

MI SYSTEM

BU Installation Systems Installation Technical Manual Technical Data MI System

Version 2.1 10.2018



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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.



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Product	Designation	Item number	Page
MI Syst	em girders (chan	nels) - section prop	erties
	MI-90 3m MI-90 6m	304798 304799	7 7
B - Contraction	MI-120 3m MI-120 6m	304800 304801	7 7
MI System con	nectors		
3/16" (8) 2-15/16" (75) 5-11/16" (1 3-3,6" (85)	45) MIC-BA	2174677	9
3-3/8" (85) 5-11/16" (145)	(145) MIC-BAH	2179532	15
100 - 75 8 - 192