting components of capacity evaluated in following tables:

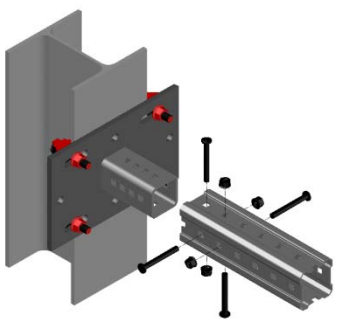
1. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation



2. Welds - per analytical calculation

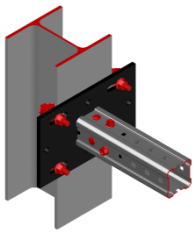
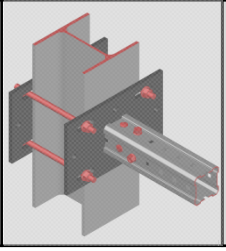


3. Beam Clamps - per analytical calculation



MIC-S120-CH Base Material Connector - Steel

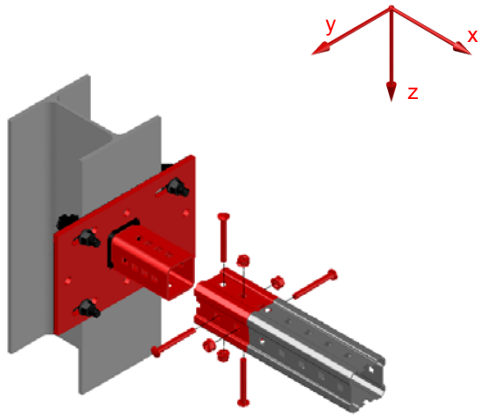
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation

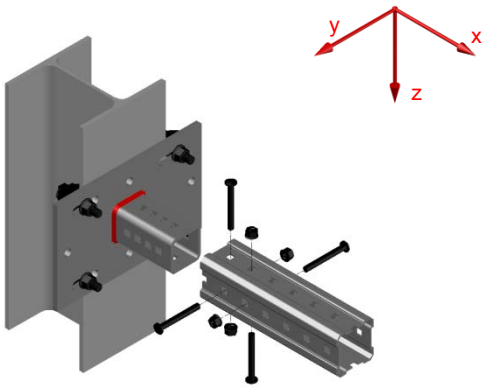


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
28.00	118.82	53.80	53.80	58.10	58.10
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
5.39	5.39	4.07	4.07	3.00	3.00

Interaction:

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

2. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
316.42	316.42	81.16	81.16	100.68	100.68
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
9.16	9.16	5.18	5.18	6.04	6.04

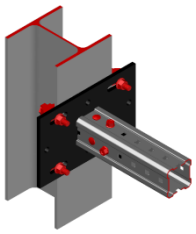
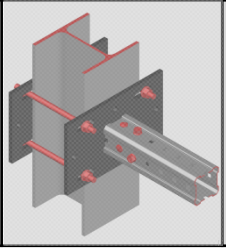
Interaction:

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

MIC-S120-CH Base Material Connector - Steel

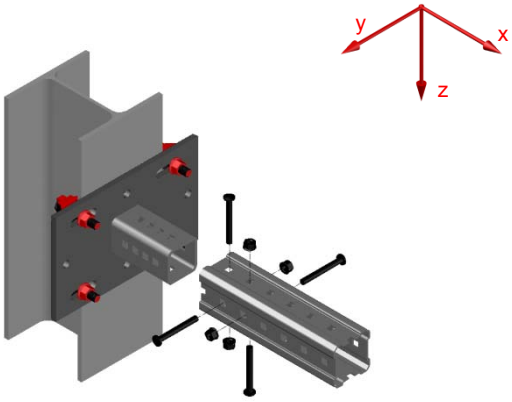
Validity:

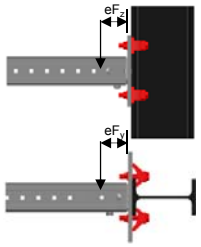
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

3. Beam Clamps - per analytical calculation





with e_y=e_z=0.070 m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.41	1.41	7.37	7.37	8.45	8.45

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

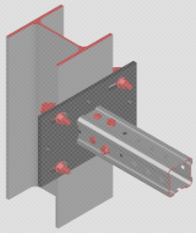
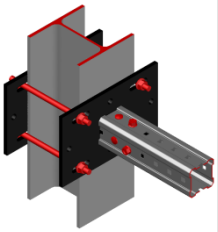
$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{y,Ed}*ey}{M_{z,Rd}} + \frac{F_{z,Ed}*ez}{M_{y,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$$

Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1.$

$$\sqrt{\left(F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)\right)^2 + \left(F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

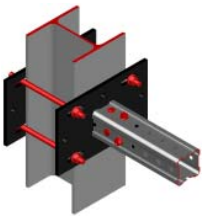
MIC-S120-CH Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Boxed

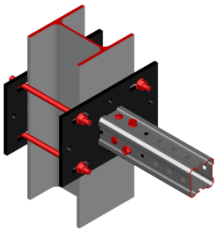
Bill of Material for this loading case:

1x MIC-S120-CH 2174670
Hardware not included in packaging:
Base plate
1x MIB-SCH 2174676
Threaded rods cut to particular length
4x AM16x1000 8.8 HDG...m 419104
Lock washer
8x LW M16 HDG plus washer 2185343
Nut
8x M16-F nut 304767



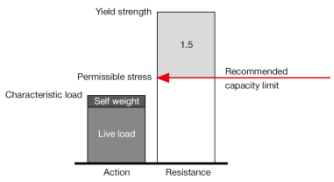
Combinations covered by loading case

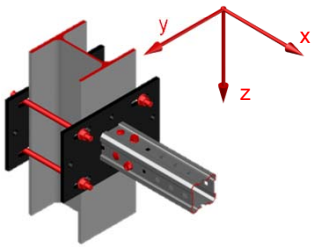
Connector used for a perpendicular connection of MI-120 girder to flange of structural steel profiles.
For flange width 235-300mm.



Recommended loading capacity - simplified for most common applications

Method



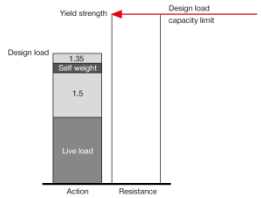


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
17.67	12.67	12.67

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

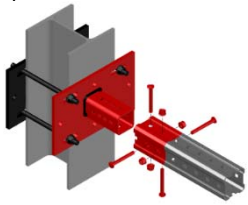
Design loading capacity - 3D 1/3

Method

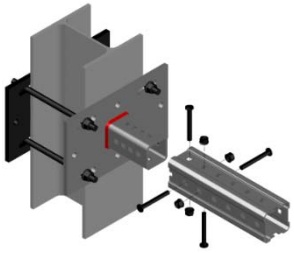


Limiting components of capacity evaluated in following tables:

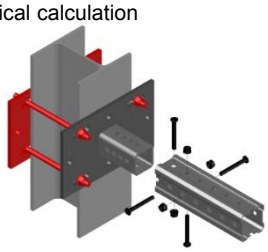
1. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation



2. Welds - per analytical calculation

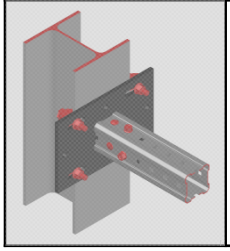
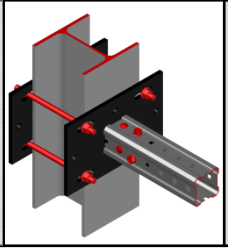


3. Base plate and through bolts - per analytical calculation



MIC-S120-CH Base Material Connector - Steel

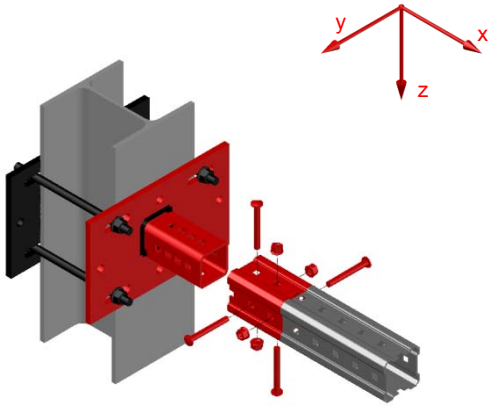
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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. Connection system, including connector, hardware and affected portion of MI-120 girders, per FEA simulation

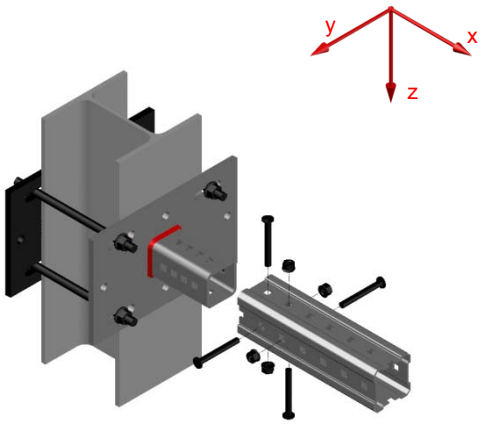


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
26.50	55.30	53.80	53.80	58.10	58.10
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
5.39	5.39	4.07	4.07	3.00	3.00

Interaction:

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

2. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
316.42	316.42	81.16	81.16	100.68	100.68
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
9.16	9.16	5.18	5.18	6.04	6.04

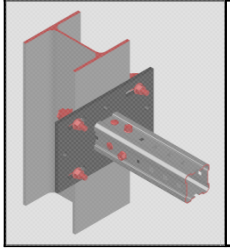
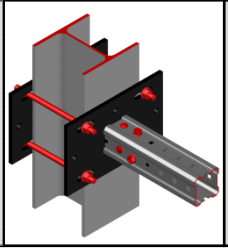
Interaction:

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

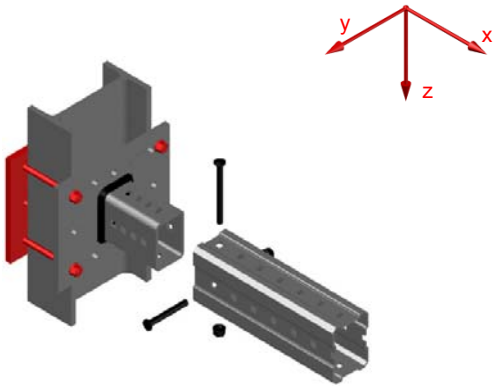
MIC-S120-CH Base Material Connector - Steel

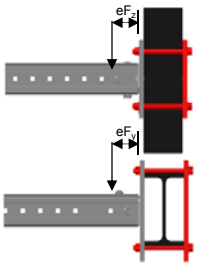
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3





with e_y=e_z=0.070 m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
150.80	Not decisive	19.00	19.00	19.00	19.00
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.57	2.57	10.86	10.86	12.29	12.29

Interaction:

Normal force interaction:

The eccentricity ey and ez between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

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

Shear force interaction:

- Shear Interaction Equation is only valid for TENSILE $F_{x,Ed}$ loads ($F_{x,Ed} > 0$). Equation is not valid for compressive $F_{x,Ed}$ loads ($F_{x,Ed} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $F_{x,Ed} / F_{x,Rd} < 1$.

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

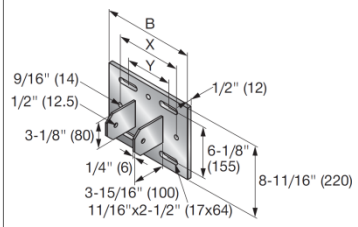
MIC-SA-MAH Base Material Connector - Steel

Designation	Item number
MIC-SA-MAH	**2174671**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**

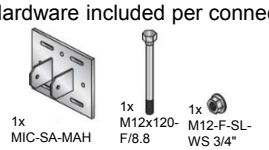
Weight:
6701g incl. components

Description:
Hilti Hot-dipped galvanized baseplate connector, used for anchoring a MI-90 girder to a steel beam at 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. For use with **M16** hardware.



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

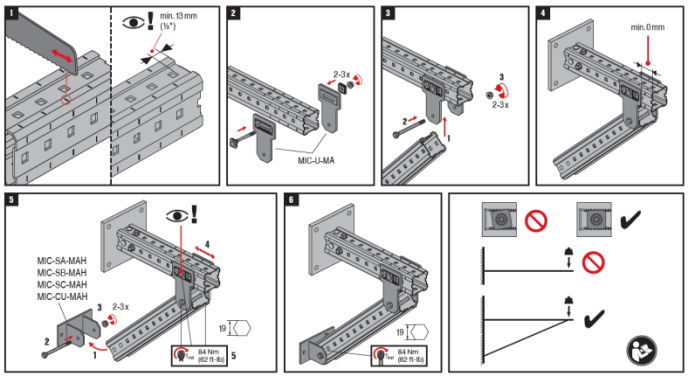
Hardware included per connector



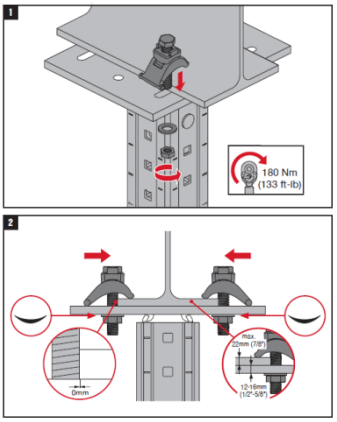
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

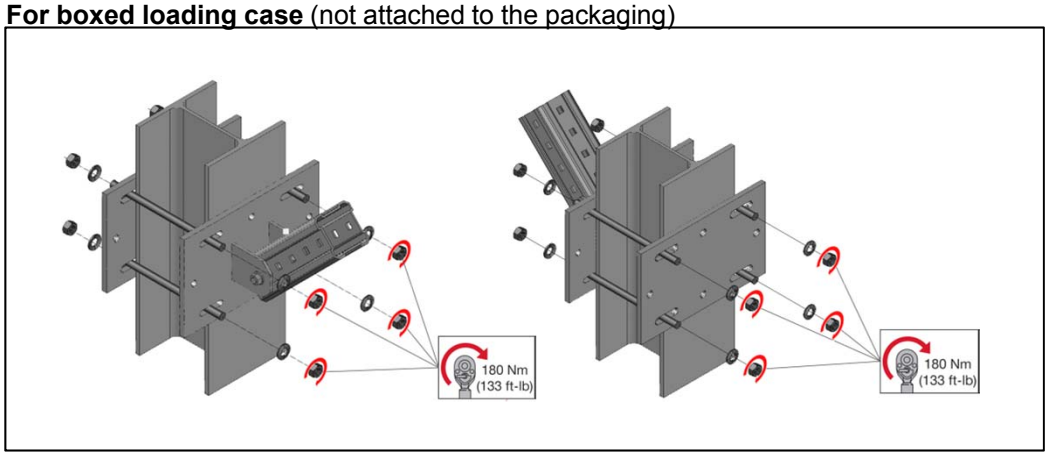
For both loading cases:



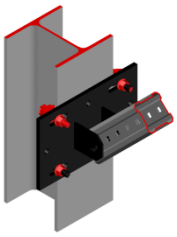
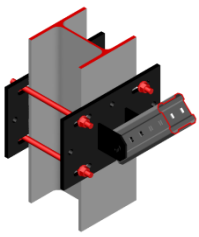
For clamped loading case



For boxed loading case (not attached to the packaging)



MIC-SA-MAH Base Material Connector - Steel

Possible loading cases		
Clamped	**Boxed**	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

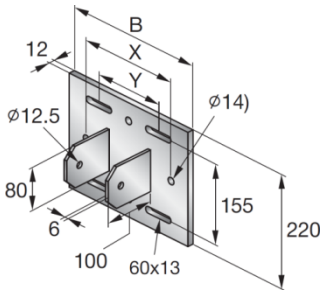
Standards and codes:

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
- Mathcad 15

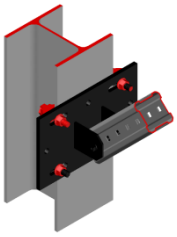
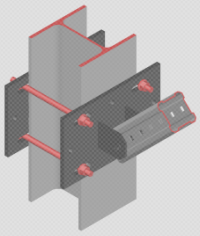
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



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

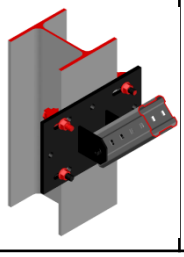
MIC-SA-MAH Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Clamped

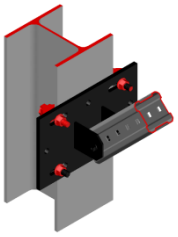
Bill of Material for this loading case:

MIC-SA-MAH **2174671**
Hardware not included in packaging:
Beam clamps
4x MI-SGC M16 **387398**



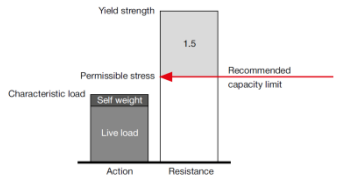
Combinations covered by loading case

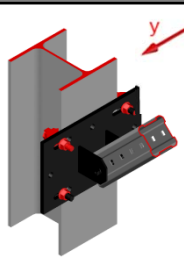
Connector used for
an angled connection
of MI-90 to
structural steel profiles
(bracing).
For flange width 75-165mm.

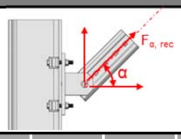


Recommended loading capacity - simplified for most common applications

Method







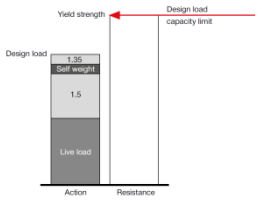
±Fy,rec. [kN]
4.40

α	0°	30°	45°	60°	90°
$\pm F_{\alpha,rec.}$ [kN]	11.13	7.50	8.83	7.94	6.87

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

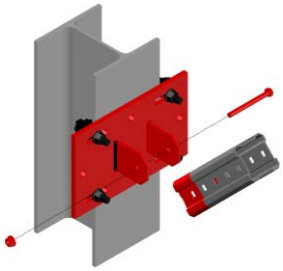
Design loading capacity - 3D 1/4

Method

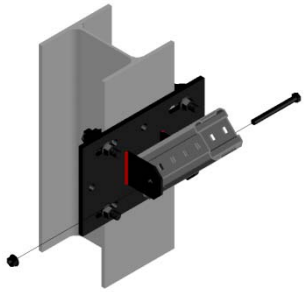


Limiting components of capacity evaluated in following tables:

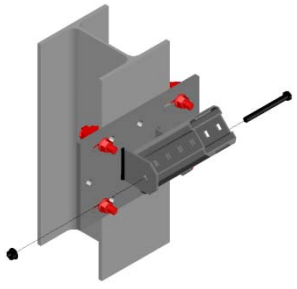
1. Connection system, including connector and hardware, per FEA simulation



2. Welds - per analytical calculation

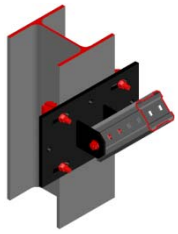
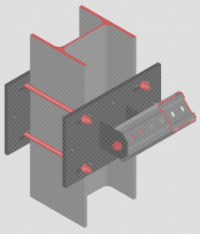


3. Beam Clamps - per analytical calculation



MIC-SA-MAH Base Material Connector - Steel

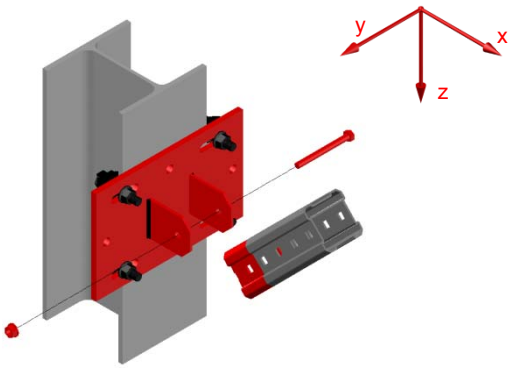
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

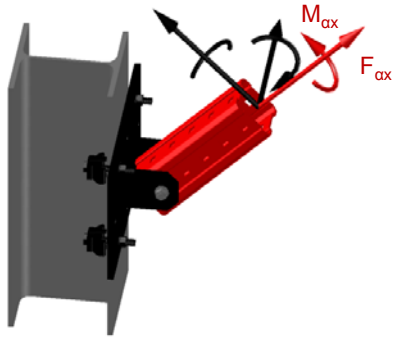
Clamped	Boxed	
		

Design loading capacity - 3D 2/4

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. Connection system, including connector and hardware, per FEA simulation





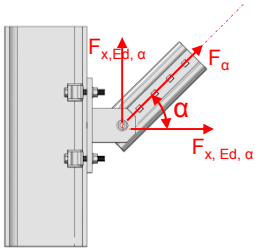
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
16.70	16.70	6.60	6.60	16.70	16.70
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.70	0.70	0.00	0.00	0.00	0.00

Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt

Interaction:
Due to the fact, that the same resistance values as for MIC-CU-MA are decisive, the same interaction formulation can be used:

$$\left(\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}}\right)^2 + \left(\frac{F_{z\,Ed\,\alpha}}{F'_{z\,Rd}}\right)^2 + \frac{F_{y\,Ed}}{F'_{y\,Rd}} + \frac{M_{x\,Ed}}{M'_{x\,Rd}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,\,Ed,\,\alpha} = F_\alpha$ x cos (α)
$Fz'_{,\,Ed,\,\alpha} = F_\alpha$ x sin (α)



Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SA-MAH Base Material Connector - Steel

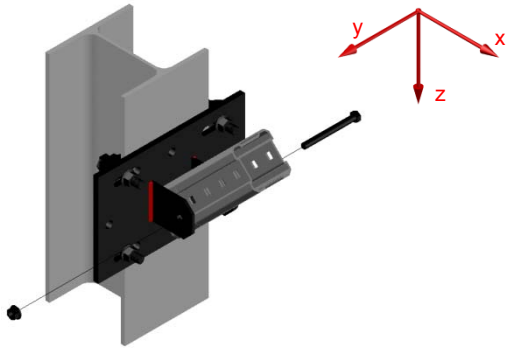
Validity:

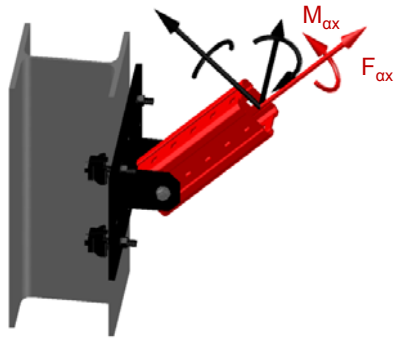
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 3/4

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

2. Welds - per analytical calculation





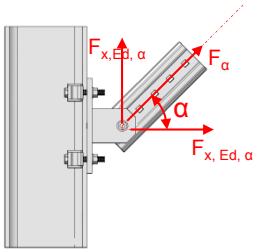
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
325.83	325.83	11.97	11.97	47.45	47.45
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.30	2.30	0.00	0.00	0.00	0.00

Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt

Interaction:

$$\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}} + \frac{F_{z\,Ed\,\alpha}}{F'_{z\,Rd}} + \frac{F_{y\,Ed}}{F'_{y\,Rd}} + \frac{M_{x\,Ed}}{M'_{x\,Rd}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,Ed,\alpha}$ = F_{α} x cos (α)
$Fz'_{Ed,\alpha}$ = F_{α} x sin (α)
$M'_{x,Ed} = M_{\alpha x}$



Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SA-MAH Base Material Connector - Steel

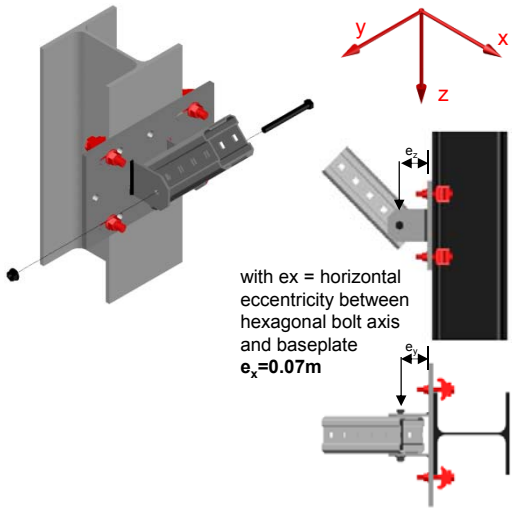
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 4/4

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

3. Beam Clamps - per analytical calculation



with ex = horizontal eccentricity between hexagonal bolt axis and baseplate
e_x=0.07m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.84	0.84	6.66	6.66	3.33	3.33

Normal force interaction:

The eccentricity e_y and e_z between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

$$\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}} + \frac{F_{y\,Ed}\times ey}{M_{z\,Rd}} + \frac{F_{z\,Ed\,\alpha}\times ez}{M'_{y\,Rd}} + \frac{M_{z\,Ed}}{M'_{z\,Rd}} \le 1$$

with e_y=e_z=0.070 m

Shear force interaction:

Shear force interaction for +Fx (tensile normal force):

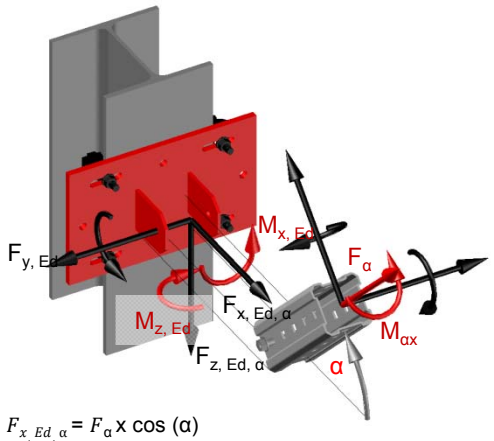
$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd}\times\left(1-\frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2+\left(\frac{F_{z\,Ed}}{F_{z,Rd}\times\left(1-\frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2}+\frac{M_{x\,Ed}}{M_{x,Rd}\times\left(1-\frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\le 1$$

Shear force interaction for -Fx (compressive normal force):

$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd}}\right)^2+\left(\frac{F_{z\,Ed}}{F_{z,Rd}}\right)^2}+\frac{M_{x\,Ed}}{M_{x,Rd}}\le 1$$

Note: Due to the fact, that depending on the inclination of the channel, the acting torsional moment Mαx can either generate shear or tension, it will be considered in both interactions.

Transition of the forces generated on inclined brace to base material connector's coordinate system

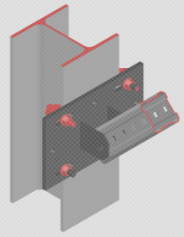
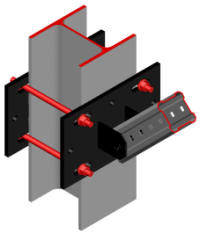


$F_{x,Ed,\alpha} = F_\alpha$ x cos (α)
$F_{z,Ed,\alpha} = F_\alpha$ x sin (α)

$M_{x,Ed} = M_{\alpha x}$ x cos (α)
$M_{z,Ed} = M_{\alpha x}$ x sin (α)

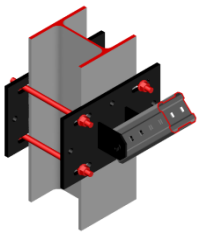
Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SA-MAH Base Material Connector - Steel

Clamped	Boxed	
		

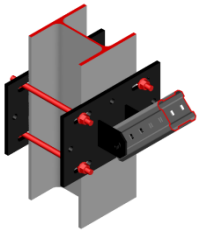
Loading case: Boxed

Bill of Material for this loading case:
1x MIC-SA-MAH 2174671
Hardware not included in packaging:
Base plate
1x MIB-SAH 2174674
Threaded rods cut to particular length
4x AM16x1000 8.8 HDG…m 419104
Lock washer
8x LW M16 HDG plus washer 2185343
Nut
8x M16-F nut 304767



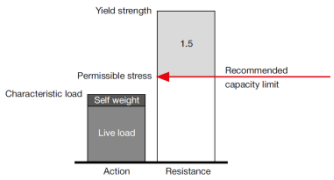
Combinations covered by loading case

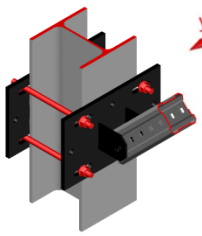
Connector used for an angled connection of MI-90 to structural steel profiles (bracing).
For flange width 75-165mm.

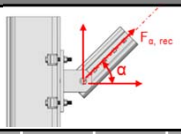


Recommended loading capacity - simplified for most common applications

Method







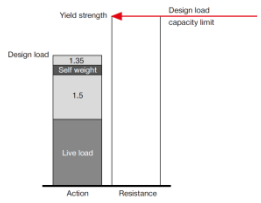
±Fy,rec. [kN]
4.40

α	0°	30°	45°	60°	90°
±$F_{α,rec.}$ [kN]	11.13	11.13	11.13	11.13	11.13

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

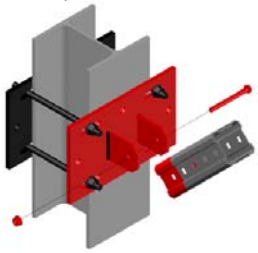
Design loading capacity - 3D 1/4

Method

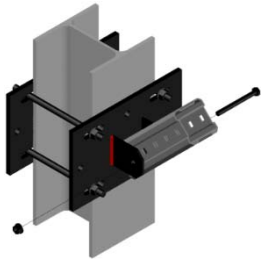


Limiting components of capacity evaluated in following tables:

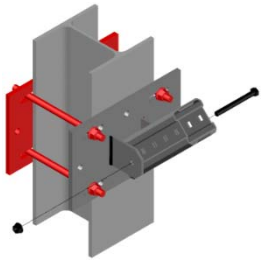
1. Connection system, including connector and hardware, per FEA simulation



2. Welds - per analytical calculation

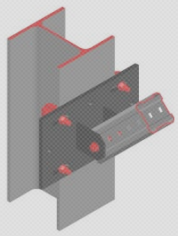
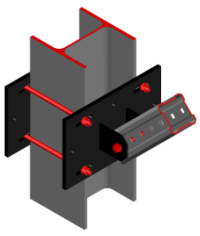


3. Base plate and through bolts - per analytical calculation



MIC-SA-MAH Base Material Connector - Steel

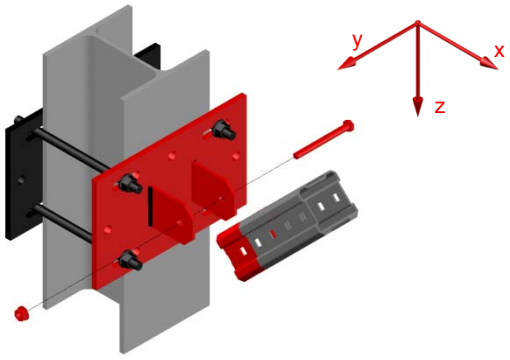
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 2/4

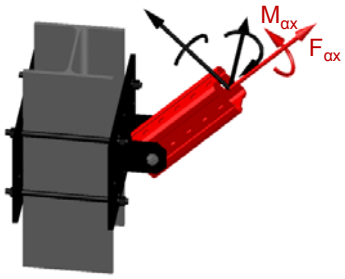
Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Connection system, including connector and hardware, per FEA simulation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
16.70	16.70	6.60	6.60	16.70	16.70
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.70	0.70	0.00	0.00	0.00	0.00

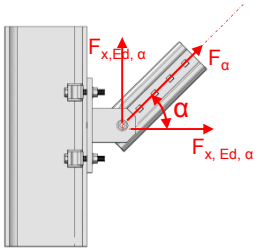
Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt



Interaction:
Due to the fact, that the same resistance values as for MIC-CU-MA are decisive, the same interaction formulation can be used:

$$\left(\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}}\right)^2 + \left(\frac{F_{z\,Ed\,\alpha}}{F'_{z\,Rd}}\right)^2 + \frac{F_{y\,Ed}}{F'_{y\,Rd}} + \frac{M_{x\,Ed}}{M'_{x\,Rd}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,\,Ed,\,\alpha} = F_{\alpha}$ x cos (α)
$Fz'_{,\,Ed,\,\alpha} = F_{\alpha}$ x sin (α)



Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SA-MAH Base Material Connector - Steel

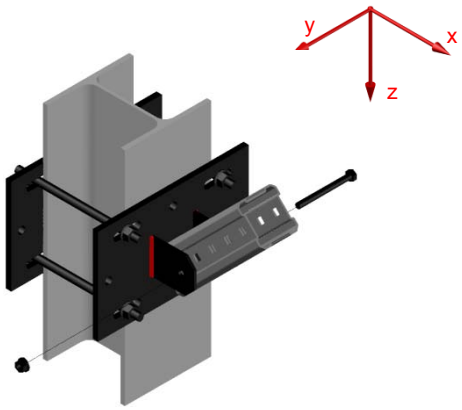
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 3/4

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

2. Welds - per analytical calculation



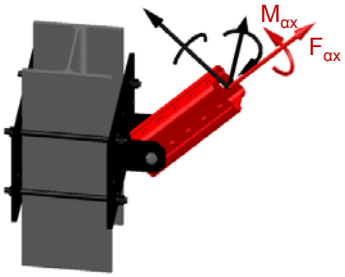
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
325.83	325.83	11.97	11.97	47.45	47.45
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.30	2.30	0.00	0.00	0.00	0.00

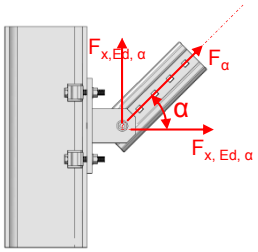
Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt

Interaction:

$$\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}} + \frac{F_{z\,Ed\,\alpha}}{F'_{z\,Rd}} + \frac{F_{y\,Ed}}{F'_{y\,Rd}} + \frac{M_{x\,Ed}}{M'_{x\,Rd}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,Ed,\alpha} = F_{\alpha}$ x cos (α)
$Fz'_{Ed,\alpha} = F_{\alpha}$ x sin (α)
$M'_{x,Ed} = M_{\alpha x}$





Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SA-MAH Base Material Connector - Steel

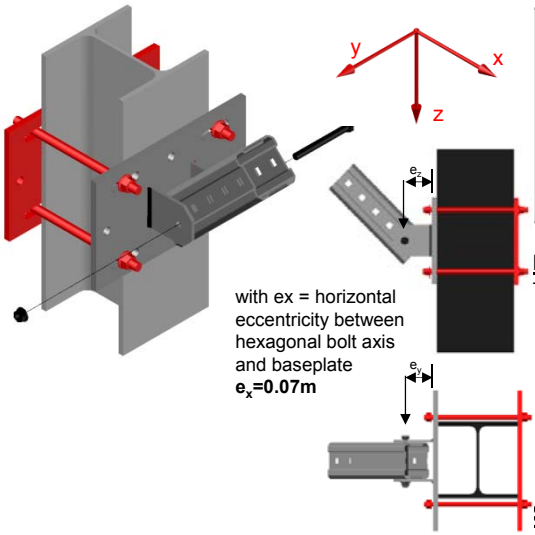
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 4/4

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

3. Base plate and through bolts - per analytical calculation



with ex = horizontal eccentricity between hexagonal bolt axis and baseplate
e_x=0.07m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
164.00	Not decisive	20.66	20.66	20.66	20.66
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.67	1.67	9.84	9.84	6.56	6.56

Normal force interaction:

The eccentricity e_y and e_z between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

$$\frac{F_{x\,Ed,\alpha}}{F'_{x,Rd}} + \frac{F_{y\,Ed}}{M_{z,Rd}} \times ey + \frac{F_{z\,Ed,\alpha}}{M'_{y,Rd}} \times ez + \frac{M_{z\,Ed}}{M'_{z,Rd}} \leq 1$$

with e_y=e_z=0.070 m

Shear force interaction:

Shear force interaction for +Fx (tensile normal force):

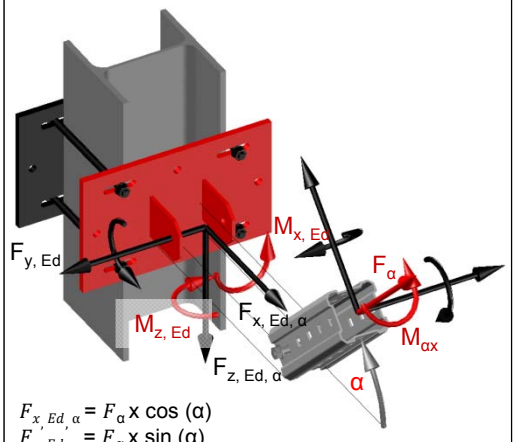
$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z\,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2} + \frac{M_{x\,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)} \leq 1$$

Shear force interaction for -Fx (compressive normal force):

$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd}}\right)^2 + \left(\frac{F_{z\,Ed}}{F_{z,Rd}}\right)^2} + \frac{M_{x\,Ed}}{M_{x,Rd}} \leq 1$$

Note: Due to the fact, that depending on the inclination of the channel, the acting torsional moment Mαx can either generate shear or tension, it will be considered in both interactions.

Transition of the forces generated on inclined brace to base material connector's coordinate system



$F_{x,Ed,\alpha} = F_\alpha$ x cos (α)
$F_{z,Ed,\alpha} = F_\alpha$ x sin (α)

$M_{x,Ed} = M_{\alpha x}$ x cos (α)
$M_{z,Ed} = M_{\alpha x}$ x sin (α)

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

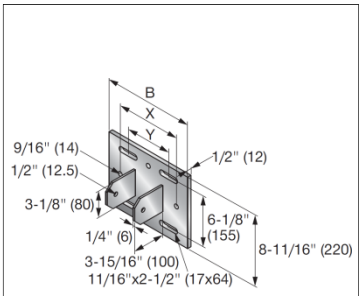
MIC-SB-MAH Base Material Connector - Steel

Designation	Item number
MIC-SB-MAH	**2174672**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**

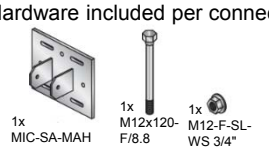
Weight:
8154 g incl. components

Description:
Hilti Hot-dipped galvanized baseplate connector, used for anchoring a MI-90 girder to a steel beam at 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. For use with **M16** hardware.



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

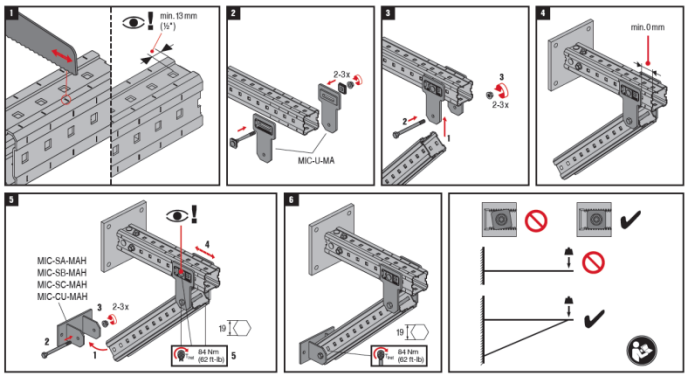
Hardware included per connector



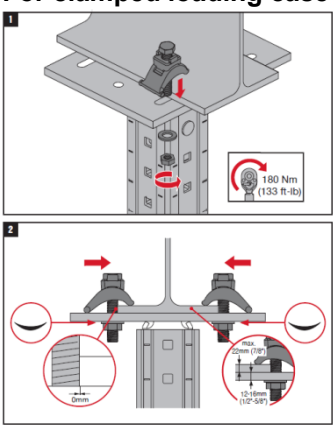
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

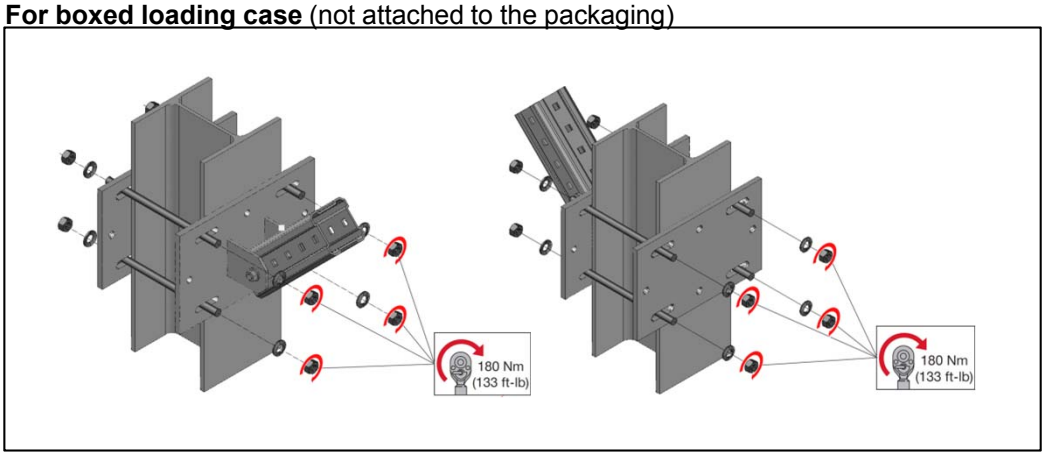
Instruction For Use:

For both loading cases:

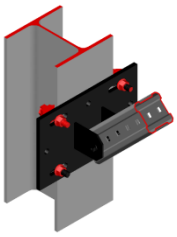
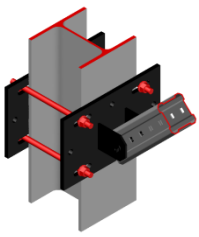


For clamped loading case **For boxed loading case** (not attached to the packaging)





MIC-SB-MAH Base Material Connector - Steel

Possible loading cases		
Clamped	**Boxed**	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

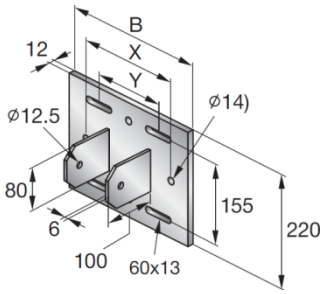
Standards and codes:

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
- Mathcad 15

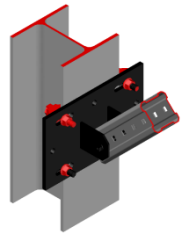
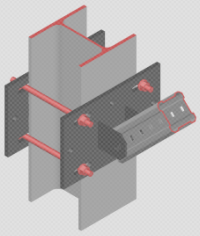
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



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

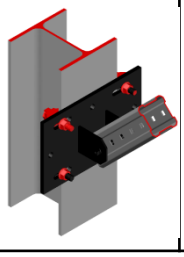
MIC-SB-MAH Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Clamped

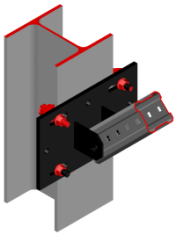
Bill of Material for this loading case:

MIC-SB-MAH **2174672**
Hardware not included in packaging:
Beam clamps
4x MI-SGC M16 **387398**



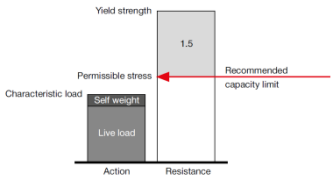
Combinations covered by loading case

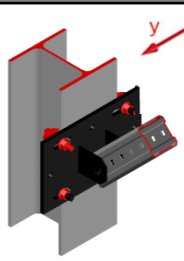
Connector used for
an angled connection
of MI-90 to
structural steel profiles
(bracing).
For flange width 165-235mm.

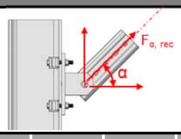


Recommended loading capacity - simplified for most common applications

Method







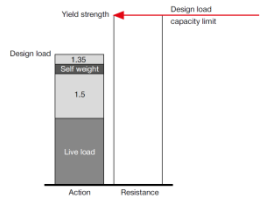
±Fy,rec. [kN]
4.40

α	0°	30°	45°	60°	90°
$\pm F_{\alpha,rec.}$ [kN]	11.13	7.50	8.83	7.94	6.87

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

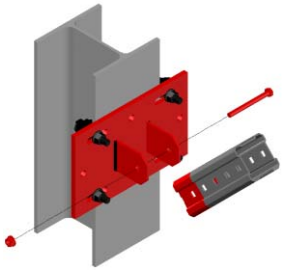
Design loading capacity - 3D 1/4

Method

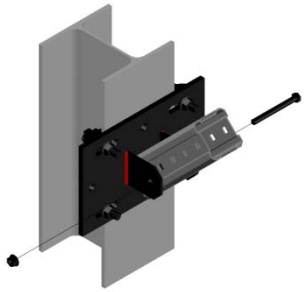


Limiting components of capacity evaluated in following tables:

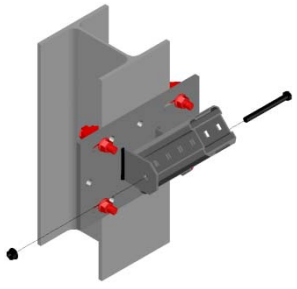
1. Connection system, including connector and hardware, per FEA simulation



2. Welds - per analytical calculation

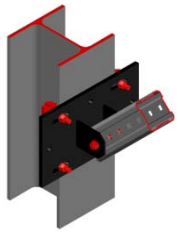
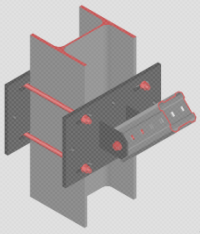


3. Beam Clamps - per analytical calculation



MIC-SB-MAH Base Material Connector - Steel

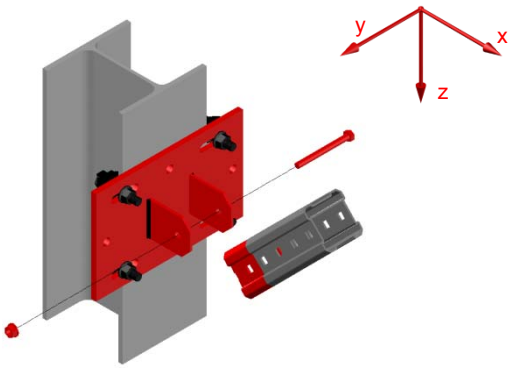
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

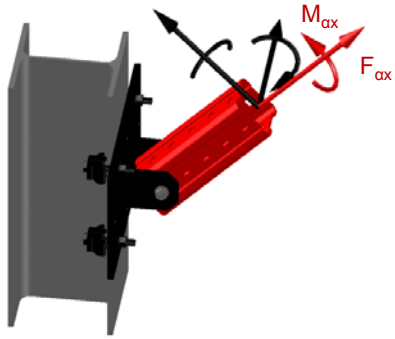
Clamped	Boxed	
		

Design loading capacity - 3D 2/4

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. Connection system, including connector and hardware, per FEA simulation





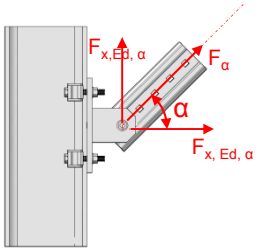
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
16.70	16.70	6.60	6.60	16.70	16.70
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.70	0.70	0.00	0.00	0.00	0.00

Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt

Interaction:
Due to the fact, that the same resistance values as for MIC-CU-MA are decisive, the same interaction formulation can be used:

$$\left(\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}}\right)^2 + \left(\frac{F_{z\,Ed\,\alpha}}{F'_{z\,Rd}}\right)^2 + \frac{F_{y\,Ed}}{F'_{y\,Rd}} + \frac{M_{x\,Ed}}{M'_{x\,Rd}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,\,Ed,\,\alpha} = F_\alpha$ x cos (α)
$Fz'_{,\,Ed,\,\alpha} = F_\alpha$ x sin (α)



Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SB-MAH Base Material Connector - Steel

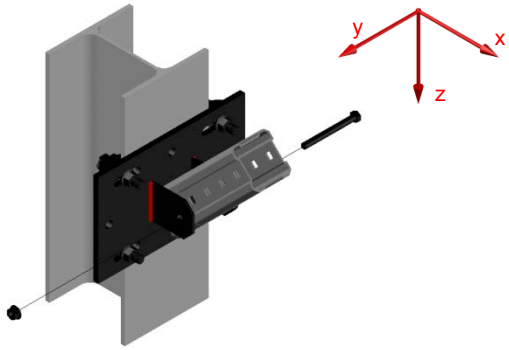
Validity:

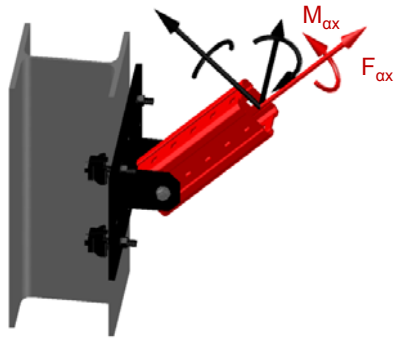
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 3/4

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

2. Welds - per analytical calculation





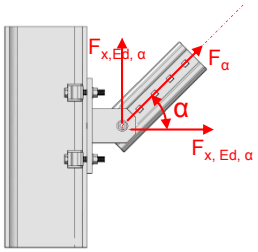
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
325.83	325.83	11.97	11.97	47.45	47.45
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.30	2.30	0.00	0.00	0.00	0.00

Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt

Interaction:

$$\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}} + \frac{F_{z\,Ed\,\alpha}}{F'_{z\,Rd}} + \frac{F_{y\,Ed}}{F'_{y\,Rd}} + \frac{M_{x\,Ed}}{M'_{x\,Rd}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,Ed,\alpha}$ = F_α x cos (α)
$Fz'_{Ed,\alpha}$ = F_α x sin (α)
$M'_{x,Ed} = M_{\alpha x}$



Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SB-MAH Base Material Connector - Steel

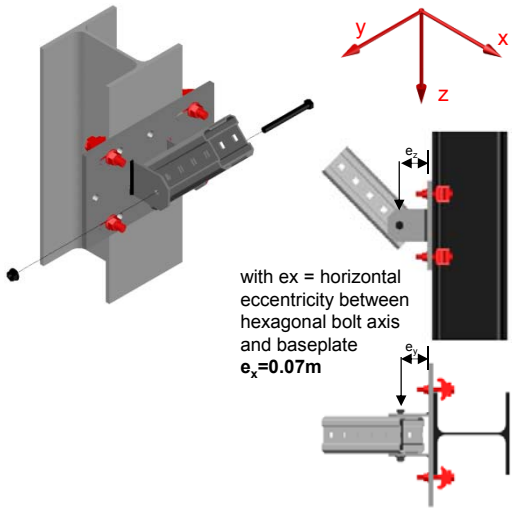
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 4/4

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

3. Beam Clamps - per analytical calculation



with ex = horizontal eccentricity between hexagonal bolt axis and baseplate
e_x=0.07m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.12	1.12	6.66	6.66	6.66	6.66

Normal force interaction:

The eccentricity e_y and e_z between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

$$\frac{F_{x\,Ed,\alpha}}{F'_{x,Rd}} + \frac{F_{y,Ed} \times ey}{M_{z,Rd}} + \frac{F_{z,Ed,\alpha} \times ez}{M'_{y,Rd}} + \frac{M_{z,Ed}}{M'_{z,Rd}} \leq 1$$

with e_y=e_z=0.070 m

Shear force interaction:

Shear force interaction for +Fx (tensile normal force):

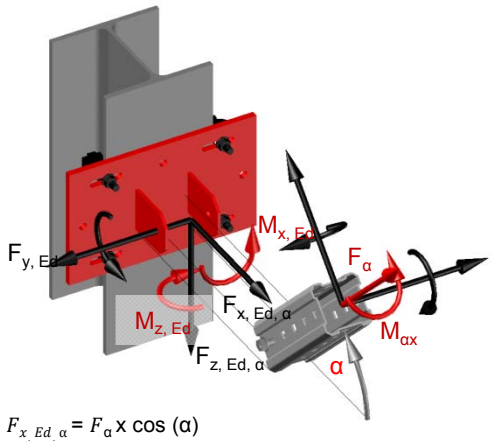
$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z\,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2} + \frac{M_{x\,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)} \leq 1$$

Shear force interaction for -Fx (compressive normal force):

$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd}}\right)^2 + \left(\frac{F_{z\,Ed}}{F_{z,Rd}}\right)^2} + \frac{M_{x\,Ed}}{M_{x,Rd}} \leq 1$$

Note: Due to the fact, that depending on the inclination of the channel, the acting torsional moment Mαx can either generate shear or tension, it will be considered in both interactions.

Transition of the forces generated on inclined brace to base material connector's coordinate system

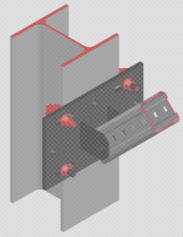
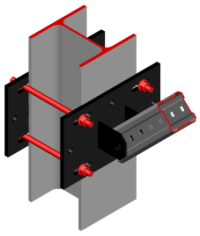


$F_{x,Ed,\alpha} = F_\alpha$ x cos (α)
$F_{z,Ed,\alpha} = F_\alpha$ x sin (α)

$M_{x,Ed} = M_{\alpha x}$ x cos (α)
$M_{z,Ed} = M_{\alpha x}$ x sin (α)

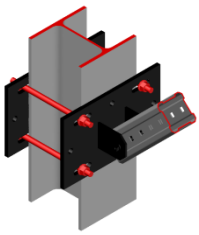
Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SB-MAH Base Material Connector - Steel

Clamped	Boxed	
		

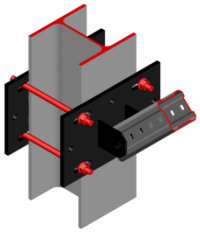
Loading case: Boxed

Bill of Material for this loading case:
1x MIC-SB-MAH 2174672
Hardware not included in packaging:
Base plate
1x MIB-SBH 2174675
Threaded rods cut to particular length
4x AM16x1000 8.8 HDG…m 419104
Lock washer
8x LW M16 HDG plus washer 2185343
Nut
8x M16-F nut 304767



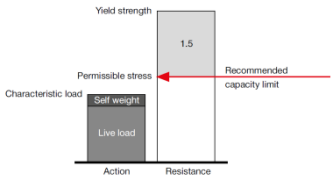
Combinations covered by loading case

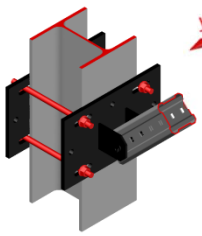
Connector used for an angled connection of MI-90 to structural steel profiles (bracing).
For flange width 165-235mm.

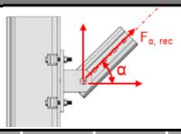


Recommended loading capacity - simplified for most common applications

Method







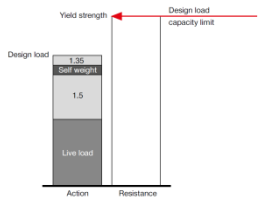
±Fy,rec. [kN]
4.40

α	0°	30°	45°	60°	90°
±$F_{α,rec.}$ [kN]	11.13	11.13	11.13	11.13	11.13

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

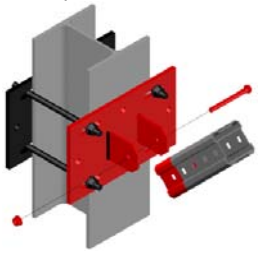
Design loading capacity - 3D 1/4

Method

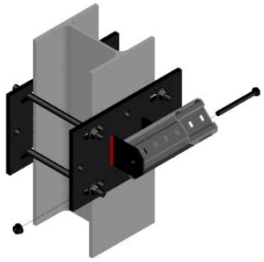


Limiting components of capacity evaluated in following tables:

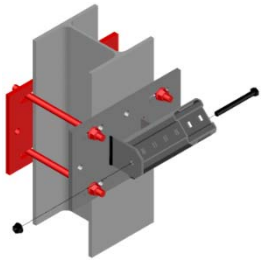
1. Connection system, including connector and hardware, per FEA simulation



2. Welds - per analytical calculation

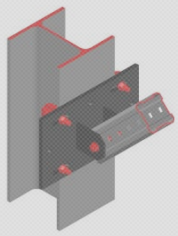
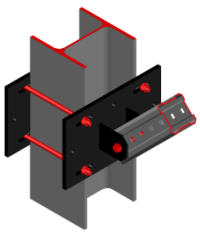


3. Base plate and through bolts - per analytical calculation



MIC-SB-MAH Base Material Connector - Steel

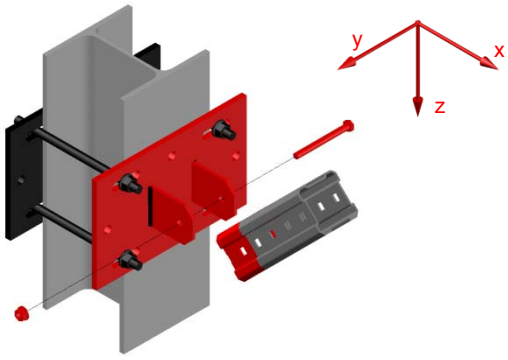
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 2/4

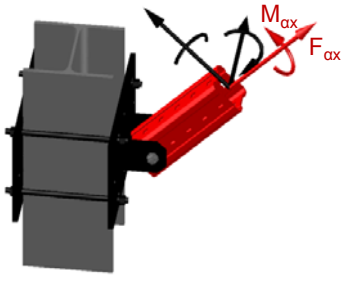
Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Connection system, including connector and hardware, per FEA simulation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
16.70	16.70	6.60	6.60	16.70	16.70
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.70	0.70	0.00	0.00	0.00	0.00

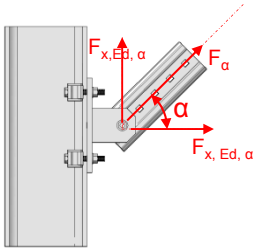
Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt



Interaction:
Due to the fact, that the same resistance values as for MIC-CU-MA are decisive, the same interaction formulation can be used:

$$\left(\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}}\right)^2 + \left(\frac{F_{z\,Ed\,\alpha}}{F'_{z\,Rd}}\right)^2 + \frac{F_{y\,Ed}}{F'_{y\,Rd}} + \frac{M_{x\,Ed}}{M'_{x\,Rd}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,Ed,\alpha} = F_\alpha \times \cos(\alpha)$
$Fz'_{,Ed,\alpha} = F_\alpha \times \sin(\alpha)$



Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SB-MAH Base Material Connector - Steel

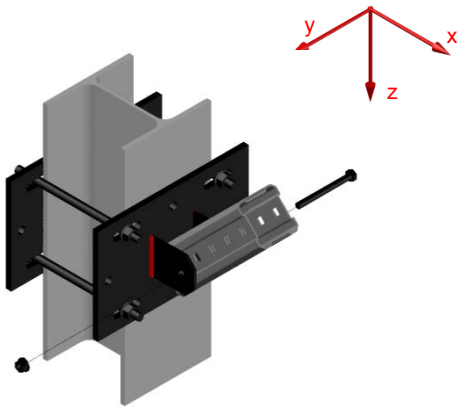
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 3/4

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

2. Welds - per analytical calculation



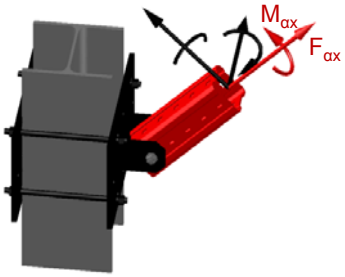
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
325.83	325.83	11.97	11.97	47.45	47.45
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.30	2.30	0.00	0.00	15.80	153.80

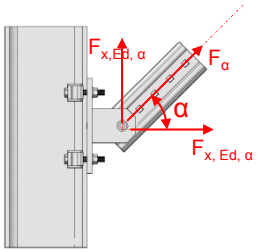
Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt

Interaction:

$$\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}} + \frac{F_{z\,Ed\,\alpha}}{F'_{z\,Rd}} + \frac{F_{y\,Ed}}{F'_{y\,Rd}} + \frac{M_{x\,Ed}}{M'_{x\,Rd}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,Ed,\alpha} = F_{\alpha}$ x cos (α)
$Fz_{Ed,\alpha} = F_{\alpha}$ x sin (α)
$M'_{x,Ed} = M_{\alpha x}$





Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SB-MAH Base Material Connector - Steel

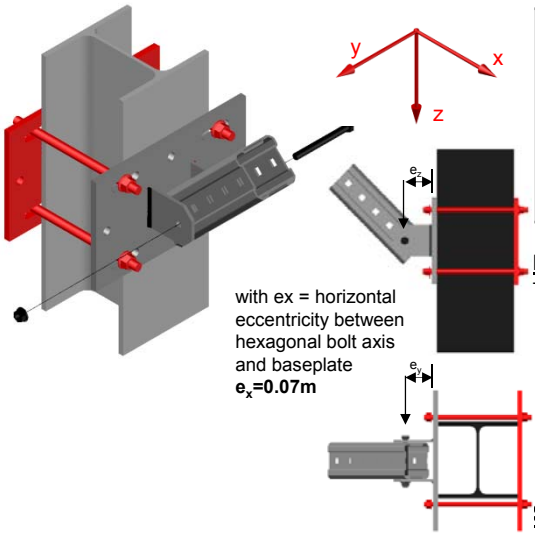
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 4/4

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

3. Base plate and through bolts - per analytical calculation



with ex = horizontal eccentricity between hexagonal bolt axis and baseplate
e_x=0.07m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
158.80	Not decisive	20.01	20.01	20.01	20.01
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
2.06	2.06	9.53	9.53	10.32	10.32

Normal force interaction:

The eccentricity e_y and e_z between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

$$\frac{F_{x\,Ed\,\alpha}}{F'_{x,Rd}} + \frac{F_{y\,Ed}}{M_{z,Rd}} \times ey + \frac{F_{z\,Ed\,\alpha}}{M'_{y,Rd}} \times ez + \frac{M_{z\,Ed}}{M'_{z,Rd}} \leq 1$$

with e_y=e_z=0.070 m

Shear force interaction:

Shear force interaction for +Fx (tensile normal force):

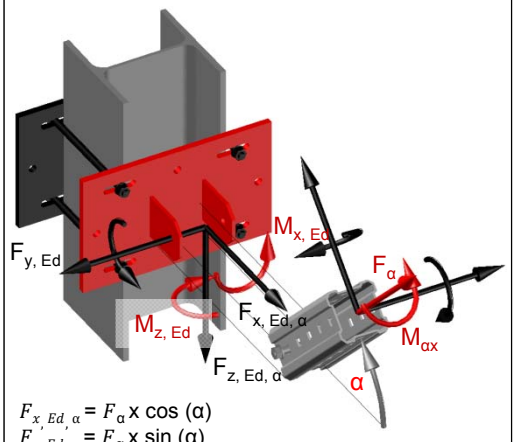
$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z\,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2} + \frac{M_{x\,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)} \leq 1$$

Shear force interaction for -Fx (compressive normal force):

$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd}}\right)^2 + \left(\frac{F_{z\,Ed}}{F_{z,Rd}}\right)^2} + \frac{M_{x\,Ed}}{M_{x,Rd}} \leq 1$$

Note: Due to the fact, that depending on the inclination of the channel, the acting torsional moment Mαx can either generate shear or tension, it will be considered in both interactions.

Transition of the forces generated on inclined brace to base material connector's coordinate system



$F_{x,Ed,\alpha} = F_\alpha \times \cos(\alpha)$
$F_{z,Ed,\alpha} = F_\alpha \times \sin(\alpha)$

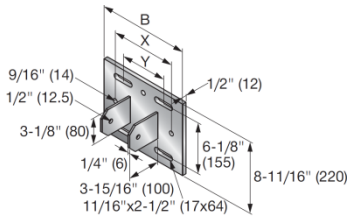
$M_{x,Ed} = M_{\alpha x} \times \cos(\alpha)$
$M_{z,Ed} = M_{\alpha x} \times \sin(\alpha)$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SC-MAH Base Material Connector - Steel

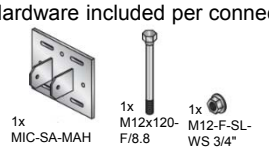
Designation	Item number
MIC-SC-MAH	**2174673**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Connector, Plate	**ISO 1461**	**55**
Bolt; Nut	**ISO 1461**	**40; 45**



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

Hardware included per connector



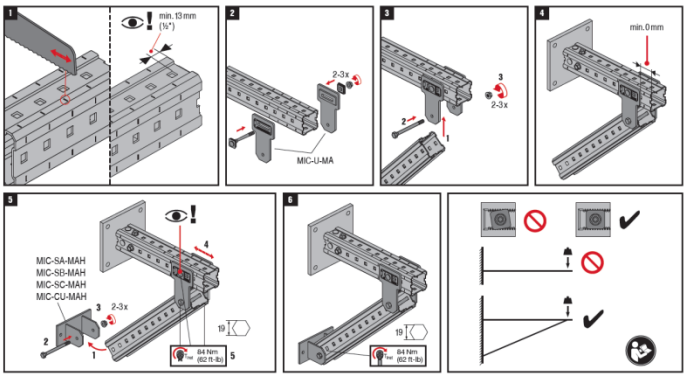
Weight:
8154 g incl. components

Description:
Hilti Hot-dipped galvanized baseplate connector, used for anchoring a MI-90 girder to a steel beam at 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. For use with **M16** hardware.

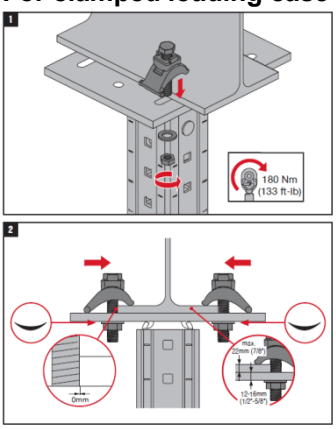
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Connector, Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

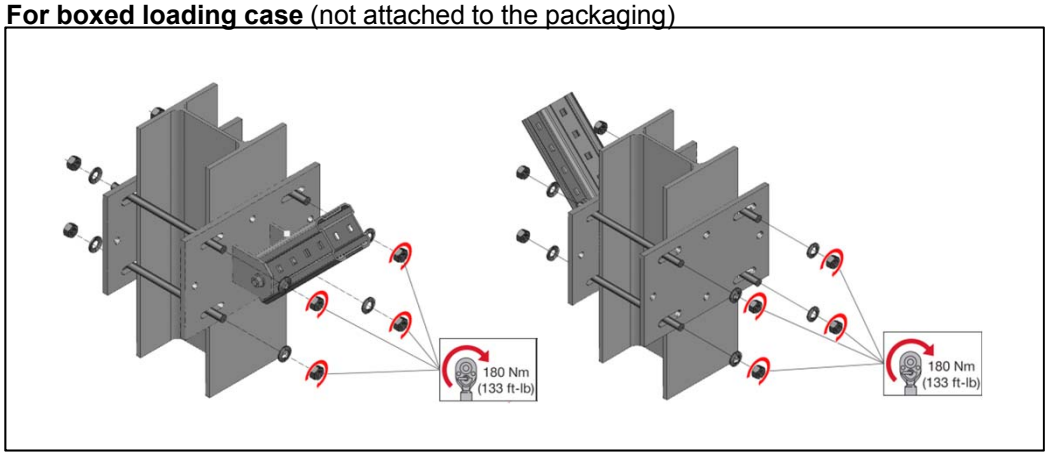
Instruction For Use:

For both loading cases:

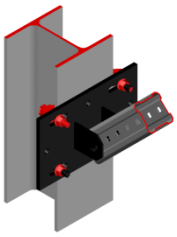
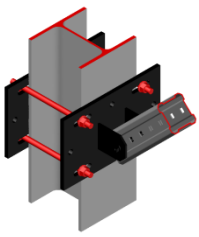


For clamped loading case **For boxed loading case** (not attached to the packaging)





MIC-SC-MAH Base Material Connector - Steel

Possible loading cases		
Clamped	**Boxed**	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

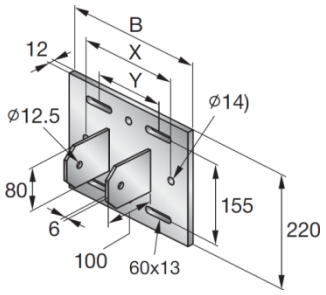
Standards and codes:

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
- Mathcad 15

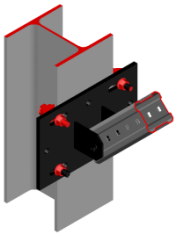
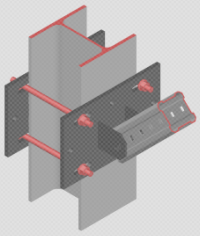
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



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

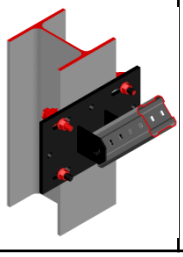
MIC-SC-MAH Base Material Connector - Steel

Clamped	Boxed	
		

Loading case: Clamped

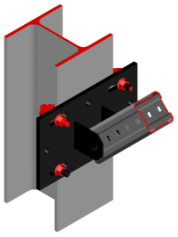
Bill of Material for this loading case:

MIC-SC-MAH **2174673**
Hardware not included in packaging:
Beam clamps
4x MI-SGC M16 **387398**



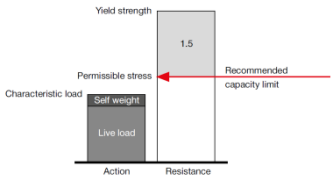
Combinations covered by loading case

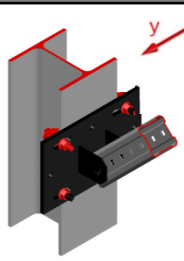
Connector used for
an angled connection
of MI-90 to
structural steel profiles
(bracing).
For flange width 235-300mm.

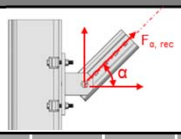


Recommended loading capacity - simplified for most common applications

Method







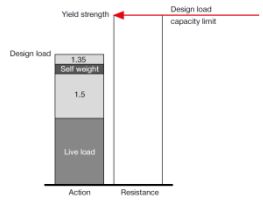
±Fy,rec. [kN]
4.40

α	0°	30°	45°	60°	90°
$\pm F_{\alpha,rec.}$ [kN]	11.13	7.50	8.83	7.94	6.87

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

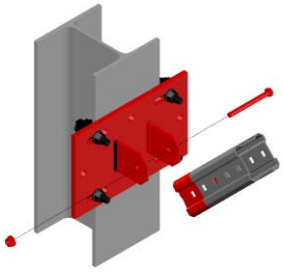
Design loading capacity - 3D 1/4

Method

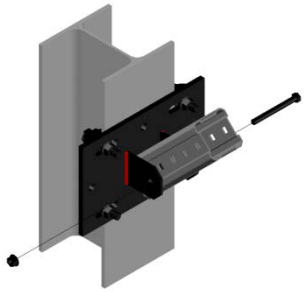


Limiting components of capacity evaluated in following tables:

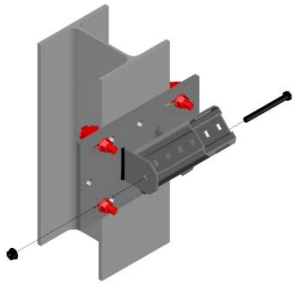
1. Connection system, including connector and hardware, per FEA simulation



2. Welds - per analytical calculation

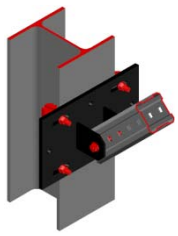
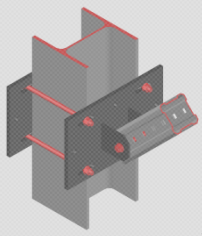


3. Beam Clamps - per analytical calculation



MIC-SC-MAH Base Material Connector - Steel

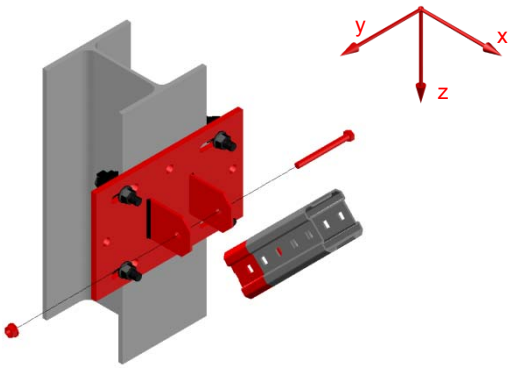
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

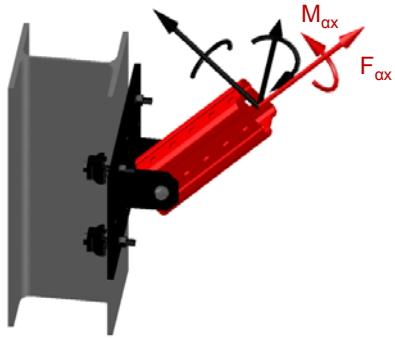
Clamped	Boxed	
		

Design loading capacity - 3D 2/4

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. Connection system, including connector and hardware, per FEA simulation





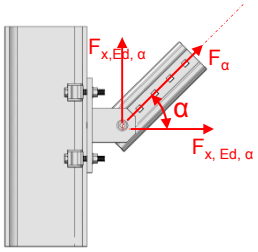
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
16.70	16.70	6.60	6.60	16.70	16.70
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.70	0.70	0.00	0.00	0.00	0.00

Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt

Interaction:
Due to the fact, that the same resistance values as for MIC-CU-MA are decisive, the same interaction formulation can be used:

$$\left(\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}}\right)^2 + \left(\frac{F_{z\,Ed\,\alpha}}{F'_{z\,Rd}}\right)^2 + \frac{F_{y\,Ed}}{F'_{y\,Rd}} + \frac{M_{x\,Ed}}{M'_{x\,Rd}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,\,Ed,\,\alpha} = F_{\alpha}$ x cos (α)
$Fz'_{,\,Ed,\,\alpha} = F_{\alpha}$ x sin (α)



Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SC-MAH Base Material Connector - Steel

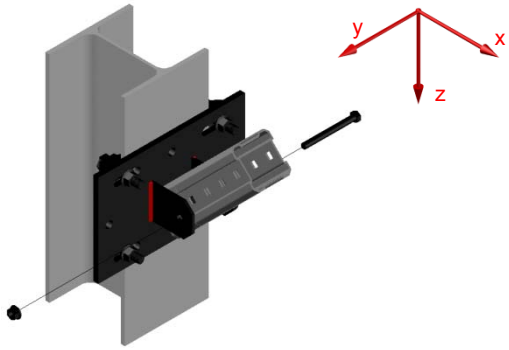
Validity:

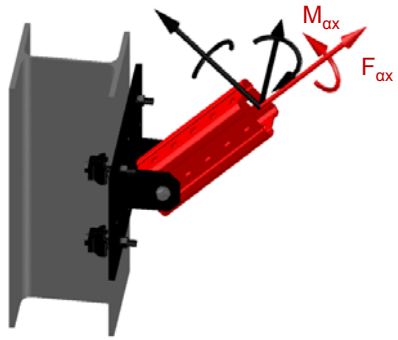
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 3/4

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

2. Welds - per analytical calculation





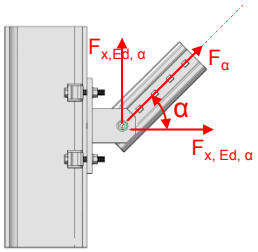
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
325.83	325.83	11.97	11.97	47.45	47.45
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.30	2.30	0.00	0.00	15.80	15.80

Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt

Interaction:

$$\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}} + \frac{F_{z\,Ed\,\alpha}}{F'_{z\,Rd}} + \frac{F_{y\,Ed}}{F'_{y\,Rd}} + \frac{M_{x\,Ed}}{M'_{x\,Rd}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,Ed,\alpha}$ = F_{α} x cos (α)
$Fz'_{Ed,\alpha}$ = F_{α} x sin (α)
$M'_{x,Ed} = M_{\alpha x}$



Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SC-MAH Base Material Connector - Steel

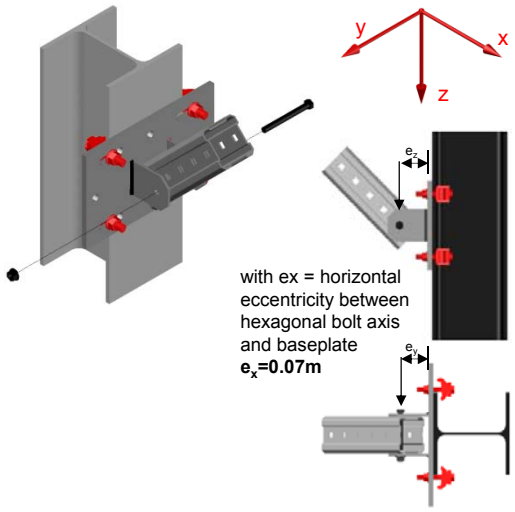
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 4/4

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

3. Beam Clamps - per analytical calculation



with ex = horizontal eccentricity between hexagonal bolt axis and baseplate
e_x=0.07m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.41	1.41	6.66	6.66	8.70	8.70

Normal force interaction:

The eccentricity e_y and e_z between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

$$\frac{F_{x\,Ed,\alpha}}{F'_{x,Rd}} + \frac{F_{y\,Ed}}{M_{z,Rd}} \times ey + \frac{F_{z\,Ed,\alpha}}{M'_{y,Rd}} \times ez + \frac{M_{z\,Ed}}{M'_{z,Rd}} \leq 1$$

with e_y=e_z=0.070 m

Shear force interaction:

Shear force interaction for +Fx (tensile normal force):

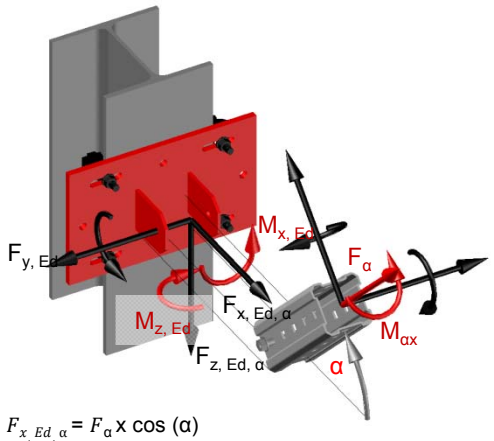
$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z\,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2} + \frac{M_{x\,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x\,Ed}}{F'_{x,Rd}}\right)} \leq 1$$

Shear force interaction for -Fx (compressive normal force):

$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd}}\right)^2 + \left(\frac{F_{z\,Ed}}{F_{z,Rd}}\right)^2} + \frac{M_{x\,Ed}}{M_{x,Rd}} \leq 1$$

Note: Due to the fact, that depending on the inclination of the channel, the acting torsional moment Mαx can either generate shear or tension, it will be considered in both interactions.

Transition of the forces generated on inclined brace to base material connector's coordinate system

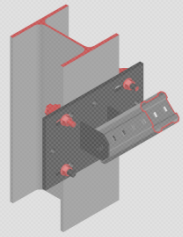
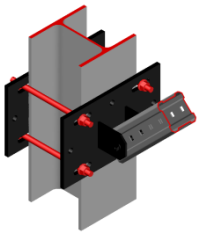


$F_{x,Ed,\alpha} = F_\alpha$ x cos (α)
$F_{z,Ed,\alpha} = F_\alpha$ x sin (α)

$M_{x,Ed} = M_{\alpha x}$ x cos (α)
$M_{z,Ed} = M_{\alpha x}$ x sin (α)

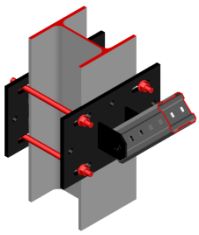
Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SC-MAH Base Material Connector - Steel

Clamped	Boxed	
		

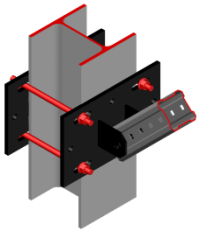
Loading case: Boxed

Bill of Material for this loading case:
1x MIC-SC-MAH 2174673
Hardware not included in packaging:
Base plate
1x MIB-SCH 2174676
Threaded rods cut to particular length
4x AM16x1000 8.8 HDG…m 419104
Lock washer
8x LW M16 HDG plus washer 2185343
Nut
8x M16-F nut 304767



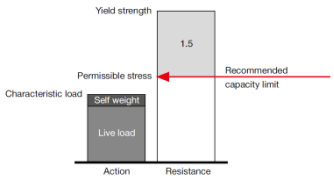
Combinations covered by loading case

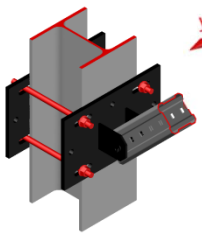
Connector used for an angled connection of MI-90 to structural steel profiles (bracing).
For flange width 235-300mm.

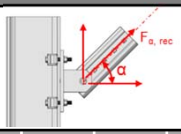


Recommended loading capacity - simplified for most common applications

Method







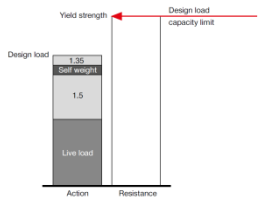
±Fy,rec. [kN]
4.40

α	0°	30°	45°	60°	90°
±$F_{α,rec.}$ [kN]	11.13	11.13	11.13	11.13	11.13

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

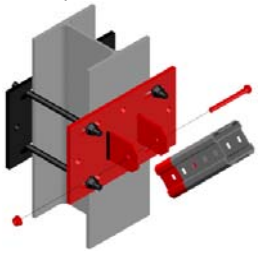
Design loading capacity - 3D 1/4

Method

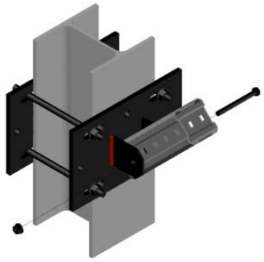


Limiting components of capacity evaluated in following tables:

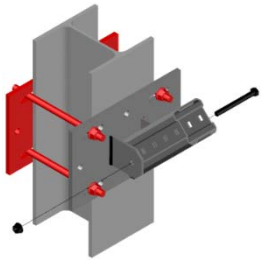
1. Connection system, including connector and hardware, per FEA simulation



2. Welds - per analytical calculation

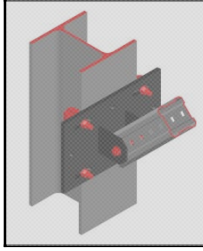
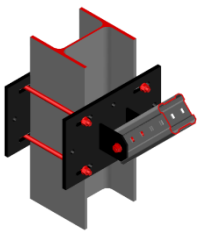


3. Base plate and through bolts - per analytical calculation



MIC-SC-MAH Base Material Connector - Steel

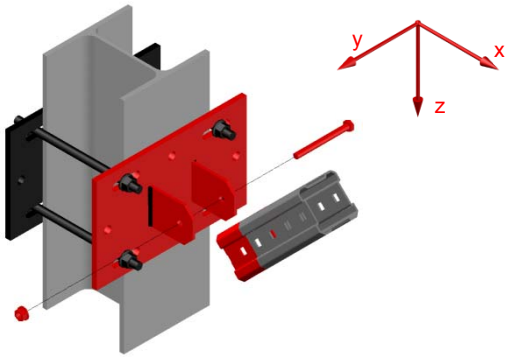
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 2/4

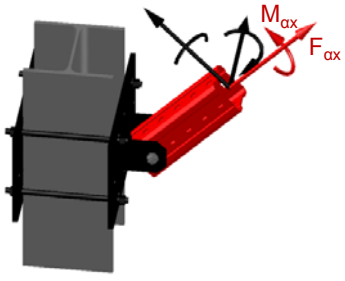
Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Connection system, including connector and hardware, per FEA simulation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
16.70	16.70	6.60	6.60	16.70	16.70
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
0.70	0.70	0.00	0.00	0.00	0.00

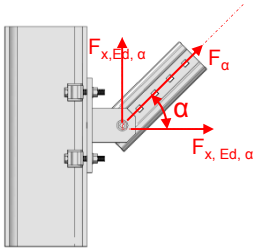
Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt



Interaction:
Due to the fact, that the same resistance values as for MIC-CU-MA are decisive, the same interaction formulation can be used:

$$\left(\frac{F_{x\,Ed\,\alpha}}{F'_{x\,Rd}}\right)^2 + \left(\frac{F_{z\,Ed\,\alpha}}{F'_{z\,Rd}}\right)^2 + \frac{F_{y\,Ed}}{F'_{y\,Rd}} + \frac{M_{x\,Ed}}{M'_{x\,Rd}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,Ed,\alpha} = F_\alpha \times \cos(\alpha)$
$Fz'_{,Ed,\alpha} = F_\alpha \times \sin(\alpha)$



Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SC-MAH Base Material Connector - Steel

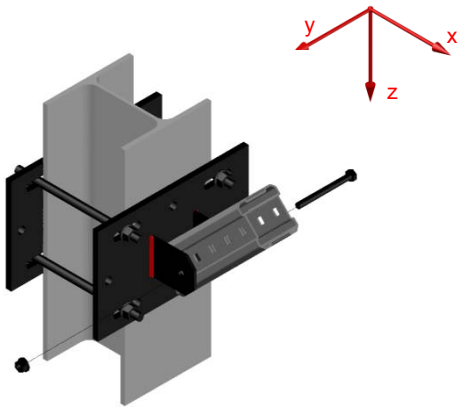
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 3/4

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

2. Welds - per analytical calculation

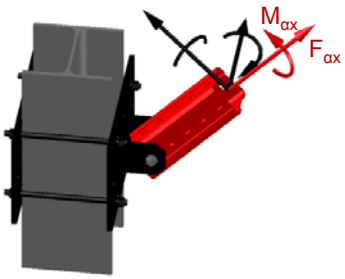


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
325.83	325.83	11.97	11.97	47.45	47.45
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.30	2.30	0.00	0.00	15.80	15.80

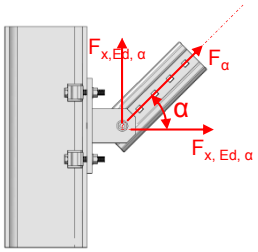
Note: Design Strength values for girder Torsion about the αx-axis ($M_{\alpha x}$) are valid for any bracing angle.
Values include verification of hexagonal bolt

Interaction:

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



Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:
$F_{x,Ed,\alpha} = F_{\alpha}$ x cos (α)
$Fz_{Ed,\alpha} = F_{\alpha}$ x sin (α)
$M'_{x,Ed} = M_{\alpha x}$



Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-SC-MAH Base Material Connector - Steel

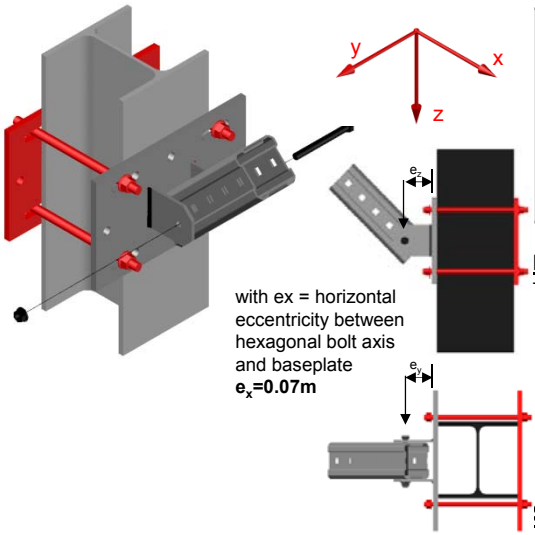
Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Design loading capacity - 3D 4/4

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

3. Base plate and through bolts - per analytical calculation



with ex = horizontal eccentricity between hexagonal bolt axis and baseplate
e_x=0.07m

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
150.80	Not decisive	19.00	19.00	19.00	19.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
2.57	2.57	9.05	9.05	12.82	12.82

Normal force interaction:

The eccentricity e_y and e_z between the point of force transfer channel / connector and baseplate, which generates an additional bending moment on the system , must be taken into account in the interaction formula.

$$\frac{F_{x\,Ed,\alpha}}{F'_{x,Rd}} + \frac{F_{y\,Ed}\times ey}{M_{z,Rd}} + \frac{F_{z\,Ed,\alpha}\times ez}{M'_{y,Rd}} + \frac{M_{z\,Ed}}{M'_{z,Rd}} \le 1$$

with e_y=e_z=0.070 m

Shear force interaction:

Shear force interaction for +Fx (tensile normal force):

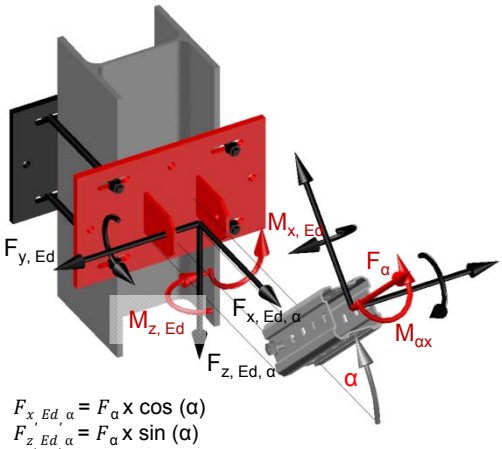
$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd}\times\left(1-\frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2+\left(\frac{F_{z\,Ed}}{F_{z,Rd}\times\left(1-\frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\right)^2}+\frac{M_{x\,Ed}}{M_{x,Rd}\times\left(1-\frac{F_{x\,Ed}}{F'_{x,Rd}}\right)}\le 1$$

Shear force interaction for -Fx (compressive normal force):

$$\sqrt{\left(\frac{F_{y\,Ed}}{F_{y,Rd}}\right)^2+\left(\frac{F_{z\,Ed}}{F_{z,Rd}}\right)^2}+\frac{M_{x\,Ed}}{M_{x,Rd}}\le 1$$

Note: Due to the fact, that depending on the inclination of the channel, the acting torsional moment Mαx can either generate shear or tension, it will be considered in both interactions.

Transition of the forces generated on inclined brace to base material connector's coordinate system



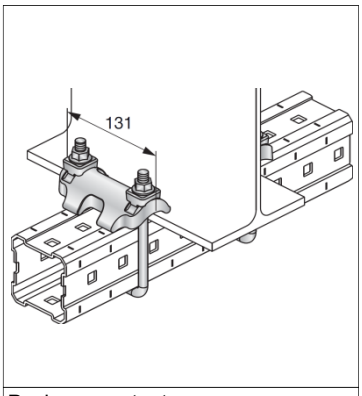
$F_{x,Ed,\alpha} = F_\alpha$ x cos (α)
$F_{z,Ed,\alpha} = F_\alpha$ x sin (α)

$M_{x,Ed} = M_{\alpha x}$ x cos (α)
$M_{z,Ed} = M_{\alpha x}$ x sin (α)

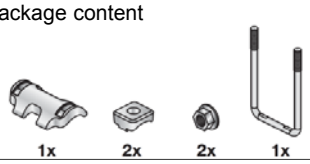
Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MI-DGC 90 Base Material Connector - Steel

Designation	Item number
MI-DGC 90	**233860**



Package content



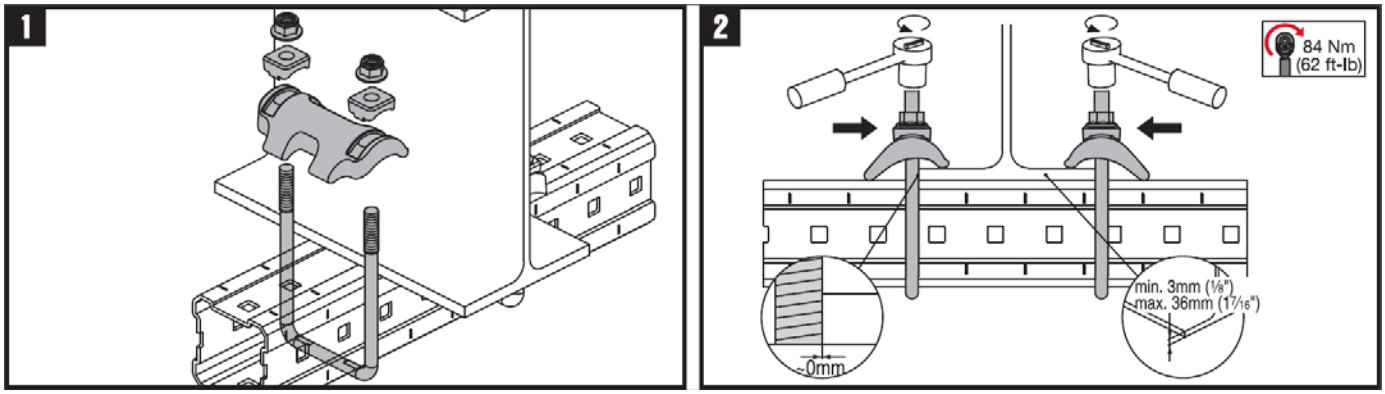
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Bolt; Nut	**ISO 1461**	**40; 45**
Clamp	**ISO 1461**	**55**
Beam Clamp U-bolt	**ASTM A153**	**56**

Weight:
1015.6 g incl. components

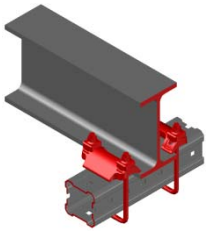
Submittal text:
Hilti Hot-dipped galvanized steel beam clamp, typically used to connect a horizontal MI-90 or MIQ-90 girder to steel beam. Two U-bolts carry the girder and are connected to the clamp with saddles and nuts.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Clamp EN-GJMB-450-6 (DIN EN 1562)	$f_y = 270 \frac{N}{mm^2}$	$f_u = 450 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Beam Clamp U-bolt 41Cr4 (DIN EN 10083-3 2007.1)	$f_y = 800 \frac{N}{mm^2}$	$f_u = 1000 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MI-DGC 90 Base Material Connector - Steel

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation
- Hardware tests

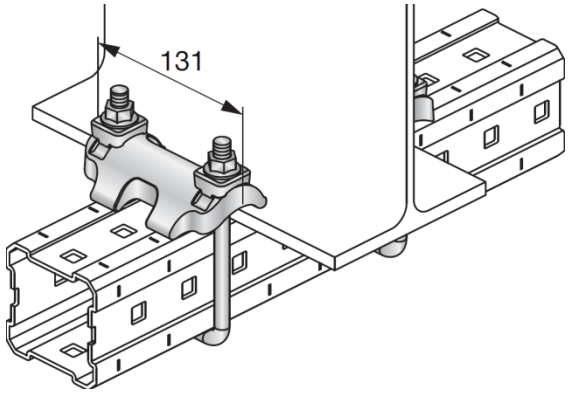
Standards and codes:

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

Software:
- Mathcad 15.0
- Microsoft Excel

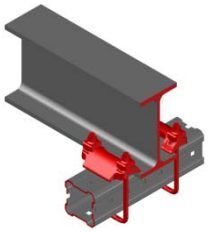
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



MI-DGC 90 Base Material Connector - Steel

Standard

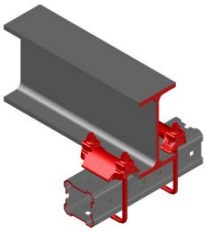


Loading case: Standard

BOM:

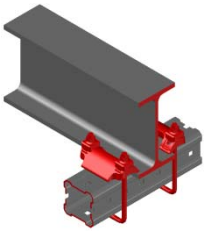
Connector incl. all associated components
MI-DGC 90 **233860**

Associated MI System girders (channels)
MI-90 3m **304799**
MI-90 6m **304798**



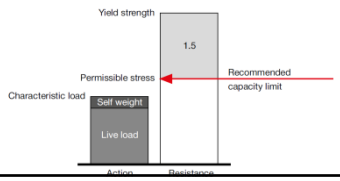
Combinations covered by loading case

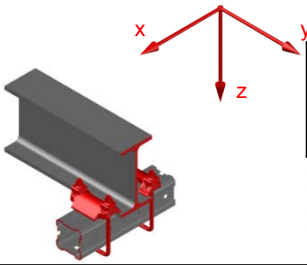
Connector used for horizontal connection of MI-90 or MIQ-90 to the flanges of structural steel profiles. Flange thickness 3-36mm.



Recommended loading capacity - simplified for most common applications

Method



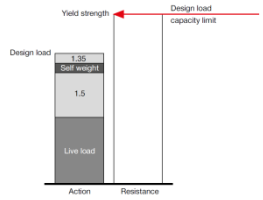


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
6.0	4.0	23.2

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

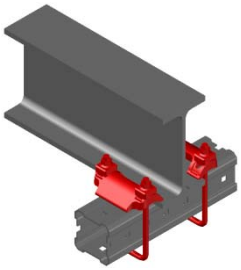
Design loading capacity - 3D 1/2

Method



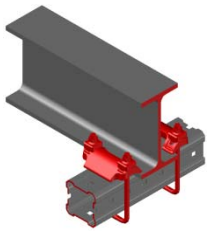
Limiting components of capacity evaluated in following tables:

1. Steel connector



MI-DGC 90 Base Material Connector - Steel

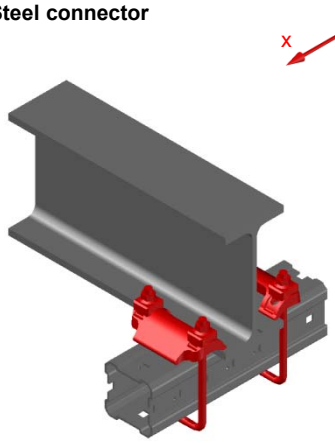
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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



valid only for pairwise use

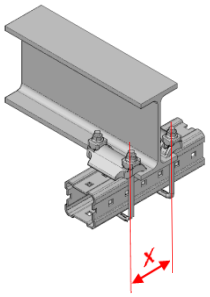
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
8.93	8.93	6.09	6.09	34.80	34.80
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.76	1.76	17.4*x	17.4*x	3.04*x	3.04*x

Interaction:
These values valid only for pairwise use.
for tension forces

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

for shear forces

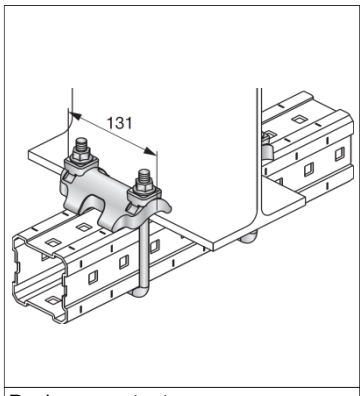
$$\sqrt{\left(\frac{F_{x.Ed}}{F_{x.Rd}}\right)^2 + \left(\frac{F_{y.Ed}}{F_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}}\right)^2} \le 1$$



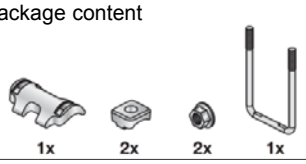
with x [m] = width of flange + 0,012m

MI-DGC 120 Base Material Connector - Steel

Designation	Item number
MI-DGC 120	**233861**



Package content



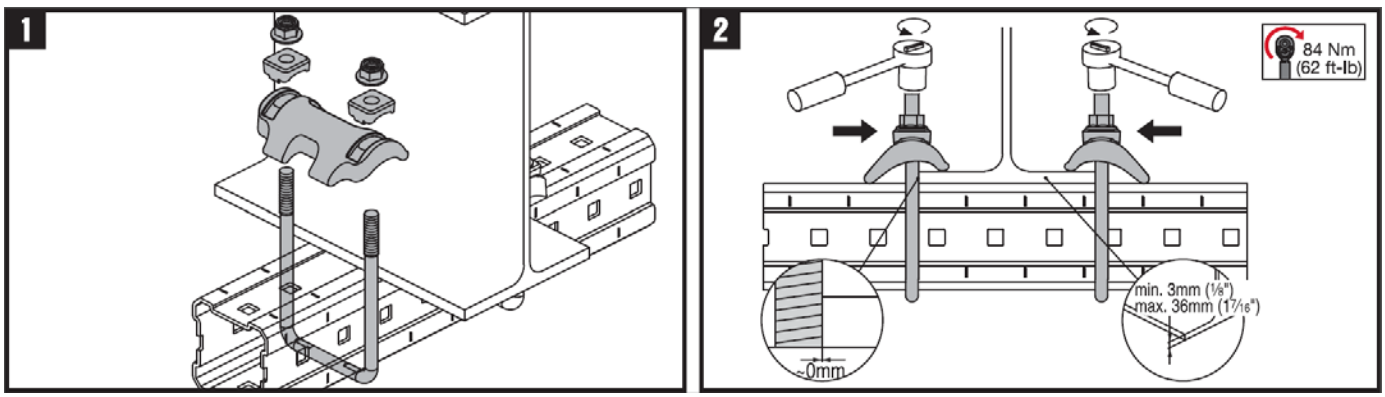
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Bolt; Nut	**ISO 1461**	**40; 45**
Clamp	**ISO 1461**	**55**
Beam Clamp U-bolt	**ASTM A153**	**56**

Weight:
1041.9 g incl. components

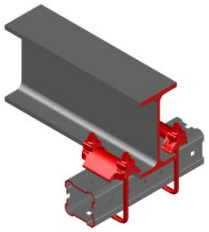
Submittal text:
Hilti Hot-dipped galvanized steel beam clamp, typically used to connect a horizontal MI-120 girder to a steel beam. Two U-bolts carry the girder and are connected to the clamp with saddles and nuts.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Bolt; Nut F Class 8.8 (ISO 898-1); Grade 8 (ISO 898-2)	$f_y = 640 \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Clamp EN-GJMB-450-6 (DIN EN 1562)	$f_y = 270 \frac{N}{mm^2}$	$f_u = 450 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Beam Clamp U-bolt 41Cr4 (DIN EN 10083-3 2007.1)	$f_y = 800 \frac{N}{mm^2}$	$f_u = 1000 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:



MI-DGC 120 Base Material Connector - Steel

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation
- Hardware tests

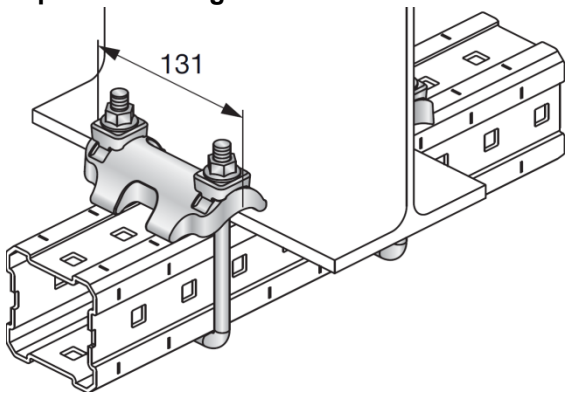
Standards and codes:

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

Software:
- Mathcad 15.0
- Microsoft Excel

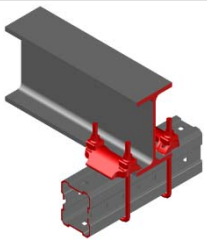
Environmental conditions:
- indoors, outdoors
- static loads
- no fatigue loads

Simplified drawing:



MI-DGC 120 Base Material Connector - Steel

Standard

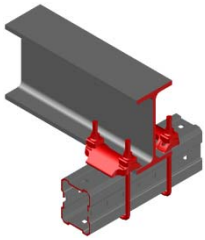


Loading case: Standard

BOM:

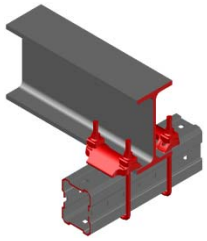
Connector incl. all associated components
MI-DGC 120 **233861**

Associated MI System girders (channels)
MI-120 3m **304800**
MI-120 6m **304801**



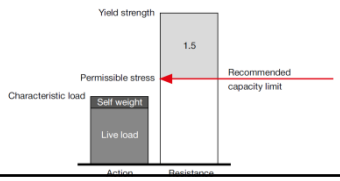
Combinations covered by loading case

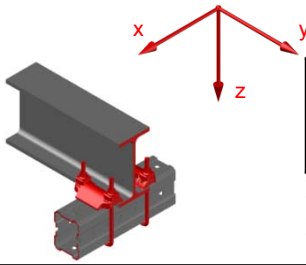
Connector used for horizontal connection of MI-120 to the flanges of structural steel profiles. Flange thickness 3-36mm.



Recommended loading capacity - simplified for most common applications

Method



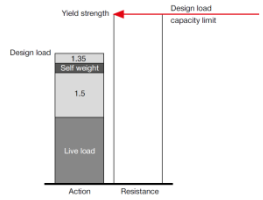


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
8.0	4.0	23.2

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

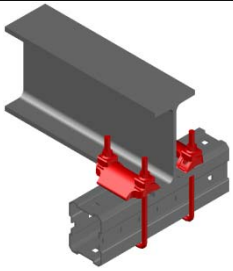
Design loading capacity - 3D 1/2

Method



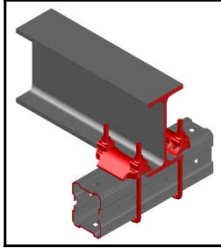
Limiting components of capacity evaluated in following tables:

1. Steel connector



MI-DGC 120 Base Material Connector - Steel

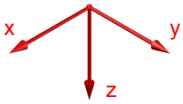
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

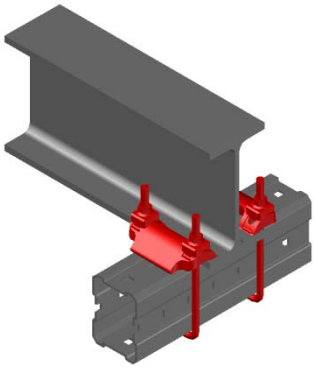
Standard		
		

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





valid only for pairwise use

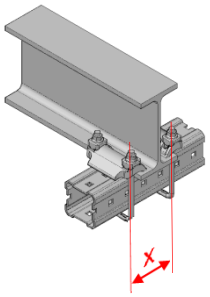
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
8.93	8.93	6.09	6.09	34.80	34.80
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.76	1.76	17.4*x	17.4*x	3.04*x	3.04*x

Interaction:
These values valid only for pairwise use.
for tension forces

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

for shear forces

$$\sqrt{\left(\frac{F_{x.Ed}}{F_{x.Rd}}\right)^2 + \left(\frac{F_{y.Ed}}{F_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}}\right)^2} \le 1$$



with x [m] = width of flange + 0,012m

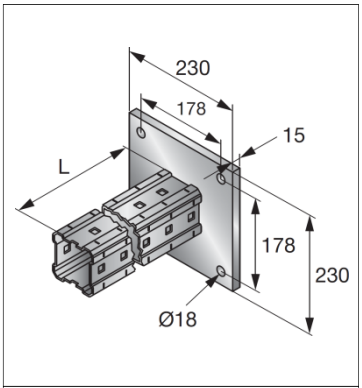
MIC-C90-DH-500-2000 Bracket - Concrete

Designation	Item number
MIC-C90-DH- 500	**2203572**
MIC-C90-DH- 750	**2203573**
MIC-C90-DH-1000	**2203574**
MIC-C90-DH-1500	**2203575**
MIC-C90-DH-2000	**2203576**

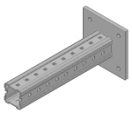
Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Bracket	**ISO 1461**	**55**

Weight:

MIC-C90-DH- 500	11086g
MIC-C90-DH- 750	13473g
MIC-C90-DH-1000	15860g
MIC-C90-DH-1500	20634g
MIC-C90-DH-2000	25407g



Hardware included per connector



Designation	L[mm]
MIC-C90-DH - 500	500
MIC-C90-DH - 750	750
MIC-C90-DH -1000	1000
MIC-C90-DH -1500	1500
MIC-C90-DH -2000	2000

Submittal text:
Hilti Hot-dipped galvanized bracket used as fixed to concrete. Four oblong anchor holes enable fine tuning of baseplate position, and girder is welded on the baseplate.

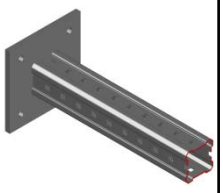
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Girder DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

No IFU attached to the packaging

Respect IFU from the used anchor

MIC-C90-DH-500-2000 Bracket - Concrete

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

Standards and codes:

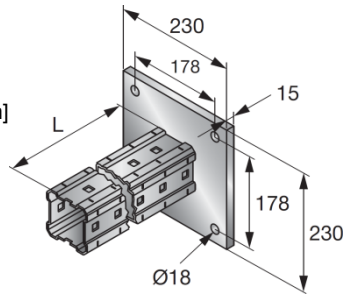
EN 1990	Basics of structural design	03.2003
EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General actions – densities, self-weight, imposed loads for buildings	09.2011
EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings	03.2012
EN 1993-1-3	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
- Mathcad 15

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

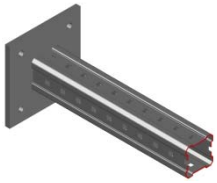
Simplified drawing:

Designation	L[mm]
MIC-C90-DH - 500	500
MIC-C90-DH - 750	750
MIC-C90-DH -1000	1000
MIC-C90-DH -1500	1500
MIC-C90-DH -2000	2000



MIC-C90-DH-500-2000 Bracket - Concrete

Standard



Loading case: Standard

BOM:

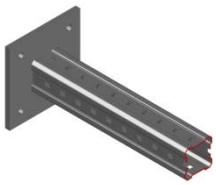
Brackets:

MIC-C90-DH- 500	**2203572**
MIC-C90-DH- 750	**2203573**
MIC-C90-DH-1000	**2203574**
MIC-C90-DH-1500	**2203575**
MIC-C90-DH-2000	**2203576**

Associated anchors*
for cracked concrete

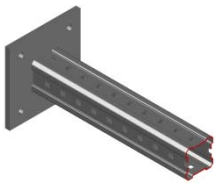
4x HST3 M16x135 35/15	**2105858**

*Anchors not incl. in capacity limits



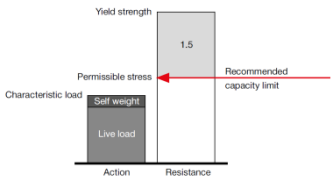
Combinations covered by loading case

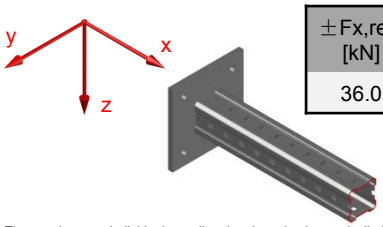
Pre-fab bracket for perpendicular connection to concrete.



Recommended loading capacity - simplified for most common applications

Method





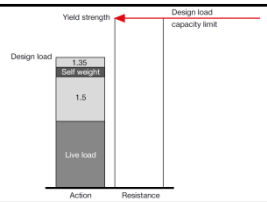
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
36.0	38.13	38.13

±My,rec. [kNm]
4.13

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

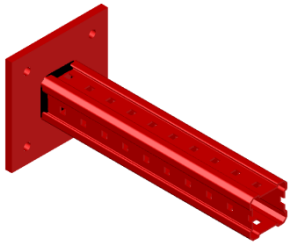
Design loading capacity - 3D 1/2

Method

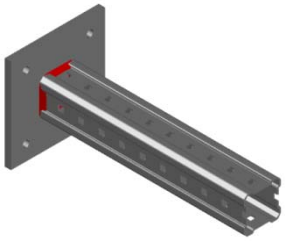


Limiting components of capacity evaluated in following tables:

1. Base plate and profile of MI-90 girder, per FEA simulation

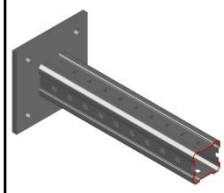


2. Welds – per analytical calculation



MIC-C90-DH-500-2000 Bracket - Concrete

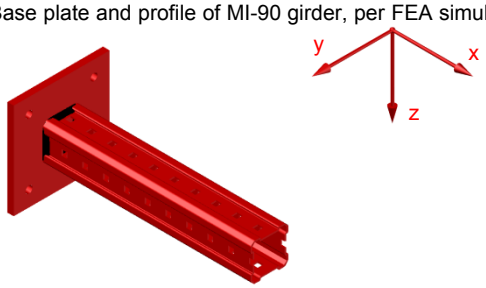
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Base plate and profile of MI-90 girder, per FEA simulation

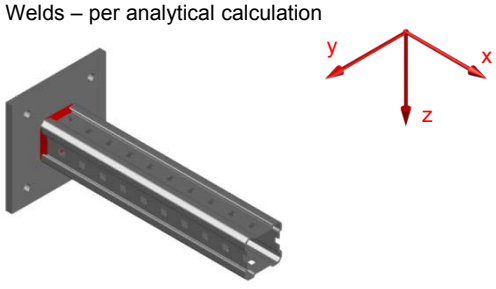


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
116.60	101.54	57.20	57.20	57.20	57.20
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
4.50	4.50	6.20	6.20	6.20	6.20

includes cross section resistance of steel base plate and channel
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. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
285.11	285.11	116.39	116.39	116.39	116.39
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
9.54	9.54	6.84	6.84	6.84	6.84

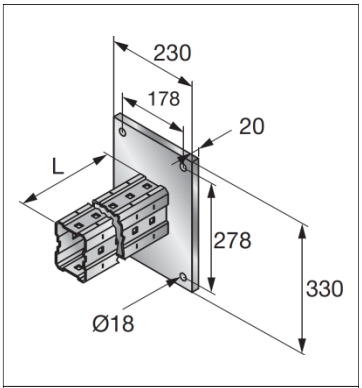
Interaction:

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

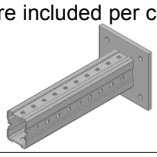
MIC-C120-DH-500-2000 Bracket - Concrete

Designation	Item number
MIC-C120-DH- 500	**2203577**
MIC-C120-DH- 750	**2203578**
MIC-C120-DH-1000	**2203579**
MIC-C120-DH-1500	**2203580**
MIC-C120-DH-2000	**2203581**

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Bracket	**ISO 1461**	**55**



Hardware included per connector



Designation	L[mm]
MIC-C120-DH- 500	500
MIC-C120-DH- 750	750
MIC-C120-DH-1000	1000
MIC-C120-DH-1500	1500
MIC-C120-DH-2000	2000

Weight:

MIC-C120-DH- 500	18528g
MIC-C120-DH- 750	21715g
MIC-C120-DH-1000	24903g
MIC-C120-DH-1500	31278g
MIC-C120-DH-2000	37653g

Submittal text:

Hilti Hot-dipped galvanized bracket used as fixed to concrete. Four oblong anchor holes enable fine tuning of baseplate position, and girder is welded on the baseplate.

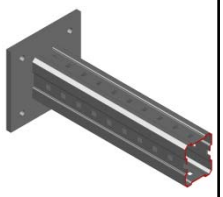
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Girder DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

No IFU attached to the packaging

Respect IFU from the used anchor

MIC-C120-DH-500-2000 Bracket - Concrete

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

Standards and codes:

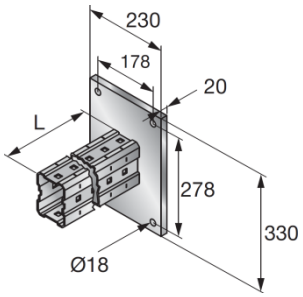
EN 1990	Basics of structural design	03.2003
EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General actions – densities, self-weight, imposed loads for buildings	09.2011
EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings	03.2012
EN 1993-1-3	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
- Mathcad 15

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

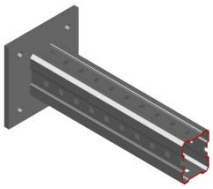
Simplified drawing:

Designation	L[mm]
MIC-C120-DH- 500	500
MIC-C120-DH- 750	750
MIC-C120-DH-1000	1000
MIC-C120-DH-1500	1500
MIC-C120-DH-2000	2000



MIC-C120-DH-500-2000 Bracket - Concrete

Standard



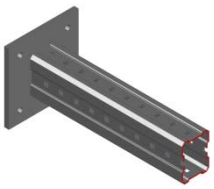
Loading case: Standard

BOM:

Brackets:

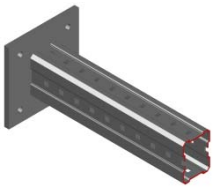
MIC-C120-DH- 500	**2203577**
MIC-C120-DH- 750	**2203578**
MIC-C120-DH-1000	**2203579**
MIC-C120-DH-1500	**2203580**
MIC-C120-DH-2000	**2203581**

Associated anchors*
for cracked concrete
4x HST3 M16x135 35/15 **2105858**
*Anchors not incl. in capacity limits



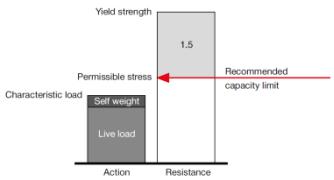
Combinations covered by loading case

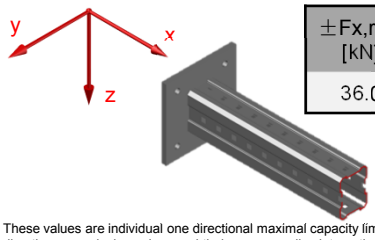
Pre-fab bracket for perpendicular connection to concrete.



Recommended loading capacity - simplified for most common applications

Method





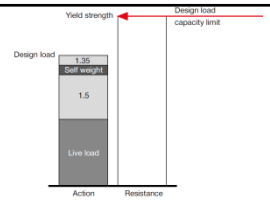
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
36.0	41.73	63.2

±My,rec. [kNm]
4.23

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

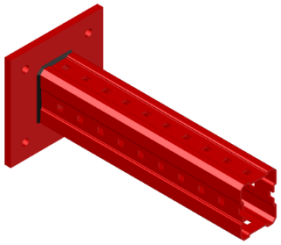
Design loading capacity - 3D 1/2

Method

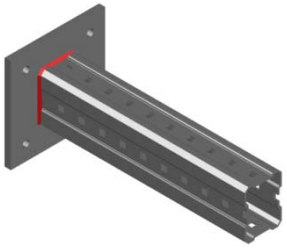


Limiting components of capacity evaluated in following tables:

1. Base plate and profile of MI-120 girder, per FEA simulation

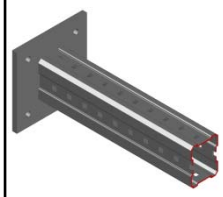


2. Welds – per analytical calculation



MIC-C120-DH-500-2000 Bracket - Concrete

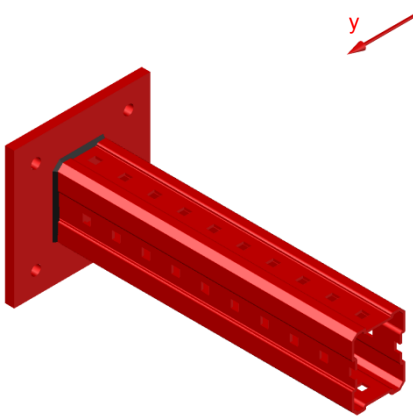
Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Base plate and profile of MI-120 girder, per FEA simulation

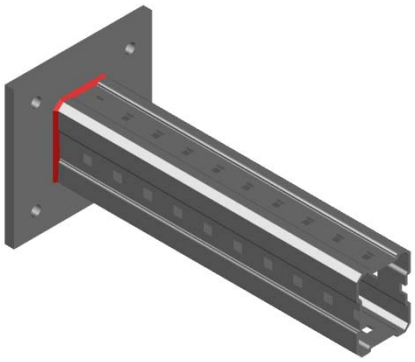


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
132.00	132.97	62.60	62.60	94.80	94.80
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
6.80	6.80	10.00	10.00	8.72	8.72

includes cross section resistance of steel base plate and channel
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. Welds – per analytical calculation



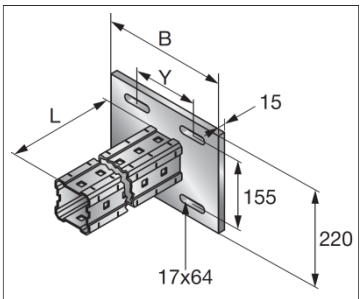
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
346.20	346.20	116.39	116.39	166.28	166.28
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
13.34	13.34	11.91	11.91	10.28	10.28

Interaction:

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

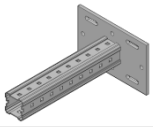
MIC-S90-AH-500-2000 Bracket - Steel

Designation	Item number
MIC-S90-AH- 500	**2203582**
MIC-S90-AH- 750	**2203583**
MIC-S90-AH-1000	**2203584**
MIC-S90-AH-1500	**2203585**
MIC-S90-AH-2000	**2203586**



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

Hardware included per connector



Designation	L[mm]
MIC-S90-AH- 500	500
MIC-S90-AH- 750	750
MIC-S90-AH-1000	1000
MIC-S90-AH-1500	1500
MIC-S90-AH-2000	2000

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Bracket	**ISO 1461**	**55**

Weight:

MIC-S90-AH- 500	11773g
MIC-S90-AH- 750	14160g
MIC-S90-AH-1000	16546g
MIC-S90-AH-1500	21320g
MIC-S90-AH-2000	26094g

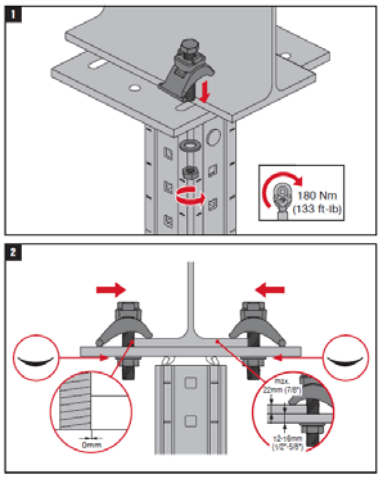
Submittal text:
Hilti Hot-dipped galvanized bracket used as fixed to structural steel profiles. The fixation could be done by two different principles.
First principle is clamping, using four beam clams clamped on flange of the structural steel profile.

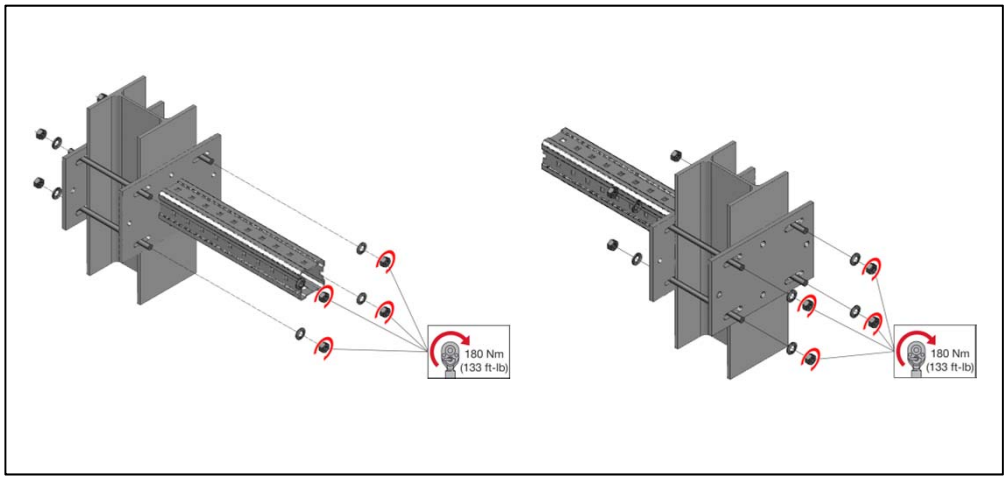
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Girder DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

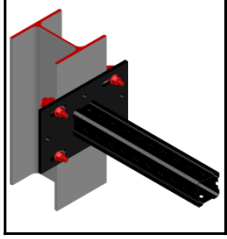
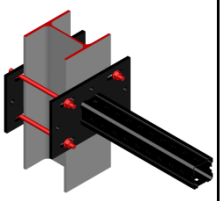
No IFU attached to the packaging

For clamped loading case **For boxed loading case** (not attached to the packaging)





MIC-S90-AH-500-2000 Bracket - Steel

Possible loading cases		
Clamped	**Boxed**	
		

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

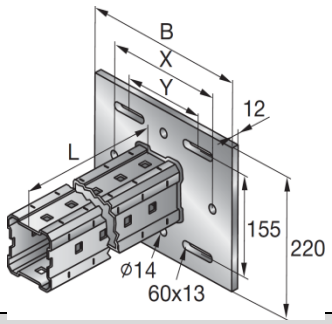
Software:
- Ansys 18.2
- Microsoft Excel
- Mathcad 15

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

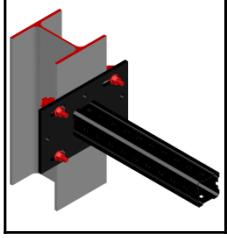
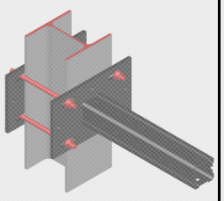
Simplified drawing:

Designation	L[mm]
MIC-S90-AH- 500	500
MIC-S90-AH- 750	750
MIC-S90-AH-1000	1000
MIC-S90-AH-1500	1500
MIC-S90-AH-2000	2000

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



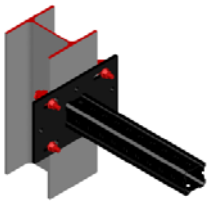
MIC-S90-AH-500-2000 Bracket - Steel

Clamped	Boxed	
		

Loading case: Clamped

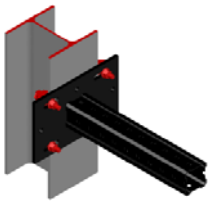
BOM:
Brackets:

1x MIC-S90-AH- 500	**2203582**
MIC-S90-AH- 750	**2203583**
MIC-S90-AH-1000	**2203584**
MIC-S90-AH-1500	**2203585**
MIC-S90-AH-2000	**2203586**
Beam clamps	
4x MI-SGC M16	**387398**



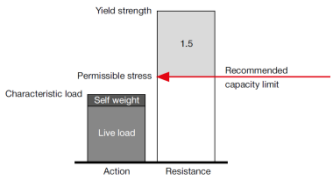
Combinations covered by loading case

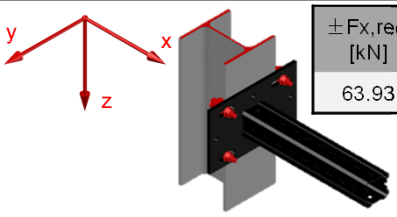
Pre-fab bracket for perpendicular connection to structural steel profiles flanges.
Flange width 75-165mm.



Recommended loading capacity - simplified for most common applications

Method





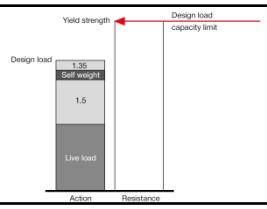
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
63.93	6.87	6.87

±My,rec. [kNm]
4.05

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

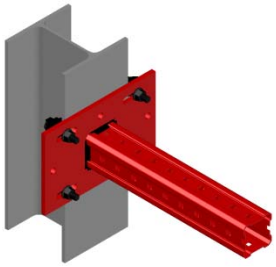
Design loading capacity - 3D 1/3

Method

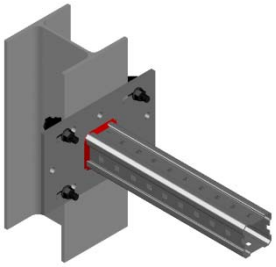


Limiting components of capacity evaluated in following tables:

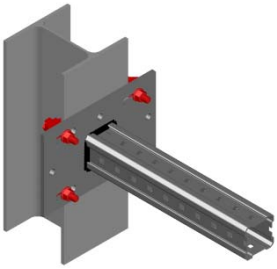
1. Bracket per FEA simulation



2. Welds – per analytical calculation



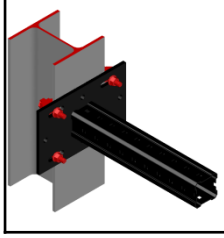
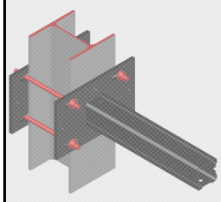
3. Beam Clamps - per analytical calculation



MIC-S90-AH-500-2000 Bracket - Steel

Validity:

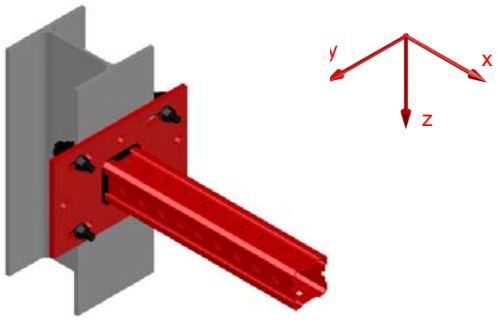
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation



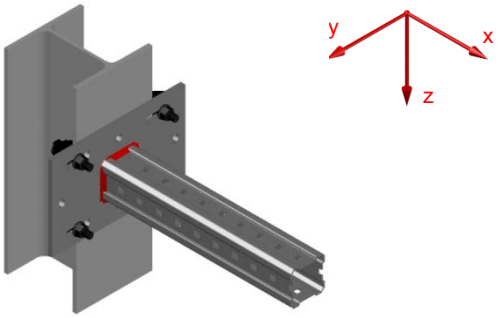
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
95.90	101.54	57.20	57.20	57.20	57.20
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
4.50	4.50	6.08	6.08	6.08	6.08

includes cross section resistance of steel base plate and channel

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. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
285.11	285.11	116.39	116.39	116.39	116.39
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
9.54	9.54	6.84	6.84	6.84	6.84

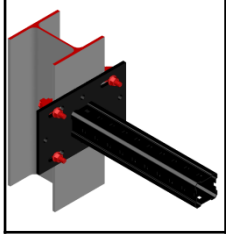
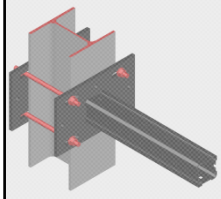
Interaction:

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

MIC-S90-AH-500-2000 Bracket - Steel

Validity:

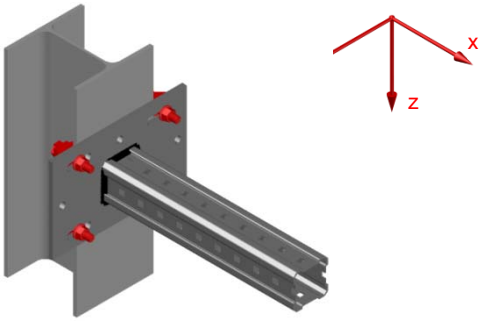
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Beam Clamps - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.84	0.84	7.37	7.37	4.25	4.25

Interaction:

Normal force interaction:

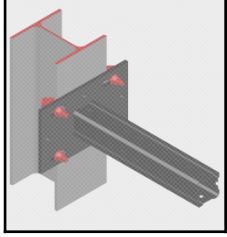
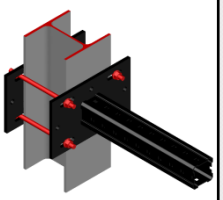
$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$$

Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

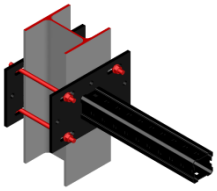
MIC-S90-AH-500-2000 Bracket - Steel

Clamped	Boxed	
		

Loading case: Boxed

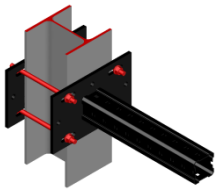
BOM:
Brackets:

1x MIC-S90-AH- 500	**2203582**
MIC-S90-AH- 750	**2203583**
MIC-S90-AH-1000	**2203584**
MIC-S90-AH-1500	**2203585**
MIC-S90-AH-2000	**2203586**
Base plate	
1x MIB-SBH	**2174675**
Threaded rods cut to particular length	
4x AM16x1000 8.8 HDG…m	**419104**
Lock washer	
8x LW M16 HDG plus washer	**2185343**
Nut	
8x M16-F nut	**304767**



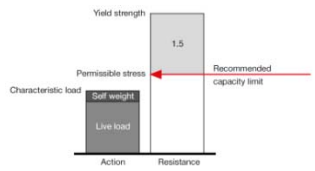
Combinations covered by loading case

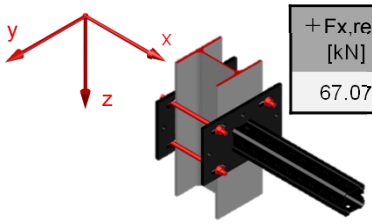
Pre-fab bracket for perpendicular connection to structural steel
Profiles boxing it with two base plates.
Flange width 75-165mm.



Recommended loading capacity - simplified for most common applications

Method





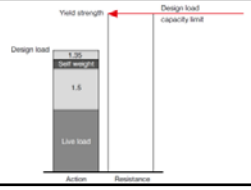
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
67.07	13.77	13.77

±My,rec. [kNm]
4.05

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

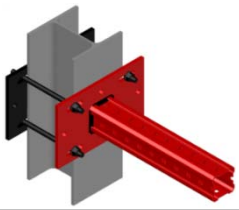
Design loading capacity - 3D 1/3

Method

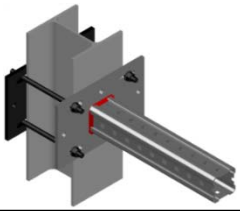


Limiting components of capacity evaluated in following tables:

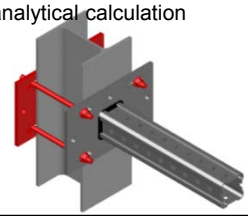
1. Bracket per FEA simulation



2. Welds - per analytical calculation



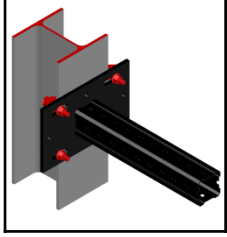
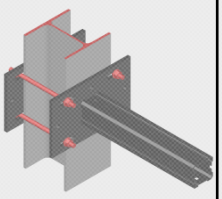
3. Base plate and through bolts - per analytical calculation



MIC-S90-AH-500-2000 Bracket - Steel

Validity:

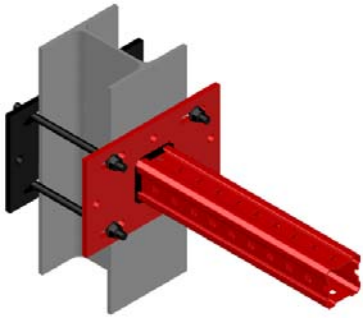
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

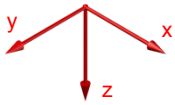
Clamped	Boxed	
		

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation





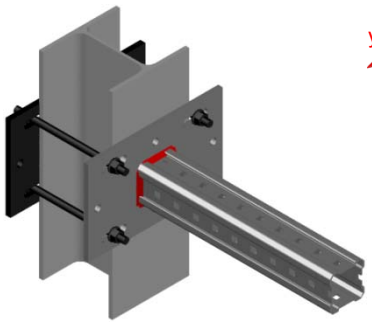
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
100.60	101.54	57.20	57.20	57.20	57.20
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
4.50	4.50	6.08	6.08	6.08	6.08

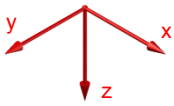
includes cross section resistance of steel base plate and channel

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. Welds - per analytical calculation





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
285.11	285.11	116.39	116.39	116.39	116.39
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
9.54	9.54	6.84	6.84	6.84	6.84

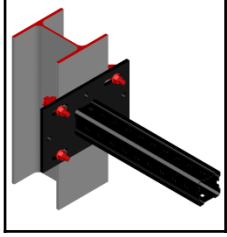
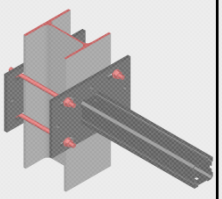
Interaction:

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

MIC-S90-AH-500-2000 Bracket - Steel

Validity:

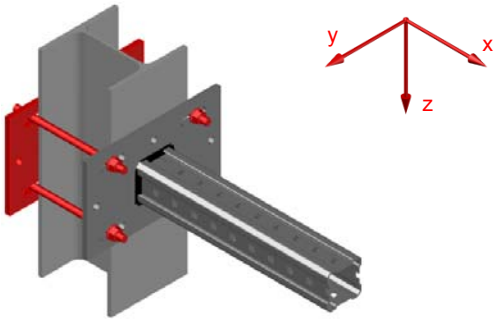
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Base plate and through bolts - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
164.00	Not decisive	20.66	20.66	20.66	20.66
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
1.67	1.67	11.64	11.64	6.81	6.81

Interaction:

Normal force interaction:

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

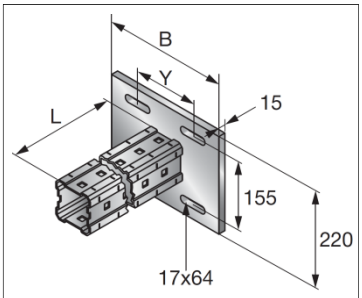
Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

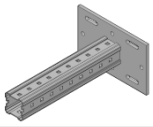
MIC-S90-BH-500-2000 Bracket - Steel

Designation	Item number
MIC-S90-BH- 500	**2203587**
MIC-S90-BH- 750	**2203588**
MIC-S90-BH-1000	**2203589**
MIC-S90-BH-1500	**2203590**
MIC-S90-BH-2000	**2203591**



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

Hardware included per connector



Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Bracket	**ISO 1461**	**55**

Weight:

MIC-S90-BH- 500	13666g
MIC-S90-BH- 750	16052g
MIC-S90-BH-1000	18439g
MIC-S90-BH-1500	23213g
MIC-S90-BH-2000	27986g

Designation	L[mm]
MIC-S90-BH- 500	500
MIC-S90-BH- 750	750
MIC-S90-BH-1000	1000
MIC-S90-BH-1500	1500
MIC-S90-BH-2000	2000

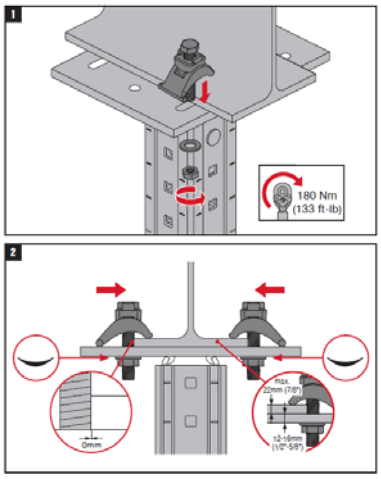
Submittal text:
Hilti Hot-dipped galvanized bracket used as fixed to structural steel profiles. The fixation could be done by two different principles.
First principle is clamping, using four beam clams clamped on flange of the structural steel profile.

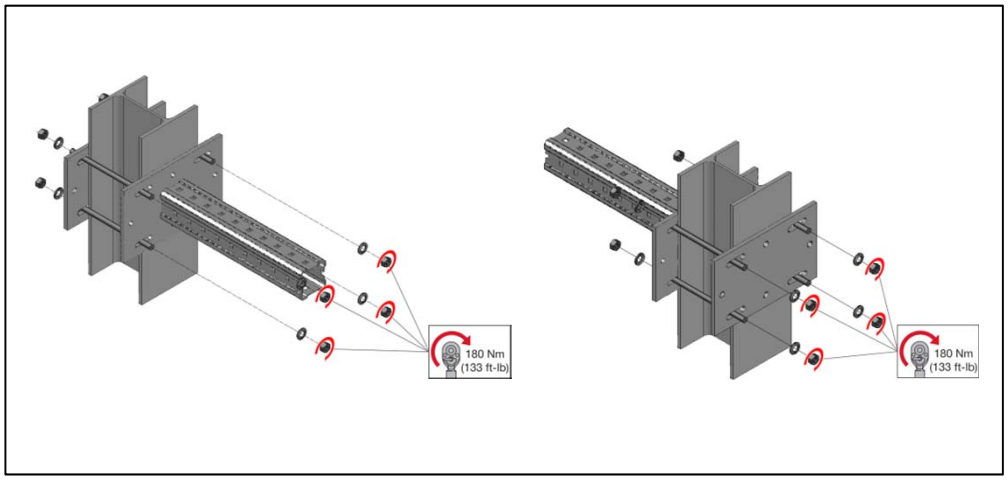
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Girder DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

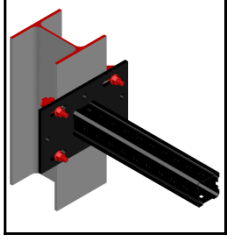
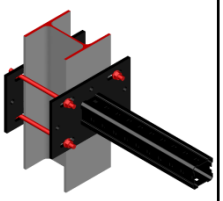
No IFU attached to the packaging

For clamped loading case **For boxed loading case** (not attached to the packaging)





MIC-S90-BH-500-2000 Bracket - Steel

Possible loading cases		
Clamped	**Boxed**	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis
- Analytic calculation

Standards and codes:

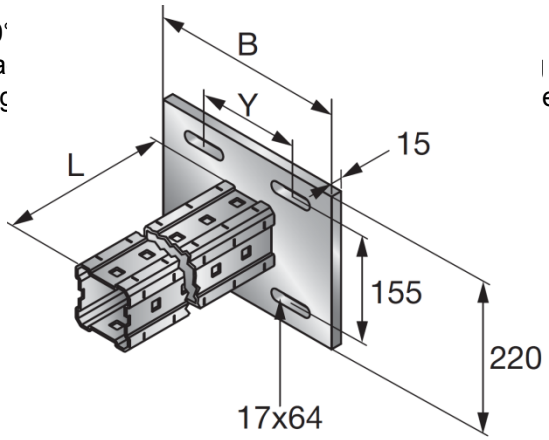
EN 1990	Basics of structural design	03.2003
EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General actions – densities, self-weight, imposed loads for buildings	09.2011
EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings	03.2012
EN 1993-1-3	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 18.2
- Microsoft Excel
- Mathcad 15

Validity:
- Temperature limits: -30
- Published allowable loa conditions. Non-static forces, including those resultin en into account during design.

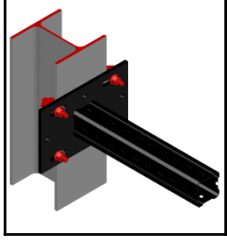
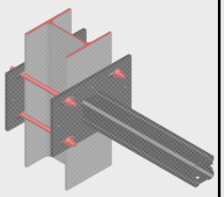
Simplified drawing:

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



Designation	L[mm]
MIC-S90-BH- 500	500
MIC-S90-BH- 750	750
MIC-S90-BH-1000	1000
MIC-S90-BH-1500	1500
MIC-S90-BH-2000	2000

MIC-S90-BH-500-2000 Bracket - Steel

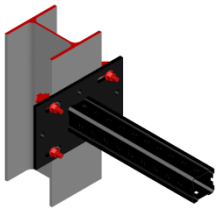
Clamped	Boxed	
		

Loading case: Clamped

BOM:

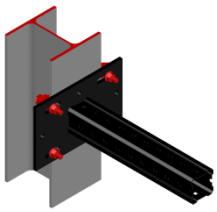
Brackets:

1x MIC-S90-BH- 500	**2203587**
MIC-S90-BH- 750	**2203588**
MIC-S90-BH-1000	**2203589**
MIC-S90-BH-1500	**2203590**
MIC-S90-BH-2000	**2203591**
Beam clamps	
4x MI-SGC M16	**387398**



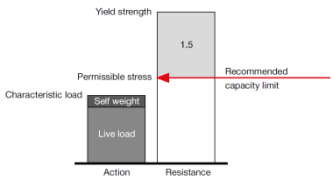
Combinations covered by loading case

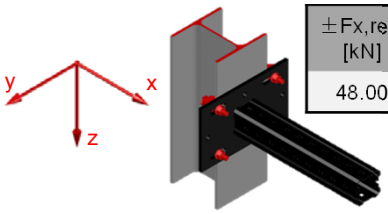
Pre-fab bracket for perpendicular connection to structural steel profiles flanges.
Flange width 165-235mm.



Recommended loading capacity - simplified for most common applications

Method





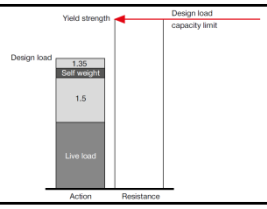
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
48.00	6.87	6.87

±My,rec. [kNm]
4.05

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

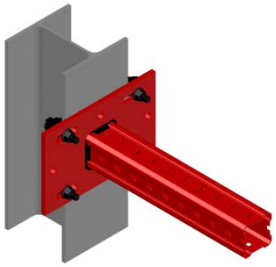
Design loading capacity - 3D 1/3

Method

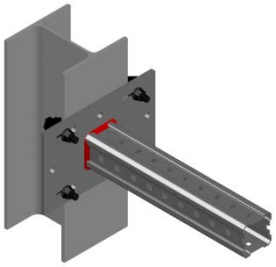


Limiting components of capacity evaluated in following tables:

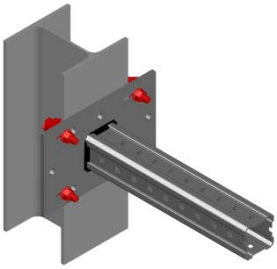
1. Bracket per FEA simulation



2. Welds – per analytical calculation



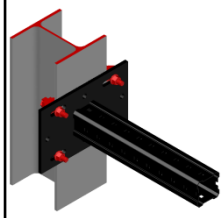
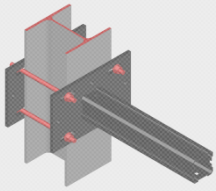
3. Beam Clamps - per analytical calculation



MIC-S90-BH-500-2000 Bracket - Steel

Validity:

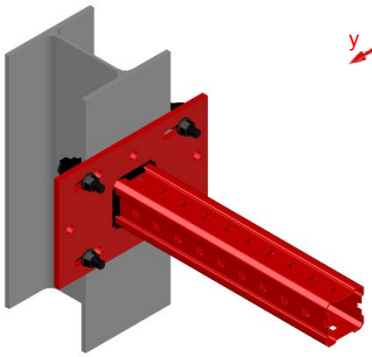
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation

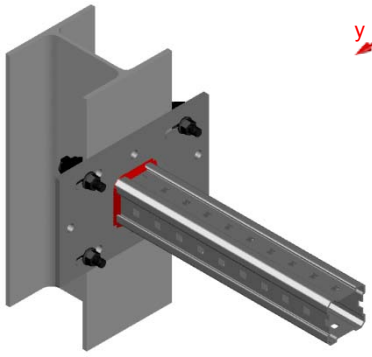


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
72.00	101.54	57.20	57.20	57.20	57.20
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
4.50	4.50	6.08	6.08	6.08	6.08

includes cross section resistance of steel base plate and channel
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. Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
285.11	285.11	116.39	116.39	116.39	116.39
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
9.54	9.54	6.84	6.84	6.84	6.84

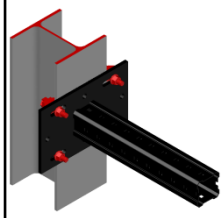
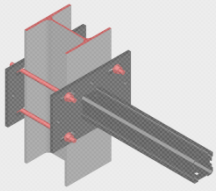
Interaction:

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

MIC-S90-BH-500-2000 Bracket - Steel

Validity:

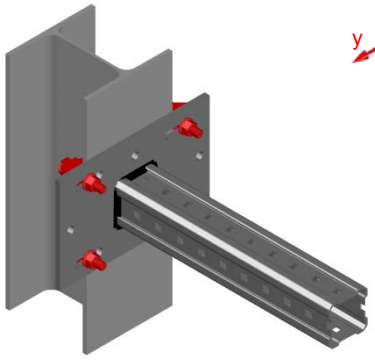
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Beam Clamps - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.12	1.12	7.37	7.37	6.81	6.81

includes cross section resistance of steel base plate and channel

Interaction:

Normal force interaction:

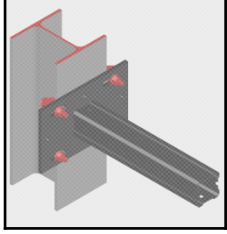
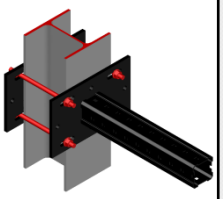
$$\frac{F_{x,Ed}}{F'_{x,Rd}} + \frac{M_{y,Ed}}{M'_{y,Rd}} + \frac{M_{z,Ed}}{M'_{z,Rd}} \leq 1$$

Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-S90-BH-500-2000 Bracket - Steel

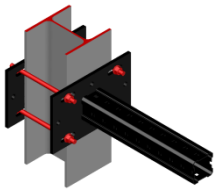
Clamped	Boxed	
		

Loading case: Boxed

BOM:
Brackets:

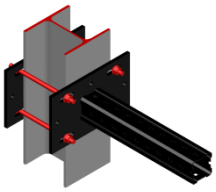
1x MIC-S90-BH- 500	**2203587**
MIC-S90-BH- 750	**2203588**
MIC-S90-BH-1000	**2203589**
MIC-S90-BH-1500	**2203590**
MIC-S90-BH-2000	**2203591**

Base plate
1x MIB-SBH 2174675
Threaded rods cut to particular length
4x AM16x1000 8.8 HDG...m 419104
Lock washer
8x LW M16 HDG plus washer 2185343
Nut
8x M16-F nut 304767



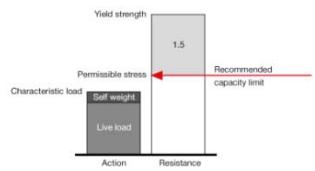
Combinations covered by loading case

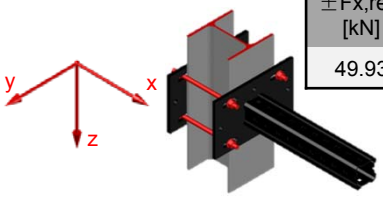
Pre-fab bracket for perpendicular connection to structural steel
Profiles boxing it with two base plates.
Flange width 165-235mm.



Recommended loading capacity - simplified for most common applications

Method





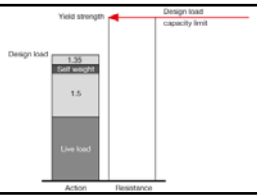
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
49.93	13.34	13.34

±My,rec. [kN]
4.05

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

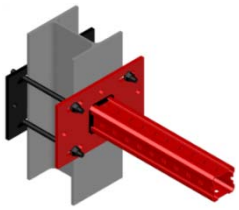
Design loading capacity - 3D 1/3

Method

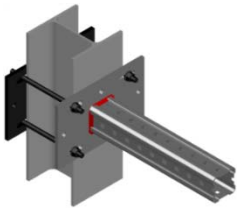


Limiting components of capacity evaluated in following tables:

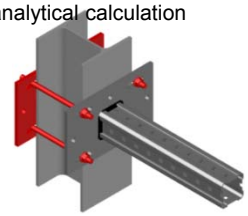
1. Bracket per FEA simulation



2. Welds - per analytical calculation



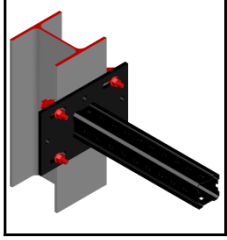
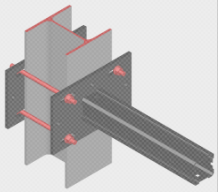
3. Base plate and through bolts - per analytical calculation



MIC-S90-BH-500-2000 Bracket - Steel

Validity:

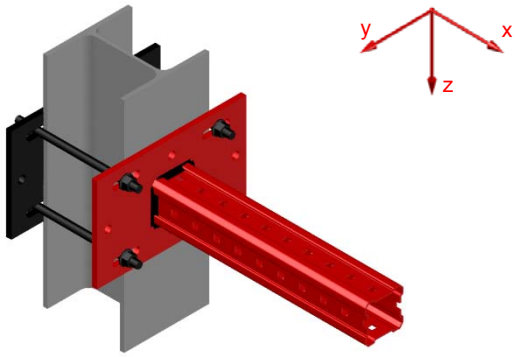
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation

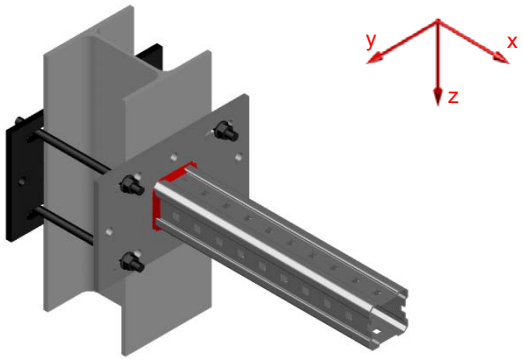


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
74.90	101.54	57.20	57.20	57.20	57.20
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
4.50	4.50	6.08	6.08	6.08	6.08

includes cross section resistance of steel base plate and channel
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. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
285.11	285.11	116.39	116.39	116.39	116.39
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
9.54	9.54	6.84	6.84	6.84	6.84

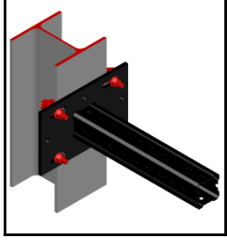
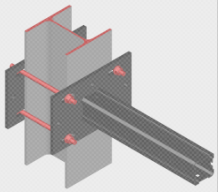
Interaction:

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

MIC-S90-BH-500-2000 Bracket - Steel

Validity:

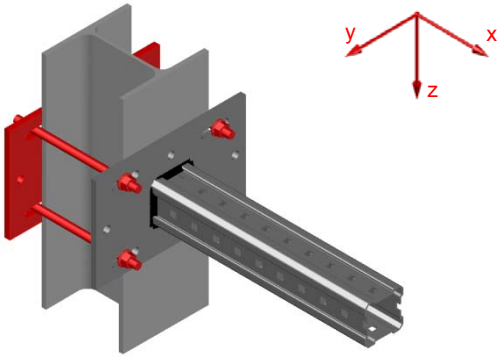
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Base plate and through bolts - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
158.80	Not decisive	20.01	20.01	20.01	20.01
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
2.06	2.06	11.27	11.27	10.56	10.56

includes cross section resistance of steel base plate and channel

Interaction:

Normal force interaction:

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

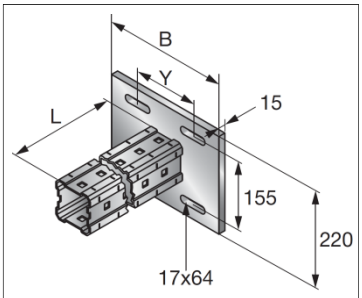
Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

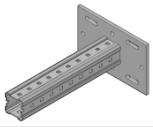
MIC-S90-CH-500-2000 Bracket - Steel

Designation	Item number
MIC-S90-CH- 500	**2203592**
MIC-S90-CH- 750	**2203593**
MIC-S90-CH-1000	**2203594**
MIC-S90-CH-1500	**2203595**
MIC-S90-CH-2000	**2203596**



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

Hardware included per connector



Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Bracket	**ISO 1461**	**55**

Weight:

MIC-S90-CH- 500	15808g
MIC-S90-CH- 750	18195g
MIC-S90-CH-1000	20582g
MIC-S90-CH-1500	25355g
MIC-S90-CH-2000	30129g

Designation	L[mm]
MIC-S90-CH- 500	500
MIC-S90-CH- 750	750
MIC-S90-CH-1000	1000
MIC-S90-CH-1500	1500
MIC-S90-CH-2000	2000

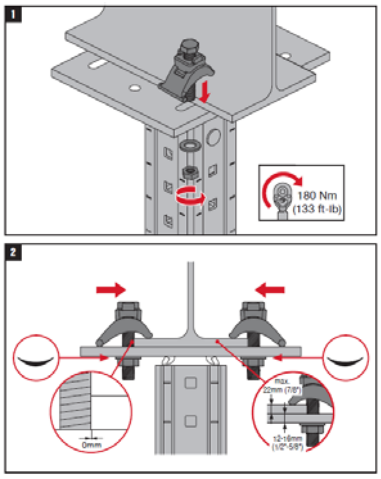
Submittal text:
Hilti Hot-dipped galvanized bracket used as fixed to structural steel profiles. The fixation could be done by two different principles.
First principle is clamping, using four beam clams clamped on flange of the structural steel profile.

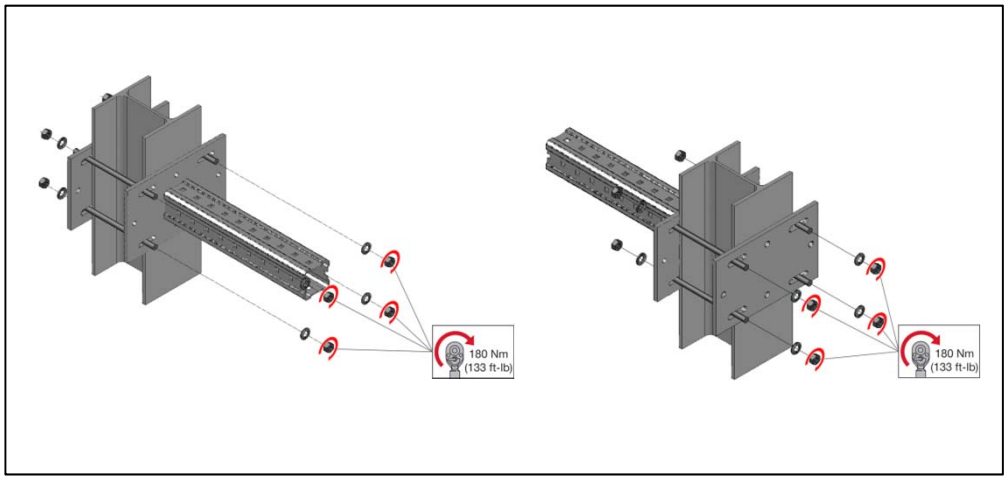
Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Girder DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

Instruction For Use:

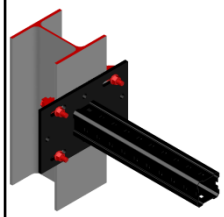
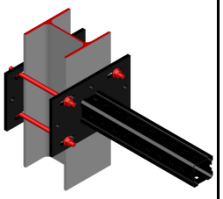
No IFU attached to the packaging

For clamped loading case **For boxed loading case** (not attached to the packaging)





MIC-S90-CH-500-2000 Bracket - Steel

Possible loading cases		
Clamped	**Boxed**	
		

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

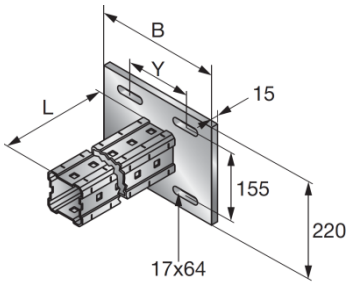
Software:
- Ansys 18.2
- Microsoft Excel
- Mathcad 15

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

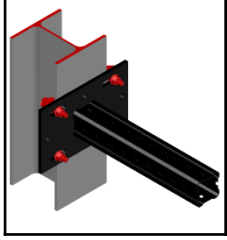
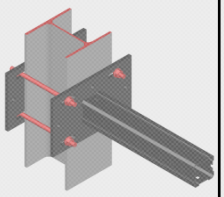
Simplified drawing:

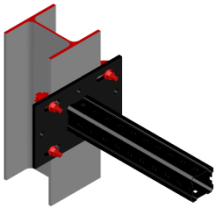
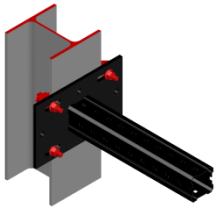
B = 430mm
X = 350mm
Y = 290mm

Designation	L[mm]
MIC-S90-CH- 500	500
MIC-S90-CH- 750	750
MIC-S90-CH-1000	1000
MIC-S90-CH-1500	1500
MIC-S90-CH-2000	2000



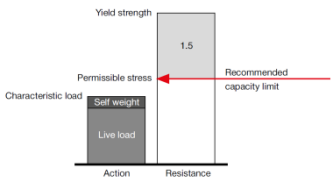
MIC-S90-CH-500-2000 Bracket - Steel

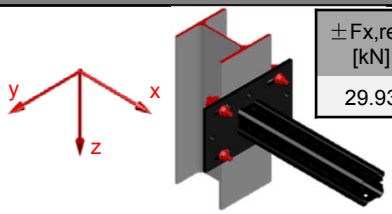
Clamped	Boxed	
		

Loading case: Clamped	Combinations covered by loading case
BOM: Brackets: **1x MIC-S90-CH- 500 2203592** **MIC-S90-CH- 750 2203593** **MIC-S90-CH-1000 2203594** **MIC-S90-CH-1500 2203595** **MIC-S90-CH-2000 2203596** Beam clamps **4x MI-SGC M16 387398** 	Pre-fab bracket for perpendicular connection to structural steel profiles flanges. Flange width 235-300mm. 

Recommended loading capacity - simplified for most common applications

Method





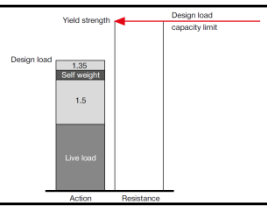
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
29.93	6.87	6.87

±My,rec. [kNm]
4.05

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

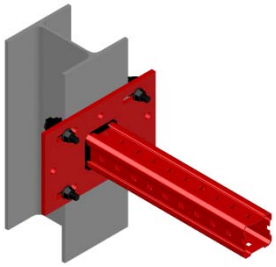
Design loading capacity - 3D 1/3

Method

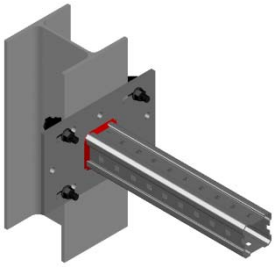


Limiting components of capacity evaluated in following tables:

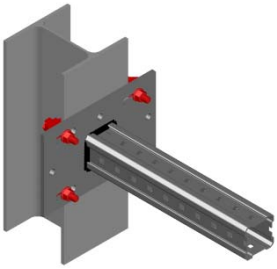
1. Bracket per FEA simulation



2. Welds – per analytical calculation



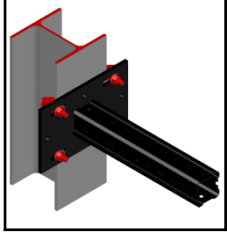
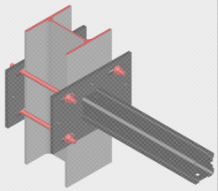
3. Beam Clamps - per analytical calculation



MIC-S90-CH-500-2000 Bracket - Steel

Validity:

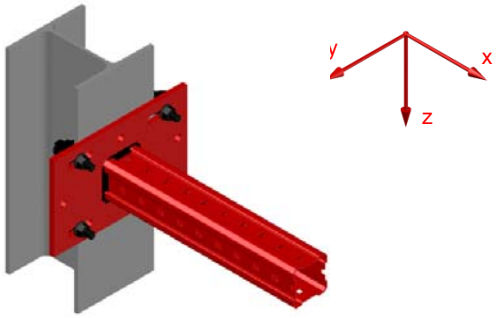
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation



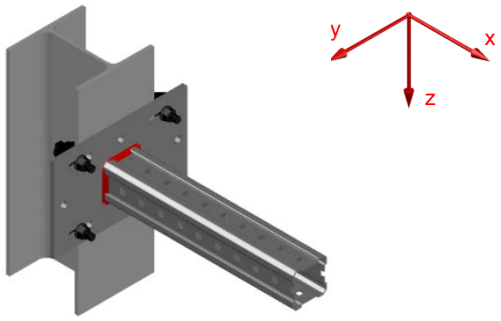
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
44.90	101.54	57.20	57.20	57.20	57.20
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
4.50	4.50	6.08	6.08	6.08	6.08

includes cross section resistance of steel base plate and channel

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. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
285.11	285.11	116.39	116.39	116.39	116.39
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
9.54	9.54	6.84	6.84	6.84	6.84

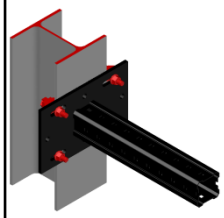
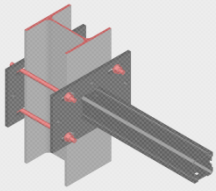
Interaction:

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

MIC-S90-CH-500-2000 Bracket - Steel

Validity:

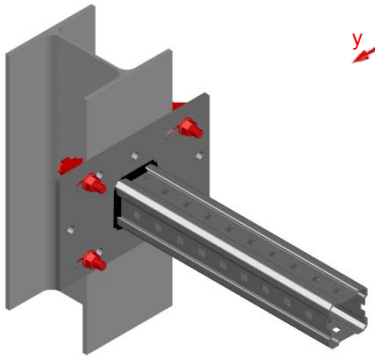
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Beam Clamps - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.41	1.41	7.37	7.37	8.45	8.45

includes cross section resistance of steel base plate and channel

Interaction:

Normal force interaction:

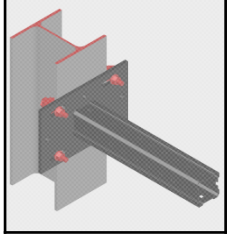
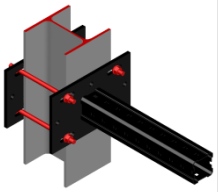
$$\frac{F_{x,Ed}}{F'_{x,Rd}} + \frac{M_{y,Ed}}{M'_{y,Rd}} + \frac{M_{z,Ed}}{M'_{z,Rd}} \leq 1$$

Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

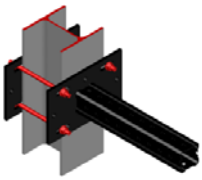
MIC-S90-CH-500-2000 Bracket - Steel

Clamped	Boxed	
		

Loading case: Boxed

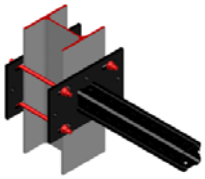
BOM:
Brackets:

1x MIC-S90-CH- 500	**2203592**
MIC-S90-CH- 750	**2203593**
MIC-S90-CH-1000	**2203594**
MIC-S90-CH-1500	**2203595**
MIC-S90-CH-2000	**2203596**
Base plate	
1x MIB-SBH	**2174675**
Threaded rods cut to particular length	
4x AM16x1000 8.8 HDG…m	**419104**
Lock washer	
8x LW M16 HDG plus washer	**2185343**
Nut	
8x M16-F nut	**304767**



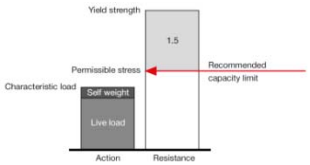
Combinations covered by loading case

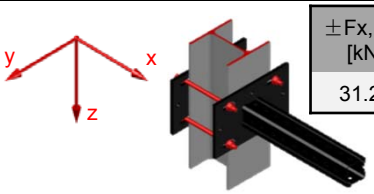
Pre-fab bracket for perpendicular connection to structural steel
Profiles boxing it with two base plates.
Flange width 235-300mm.



Recommended loading capacity - simplified for most common applications

Method





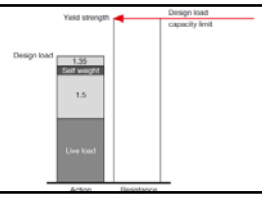
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
31.27	12.67	12.67

±My,rec. [kNm]
4.05

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

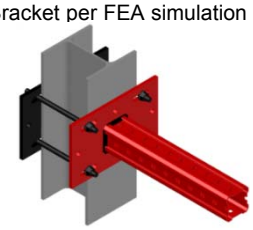
Design loading capacity - 3D 1/3

Method

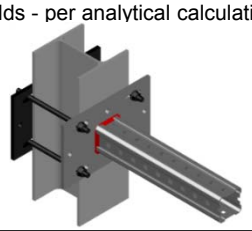


Limiting components of capacity evaluated in following tables:

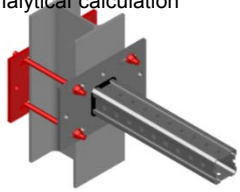
1. Bracket per FEA simulation



2. Welds - per analytical calculation



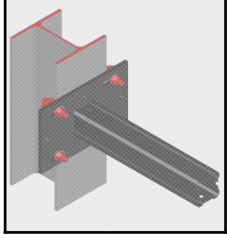
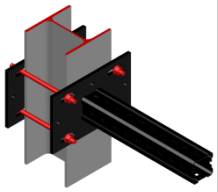
3. Base plate and through bolts - per analytical calculation



MIC-S90-CH-500-2000 Bracket - Steel

Validity:

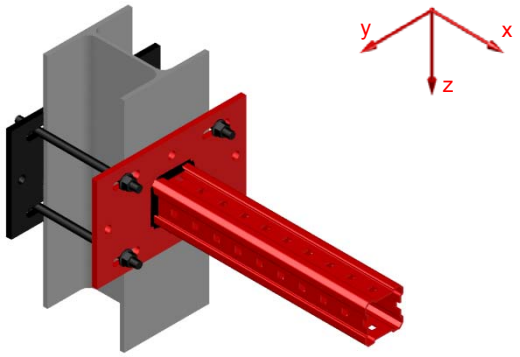
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation

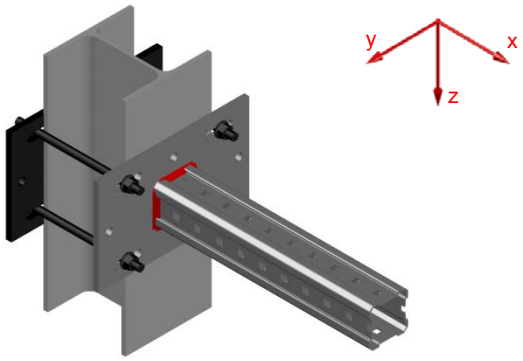


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
46.90	91.00	57.20	57.20	57.20	57.20
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
4.50	4.50	6.08	6.08	6.08	6.08

includes cross section resistance of steel base plate and channel
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. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
285.11	285.11	116.39	116.39	116.39	116.39
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
9.54	9.54	6.84	6.84	6.84	6.84

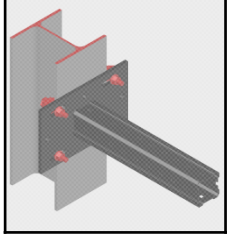
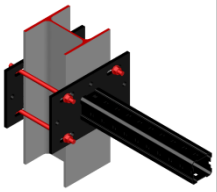
Interaction:

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

MIC-S90-CH-500-2000 Bracket - Steel

Validity:

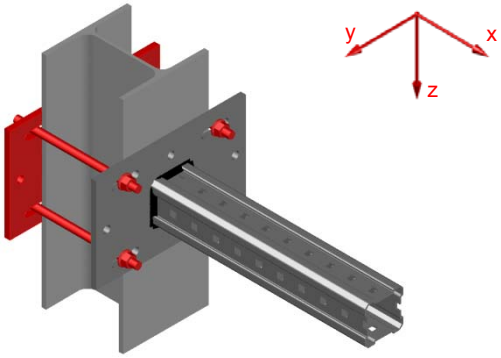
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Base plate and through bolts - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
150.80	Not decisive	19.00	19.00	19.00	19.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
2.57	2.57	10.71	10.71	12.44	12.44

includes cross section resistance of steel base plate and channel

Interaction:

Normal force interaction:

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

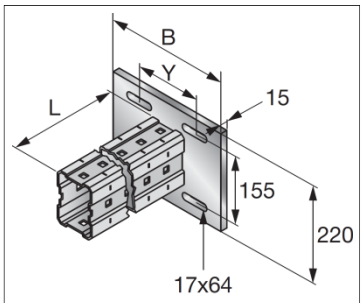
Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

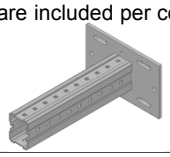
MIC-S120-AH-500-2000 Bracket - Steel

Designation	Item number
MIC-S120-AH- 500	**2203597**
MIC-S120-AH- 750	**2203598**
MIC-S120-AH-1000	**2203599**
MIC-S120-AH-1500	**2203600**
MIC-S120-AH-2000	**2203601**



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

Hardware included per connector



Designation	L[mm]
MIC-S120-AH- 500	500
MIC-S120-AH- 750	750
MIC-S120-AH-1000	1000
MIC-S120-AH-1500	1500
MIC-S120-AH-2000	2000

Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Bracket	**ISO 1461**	**55**

Weight:

MIC-S120-AH- 500	13374g
MIC-S120-AH- 750	16562g
MIC-S120-AH-1000	19750g
MIC-S120-AH-1500	26125g
MIC-S120-AH-2000	32500g

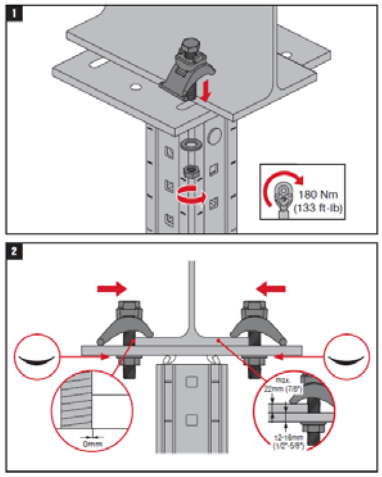
Submittal text:
Hilti Hot-dipped galvanized bracket used as fixed to structural steel profiles.
The fixation could be done by two different principles.
First principle is clamping, using four beam clams clamped on flange of the structural steel profile.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Girder DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

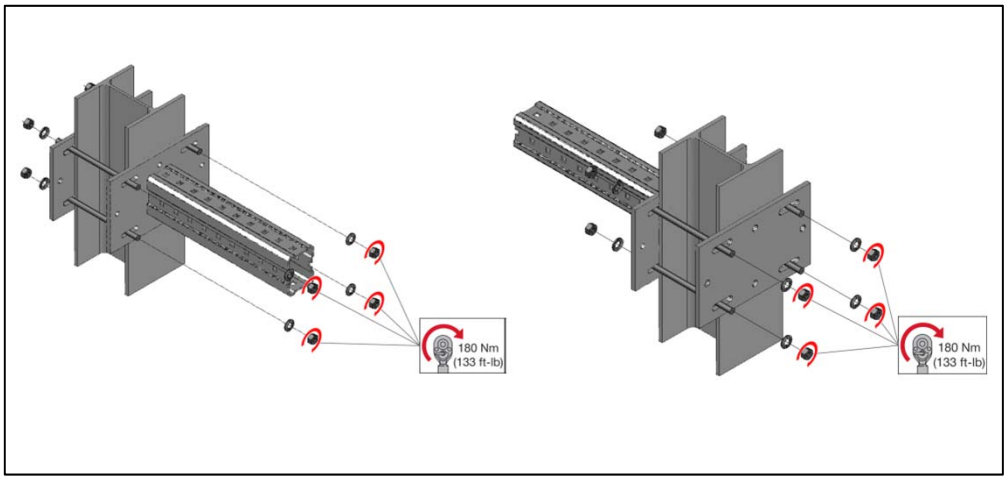
Instruction For Use:

No IFU attached to the packaging

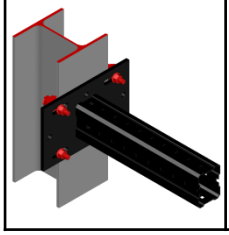
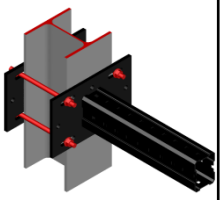
For clamped loading case



For boxed loading case (not attached to the packaging)



MIC-S120-AH-500-2000 Bracket - Steel

Possible loading cases		
Clamped	**Boxed**	
		

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

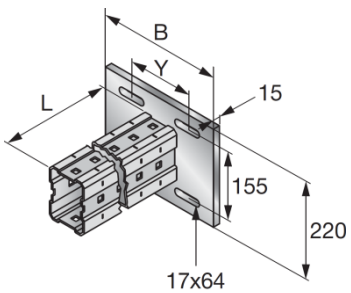
Software:
- Ansys 18.2
- Microsoft Excel
- Mathcad 15

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

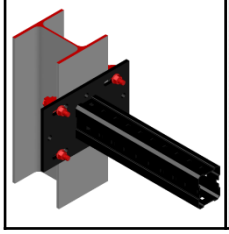
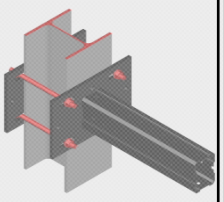
Simplified drawing:

Designation	L[mm]
MIC-S120-AH- 500	500
MIC-S120-AH- 750	750
MIC-S120-AH-1000	1000
MIC-S120-AH-1500	1500
MIC-S120-AH-2000	2000

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



MIC-S120-AH-500-2000 Bracket - Steel

Clamped	Boxed	
		

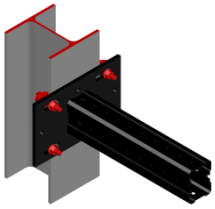
Loading case: Clamped

BOM:
Brackets:

1x	**MIC-S120-AH- 500**	**2203597**
	MIC-S120-AH- 750	**2203598**
	MIC-S120-AH-1000	**2203599**
	MIC-S120-AH-1500	**2203600**
	MIC-S120-AH-2000	**2203601**

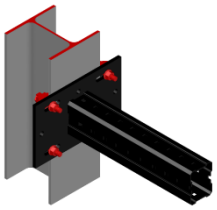
Beam clamps

4x	**MI-SGC M16**	**387398**



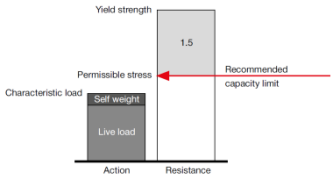
Combinations covered by loading case

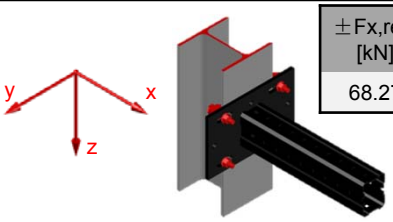
Pre-fab bracket for perpendicular connection to structural steel profiles flanges.
Flange width 75-165mm.



Recommended loading capacity - simplified for most common applications

Method





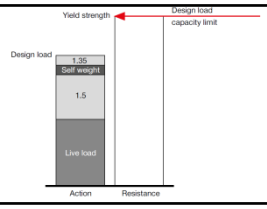
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
68.27	6.87	6.87

±My,rec. [kNm]
4.91

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

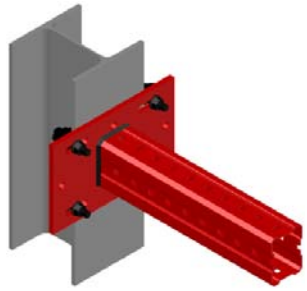
Design loading capacity - 3D 1/3

Method

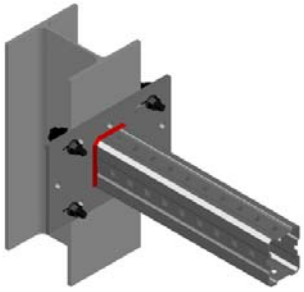


Limiting components of capacity evaluated in following tables:

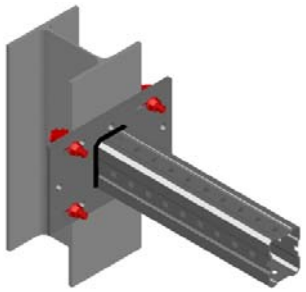
1. Bracket per FEA simulation



2. Welds – per analytical calculation



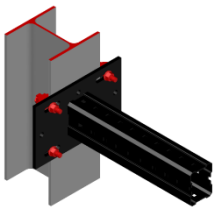
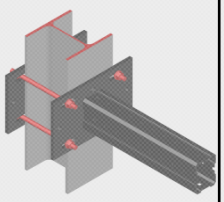
3. Beam Clamps - per analytical calculation



MIC-S120-AH-500-2000 Bracket - Steel

Validity:

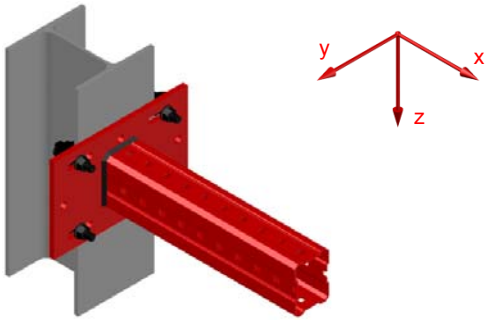
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation



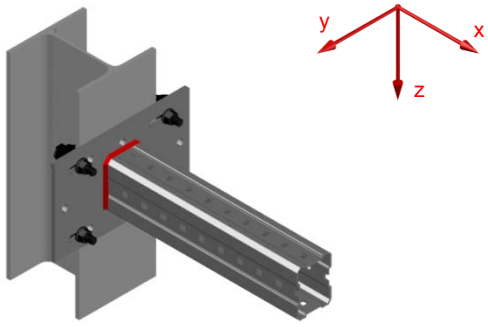
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
105.20	132.97	62.60	62.60	94.80	94.80
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
6.80	6.80	10.17	10.17	8.03	8.03

includes cross section resistance of steel base plate and channel

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. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
346.20	346.20	116.39	116.39	166.28	166.28
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
13.34	13.34	11.91	11.91	10.28	10.28

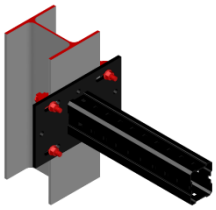
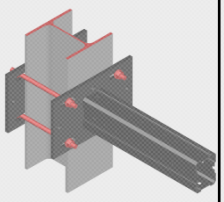
Interaction:

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

MIC-S120-AH-500-2000 Bracket - Steel

Validity:

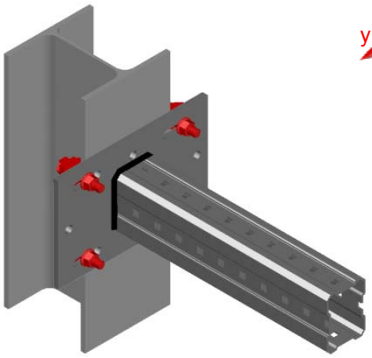
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Beam Clamps - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
0.84	0.84	7.37	7.37	4.25	4.25

includes cross section resistance of steel base plate and channel

Interaction:

Normal force interaction:

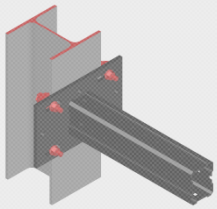
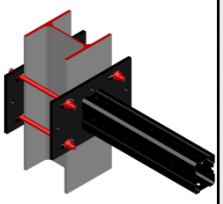
$$\frac{F_{x,Ed}}{F'_{x,Rd}} + \frac{M_{y,Ed}}{M'_{y,Rd}} + \frac{M_{z,Ed}}{M'_{z,Rd}} \leq 1$$

Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-S120-AH-500-2000 Bracket - Steel

Clamped	Boxed	
		

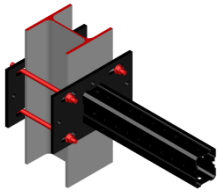
Loading case: Boxed

BOM:
Brackets:

1x MIC-S120-AH- 500	**2203597**
MIC-S120-AH- 750	**2203598**
MIC-S120-AH-1000	**2203599**
MIC-S120-AH-1500	**2203600**
MIC-S120-AH-2000	**2203601**

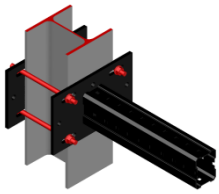
Hardware not included in packaging:

Base plate	
1x MIB-SAH	**2174674**
Threaded rods cut to particular length	
4x AM16x1000 8.8 HDG…m	**419104**
Lock washer	
8x LW M16 HDG plus washer	**2185343**
Nut	
8x M16-F nut	**304767**



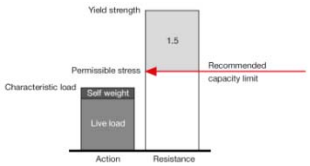
Combinations covered by loading case

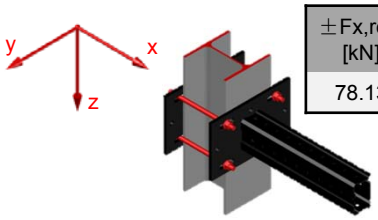
Pre-fab bracket for perpendicular connection to structural steel
Profiles boxing it with two base plates.
Flange width 75-165mm.



Recommended loading capacity - simplified for most common applications

Method





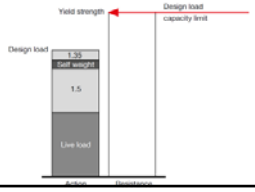
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
78.13	13.77	13.77

±My,rec. [kNm]
7.00

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

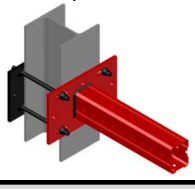
Design loading capacity - 3D 1/3

Method

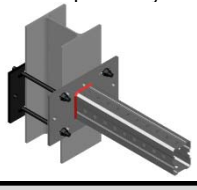


Limiting components of capacity evaluated in following tables:

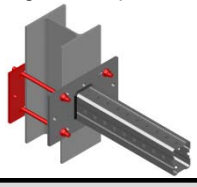
1. Bracket per FEA simulation



2. Welds - per analytical calculation



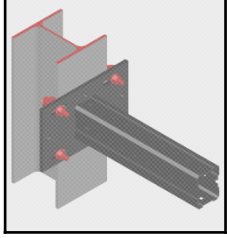
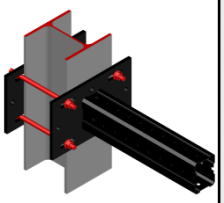
3. Base plate and through bolts - per analytical calculation



MIC-S120-AH-500-2000 Bracket - Steel

Validity:

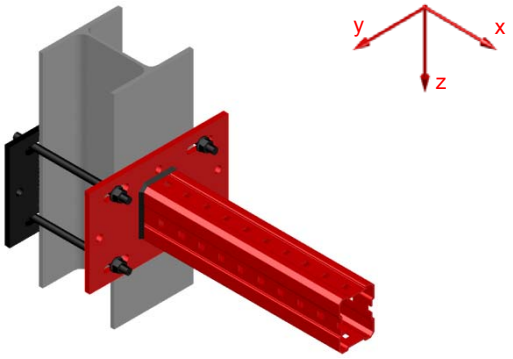
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation

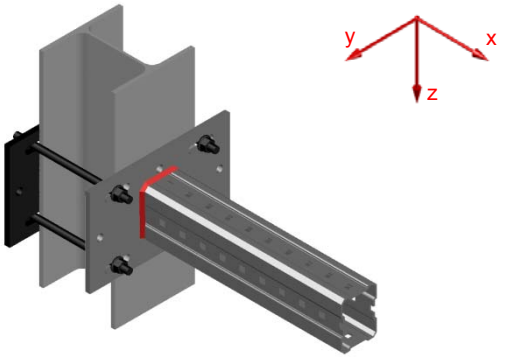


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
117.20	132.97	62.60	62.60	94.80	94.80
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
6.80	6.80	10.51	10.51	8.03	8.03

includes cross section resistance of steel base plate and channel
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. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
346.20	346.20	116.39	116.39	166.28	166.28
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
13.34	13.34	11.91	11.91	10.28	10.28

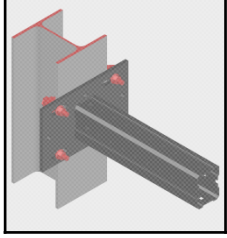
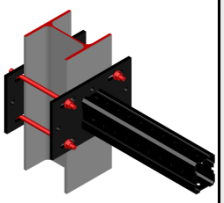
Interaction:

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

MIC-S120-AH-500-2000 Bracket - Steel

Validity:

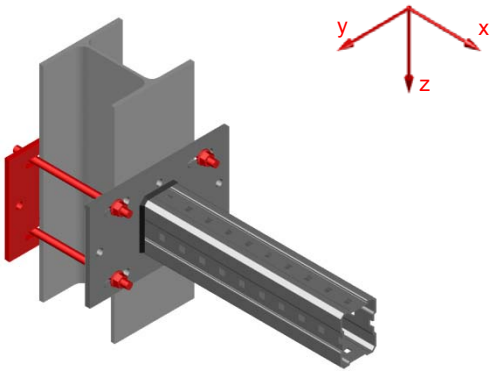
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Base plate and through bolts - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
164.00	Not decisive	20.66	20.66	20.66	20.66
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.67	1.67	11.64	11.64	6.81	6.81

includes cross section resistance of steel base plate and channel

Interaction:

Normal force interaction:

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

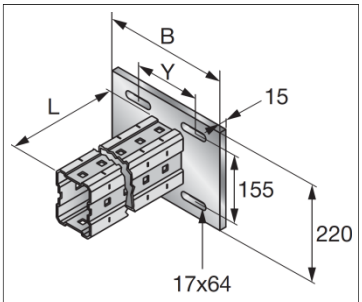
Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

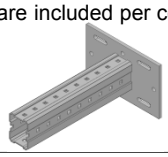
MIC-S120-BH-500-2000 Bracket - Steel

Designation	Item number
MIC-S120-BH- 500	**2203602**
MIC-S120-BH- 750	**2203603**
MIC-S120-BH-1000	**2203604**
MIC-S120-BH-1500	**2203605**
MIC-S120-BH-2000	**2203606**



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

Hardware included per connector



Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Bracket	**ISO 1461**	**55**

Weight:

MIC-S120-BH- 500	15267g
MIC-S120-BH- 750	18455g
MIC-S120-BH-1000	21642g
MIC-S120-BH-1500	28018g
MIC-S120-BH-2000	34393g

Designation	L[mm]
MIC-S120-BH- 500	500
MIC-S120-BH- 750	750
MIC-S120-BH-1000	1000
MIC-S120-BH-1500	1500
MIC-S120-BH-2000	2000

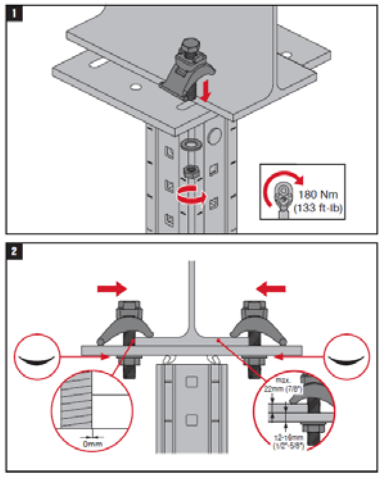
Submittal text:
Hilti Hot-dipped galvanized bracket used as fixed to structural steel profiles. The fixation could be done by two different principles.
First principle is clamping, using four beam clams clamped on flange of the structural steel profile.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Girder DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

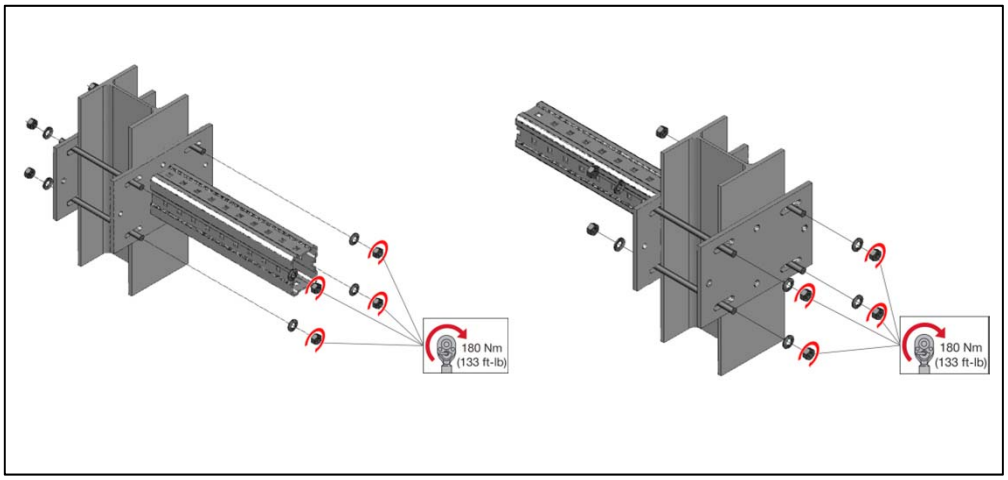
Instruction For Use:

No IFU attached to the packaging

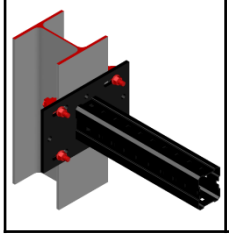
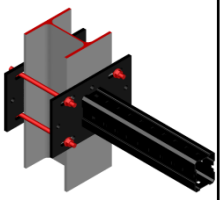
For clamped loading case



For boxed loading case (not attached to the packaging)



MIC-S120-BH-500-2000 Bracket - Steel

Possible loading cases		
Clamped	**Boxed**	
		

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

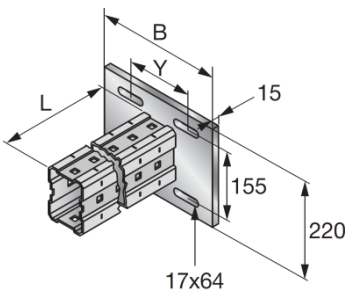
Software:
- Ansys 18.2
- Microsoft Excel
- Mathcad 15

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

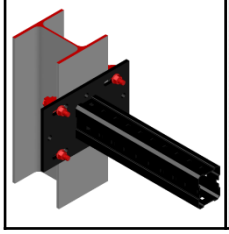
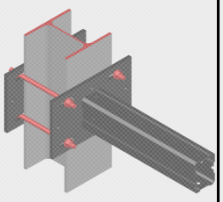
Simplified drawing:

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

Designation	L[mm]
MIC-S120-BH- 500	500
MIC-S120-BH- 750	750
MIC-S120-BH-1000	1000
MIC-S120-BH-1500	1500
MIC-S120-BH-2000	2000



MIC-S120-BH-500-2000 Bracket - Steel

Clamped	Boxed	
		

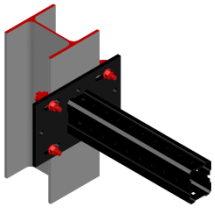
Loading case: Clamped

BOM:
Brackets:

1x MIC-S120-BH- 500	**2203602**
MIC-S120-BH- 750	**2203603**
MIC-S120-BH-1000	**2203604**
MIC-S120-BH-1500	**2203605**
MIC-S120-BH-2000	**2203606**

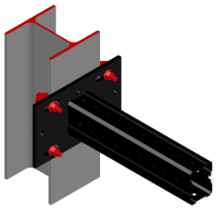
Beam clamps

4x MI-SGC M16	**387398**



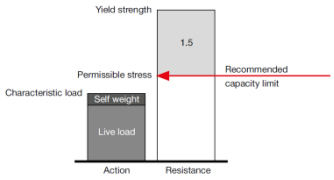
Combinations covered by loading case

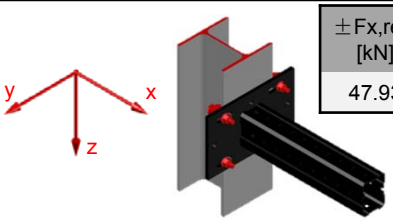
Pre-fab bracket for perpendicular connection to structural steel profiles flanges.
Flange width 165-235mm.



Recommended loading capacity - simplified for most common applications

Method





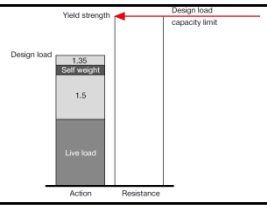
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
47.93	6.87	6.87

±My,rec. [kNm]
4.91

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

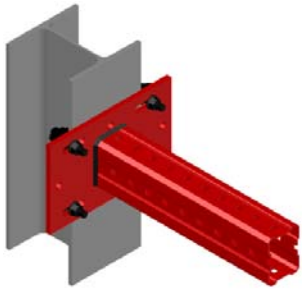
Design loading capacity - 3D 1/3

Method

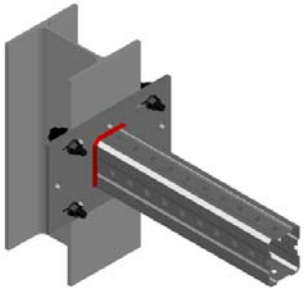


Limiting components of capacity evaluated in following tables:

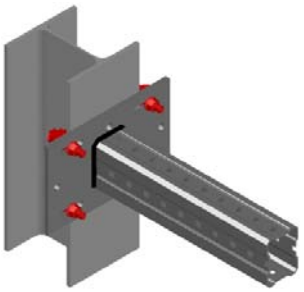
1. Bracket per FEA simulation



2. Welds – per analytical calculation



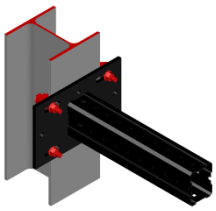
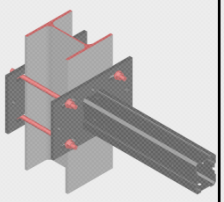
3. Beam Clamps - per analytical calculation



MIC-S120-BH-500-2000 Bracket - Steel

Validity:

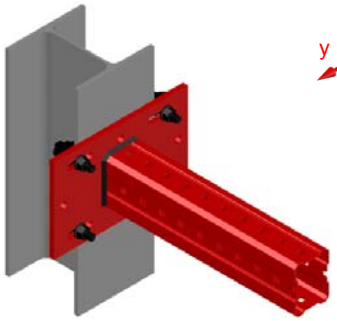
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation



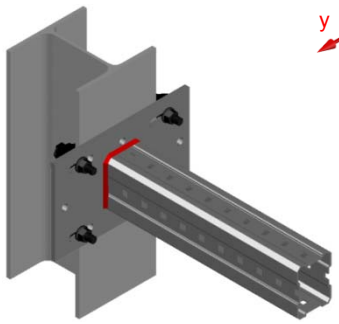
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
71.90	132.97	62.60	62.60	94.80	94.80
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
6.80	6.80	8.80	8.80	8.03	8.03

includes cross section resistance of steel base plate and channel

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. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
346.20	346.20	116.39	116.39	166.28	166.28
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
13.34	13.34	11.91	11.91	10.28	10.28

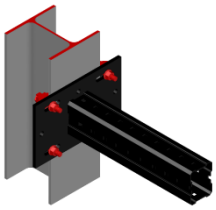
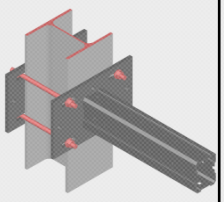
Interaction:

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

MIC-S120-BH-500-2000 Bracket - Steel

Validity:

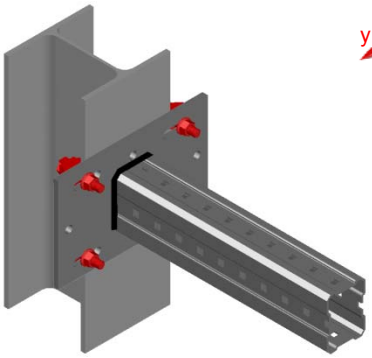
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Beam Clamps - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.12	1.12	7.37	7.37	6.81	6.81

includes cross section resistance of steel base plate and channel

Interaction:

Normal force interaction:

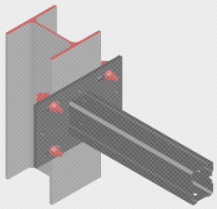
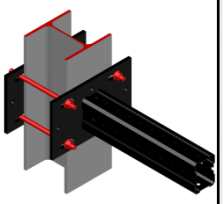
$$\frac{F_{x,Ed}}{F'_{x,Rd}} + \frac{M_{y,Ed}}{M'_{y,Rd}} + \frac{M_{z,Ed}}{M'_{z,Rd}} \leq 1$$

Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-S120-BH-500-2000 Bracket - Steel

Clamped	Boxed	
		

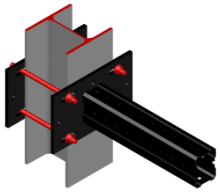
Loading case: Boxed

BOM:
Brackets:

1x MIC-S120-BH- 500	**2203602**
MIC-S120-BH- 750	**2203603**
MIC-S120-BH-1000	**2203604**
MIC-S120-BH-1500	**2203605**
MIC-S120-BH-2000	**2203606**

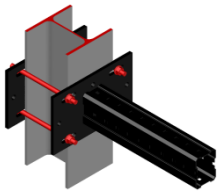
Hardware not included in packaging:

Base plate	
1x MIB-SAH	**2174674**
Threaded rods cut to particular length	
4x AM16x1000 8.8 HDG…m	**419104**
Lock washer	
8x LW M16 HDG plus washer	**2185343**
Nut	
8x M16-F nut	**304767**



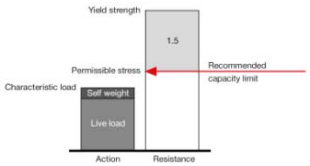
Combinations covered by loading case

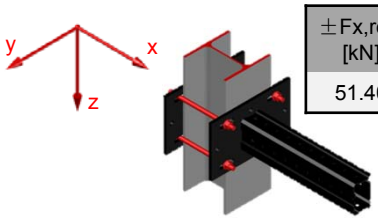
Pre-fab bracket for perpendicular connection to structural steel
Profiles boxing it with two base plates.
Flange width 165-235mm.



Recommended loading capacity - simplified for most common applications

Method





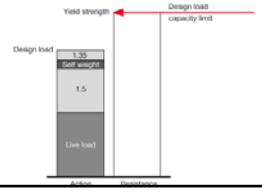
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
51.40	13.34	13.34

±My,rec. [kNm]
6.18

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

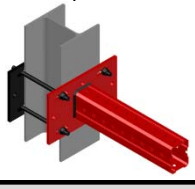
Design loading capacity - 3D 1/3

Method

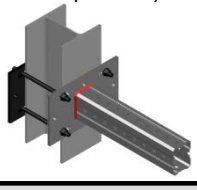


Limiting components of capacity evaluated in following tables:

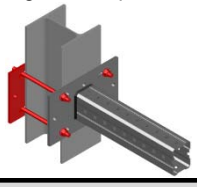
1. Bracket per FEA simulation



2. Welds - per analytical calculation



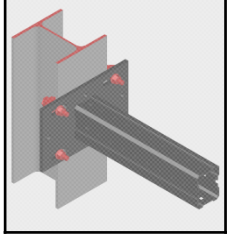
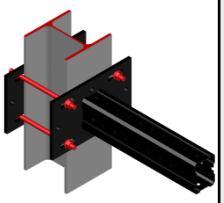
3. Base plate and through bolts - per analytical calculation



MIC-S120-BH-500-2000 Bracket - Steel

Validity:

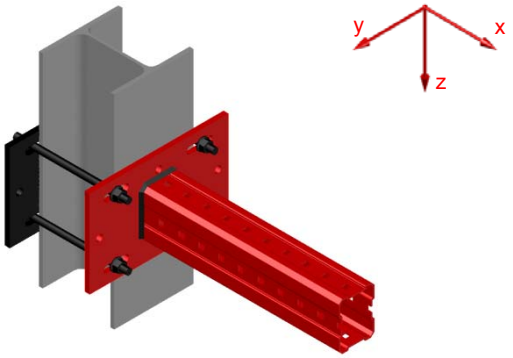
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation

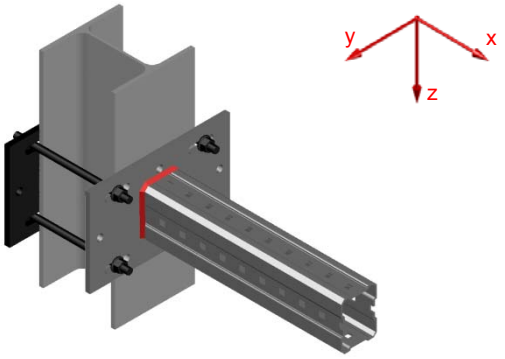


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
77.10	132.97	62.60	62.60	94.80	94.80
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
6.80	6.80	9.27	9.27	8.03	8.03

includes cross section resistance of steel base plate and channel
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. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
346.20	346.20	116.39	116.39	166.28	166.28
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
13.34	13.34	11.91	11.91	10.28	10.28

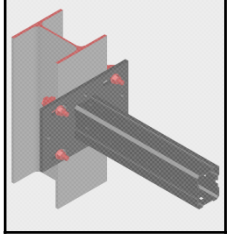
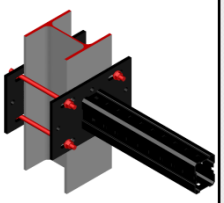
Interaction:

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

MIC-S120-BH-500-2000 Bracket - Steel

Validity:

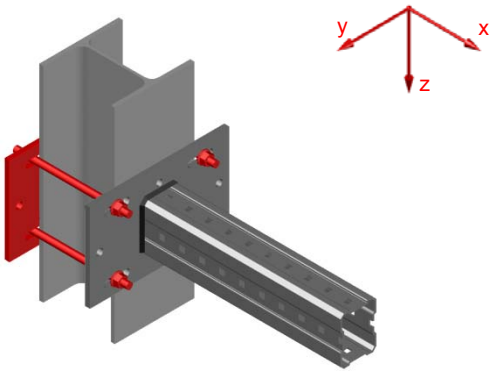
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Base plate and through bolts - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
158.80	Not decisive	20.01	20.01	20.01	20.01
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
2.06	2.06	11.27	11.27	10.56	10.56

includes cross section resistance of steel base plate and channel

Interaction:

Normal force interaction:

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

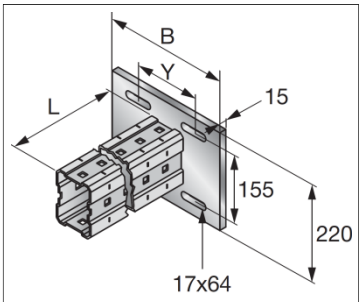
Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

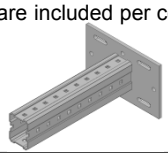
MIC-S120-CH-500-2000 Bracket - Steel

Designation	Item number
MIC-S120-CH- 500	**2203607**
MIC-S120-CH- 750	**2203608**
MIC-S120-CH-1000	**2203609**
MIC-S120-CH-1500	**2203570**
MIC-S120-CH-2000	**2203571**



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

Hardware included per connector



Corrosion protection:		
Material	**HDG per**	**Zinc thickness, min. (µm)**
Bracket	**ISO 1461**	**55**

Weight:

MIC-S120-CH- 500	17410g
MIC-S120-CH- 750	20597g
MIC-S120-CH-1000	23785g
MIC-S120-CH-1500	30160g
MIC-S120-CH-2000	36535g

Designation	L[mm]
MIC-S120-CH- 500	500
MIC-S120-CH- 750	750
MIC-S120-CH-1000	1000
MIC-S120-CH-1500	1500
MIC-S120-CH-2000	2000

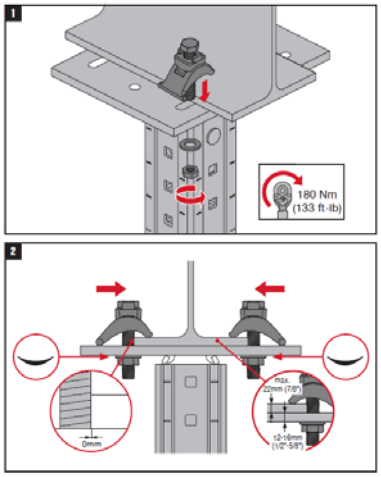
Submittal text:
Hilti Hot-dipped galvanized bracket used as fixed to structural steel profiles. The fixation could be done by two different principles.
First principle is clamping, using four beam clams clamped on flange of the structural steel profile.

Material properties				
Material	**Yield strength**	**Ultimate strength**	**Modulus of elasticity**	**Shear modulus**
Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Girder DD11 MOD (EN 10111)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations				

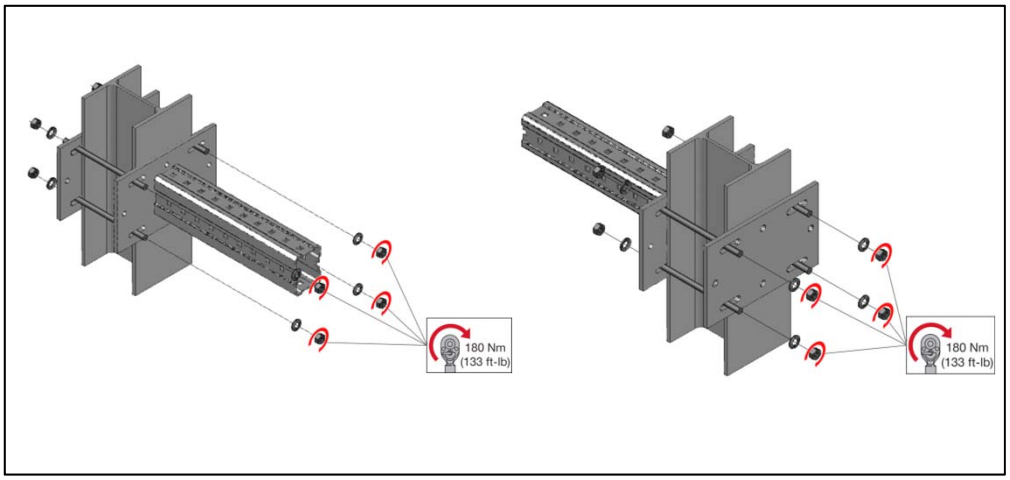
Instruction For Use:

No IFU attached to the packaging

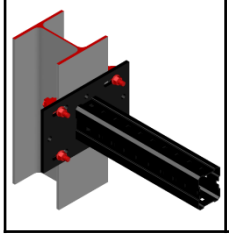
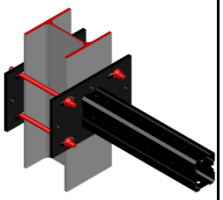
For clamped loading case



For boxed loading case (not attached to the packaging)



MIC-S120-CH-500-2000 Bracket - Steel

Possible loading cases		
Clamped	**Boxed**	
		

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

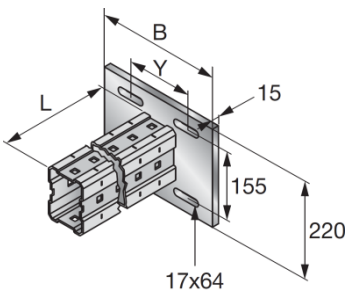
Software:
- Ansys 18.2
- Microsoft Excel
- Mathcad 15

Validity:
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

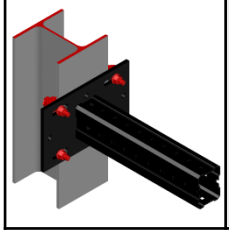
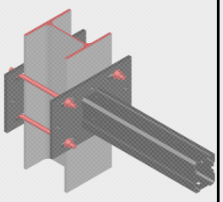
Simplified drawing:

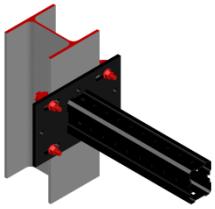
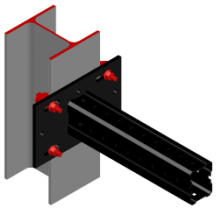
B = 350mm
X = 300mm
Y = 210mm

Designation	L[mm]
MIC-S120-CH- 500	500
MIC-S120-CH- 750	750
MIC-S120-CH-1000	1000
MIC-S120-CH-1500	1500
MIC-S120-CH-2000	2000



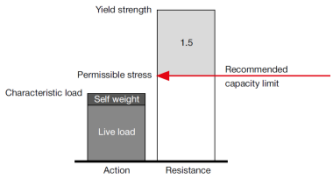
MIC-S120-CH-500-2000 Bracket - Steel

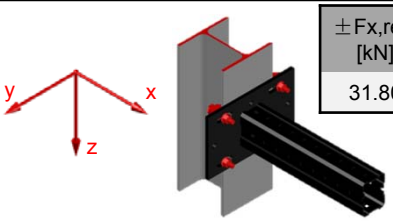
Clamped	Boxed	
		

Loading case: Clamped	Combinations covered by loading case
BOM: Brackets: **1x MIC-S120-CH- 500 2203607** **MIC-S120-CH- 750 2203608** **MIC-S120-CH-1000 2203609** **MIC-S120-CH-1500 2203570** **MIC-S120-CH-2000 2203571** Beam clamps **4x MI-SGC M16 387398** 	Pre-fab bracket for perpendicular connection to structural steel profiles flanges. Flange width 235-300mm. 

Recommended loading capacity - simplified for most common applications

Method





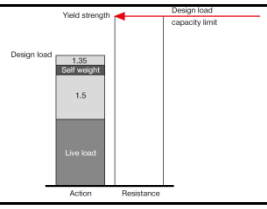
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
31.80	6.87	6.87

±My,rec. [kNm]
4.91

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

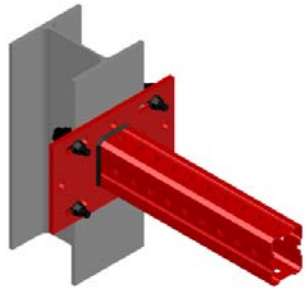
Design loading capacity - 3D 1/3

Method

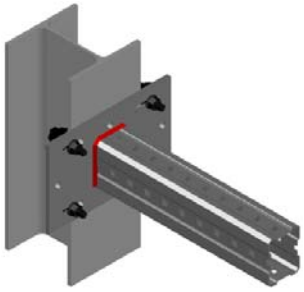


Limiting components of capacity evaluated in following tables:

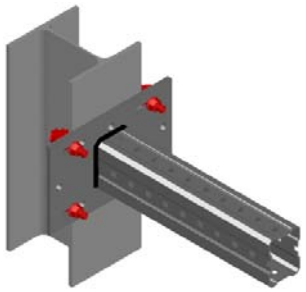
1. Bracket per FEA simulation



2. Welds – per analytical calculation



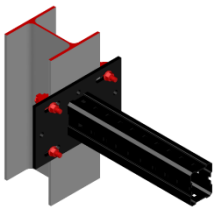
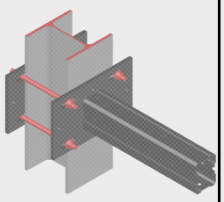
3. Beam Clamps - per analytical calculation



MIC-S120-CH-500-2000 Bracket - Steel

Validity:

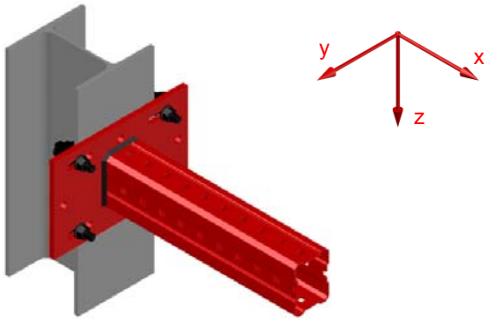
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation



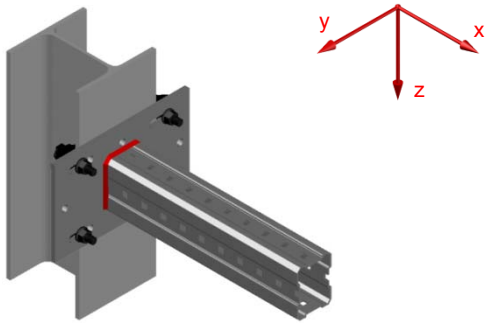
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
47.70	132.97	62.60	62.60	94.80	94.80
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
6.80	6.80	8.03	8.03	8.03	8.03

includes cross section resistance of steel base plate and channel

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. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
346.20	346.20	116.39	116.39	166.28	166.28
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
13.34	13.34	11.91	11.91	10.28	10.28

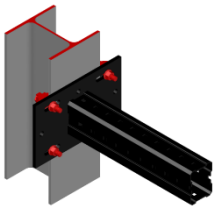
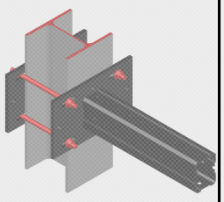
Interaction:

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

MIC-S120-CH-500-2000 Bracket - Steel

Validity:

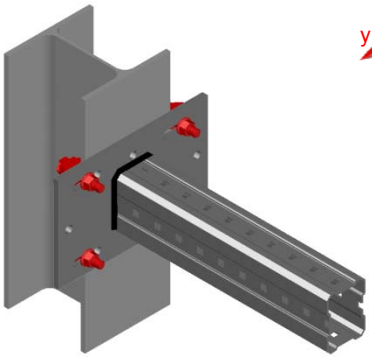
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

Clamped	Boxed	
		

Design loading capacity - 3D 3/3

Summary of design loads*
NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Beam Clamps - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.41	1.41	7.37	7.37	8.45	8.45

includes cross section resistance of steel base plate and channel

Interaction:

Normal force interaction:

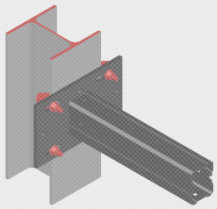
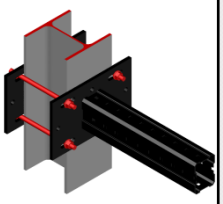
$$\frac{F_{x,Ed}}{F'_{x,Rd}} + \frac{M_{y,Ed}}{M'_{y,Rd}} + \frac{M_{z,Ed}}{M'_{z,Rd}} \leq 1$$

Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F'_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

MIC-S120-CH-500-2000 Bracket - Steel

Clamped	Boxed	
		

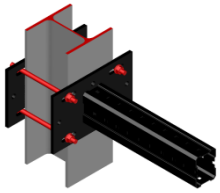
Loading case: Boxed

BOM:
Brackets:

1x MIC-S120-CH- 500	**2203607**
MIC-S120-CH- 750	**2203608**
MIC-S120-CH-1000	**2203609**
MIC-S120-CH-1500	**2203570**
MIC-S120-CH-2000	**2203571**

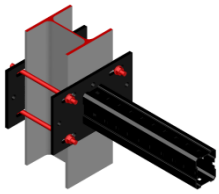
Hardware not included in packaging:

Base plate	
1x MIB-SAH	**2174674**
Threaded rods cut to particular length	
4x AM16x1000 8.8 HDG…m	**419104**
Lock washer	
8x LW M16 HDG plus washer	**2185343**
Nut	
8x M16-F nut	**304767**



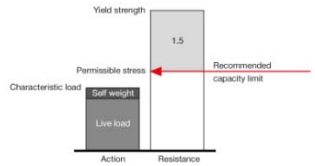
Combinations covered by loading case

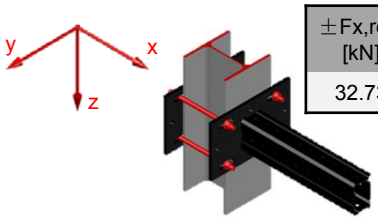
Pre-fab bracket for perpendicular connection to structural steel
Profiles boxing it with two base plates.
Flange width 235-300mm.



Recommended loading capacity - simplified for most common applications

Method





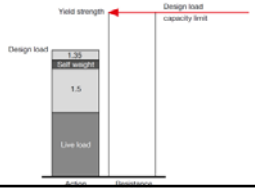
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
32.73	12.67	12.67

±My,rec. [kNm]
5.48

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

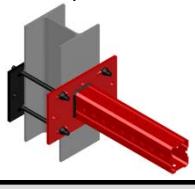
Design loading capacity - 3D 1/3

Method

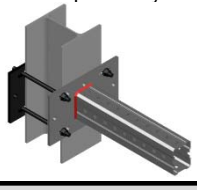


Limiting components of capacity evaluated in following tables:

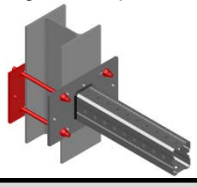
1. Bracket per FEA simulation



2. Welds - per analytical calculation



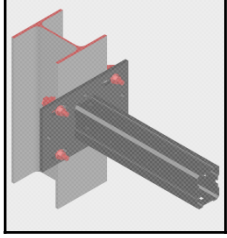
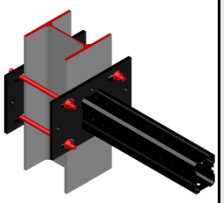
3. Base plate and through bolts - per analytical calculation



MIC-S120-CH-500-2000 Bracket - Steel

Validity:

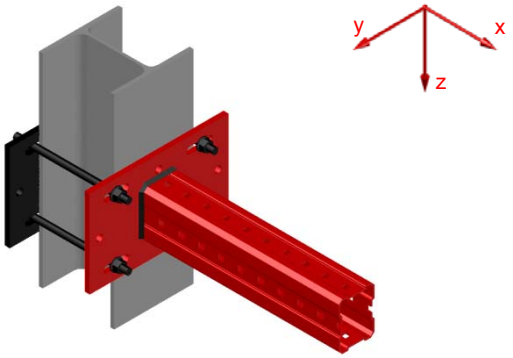
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

1. Bracket per FEA simulation

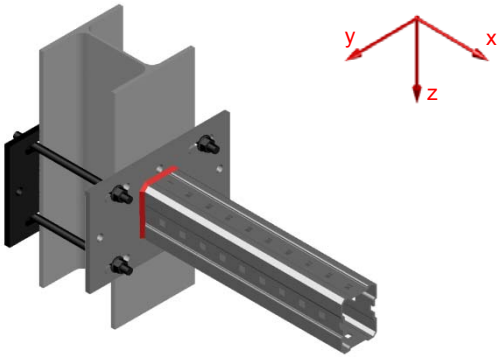


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
49.10	97.70	62.60	62.60	94.80	94.80
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
6.80	6.80	8.22	8.22	8.03	8.03

includes cross section resistance of steel base plate and channel
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. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
346.20	346.20	116.39	116.39	166.28	166.28
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
13.34	13.34	11.91	11.91	10.28	10.28

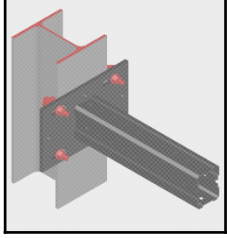
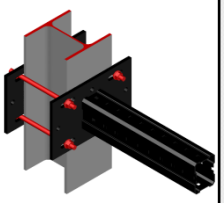
Interaction:

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

MIC-S120-CH-500-2000 Bracket - Steel

Validity:

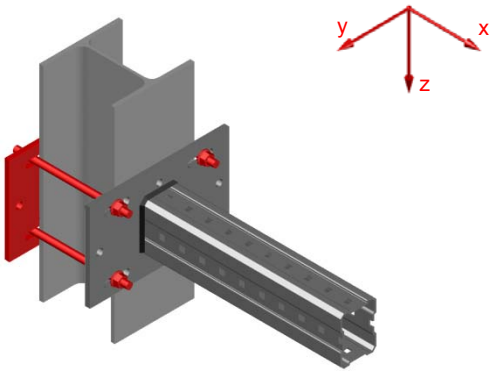
- Temperature limits: -30°C (-22°F) to +93°C (200°F).
- Published allowable loads for applications are based on static loading conditions. Non-static forces, including those resulting from thermal or other expansion must be taken into account during design.

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 and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm..

3. Base plate and through bolts - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
150.80	Not decisive	19.00	19.00	19.00	19.00
+Mx,Rd [kNm]	**-Mx,Rd [kNm]**	**+My,Rd [kNm]**	**-My,Rd [kNm]**	**+Mz,Rd [kNm]**	**-Mz,Rd [kNm]**
2.57	2.57	10.71	10.71	12.44	12.44

includes cross section resistance of steel base plate and channel

Interaction:

Normal force interaction:

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

Shear force interaction:

$$\sqrt{\left(\frac{F_{y,Ed}}{F_{y,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2 + \left(\frac{F_{z,Ed}}{F_{z,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)}\right)^2} + \frac{M_{x,Ed}}{M_{x,Rd} \times \left(1 - \frac{F_{x,Ed}}{F_{x,Rd}}\right)} \leq 1$$

Important note: The resistance of steel girder on which connector MIC-SA-MAH is mounted must be checked appropriately by the client. For determination of connector resistances the steel girder is considered to be rigid.

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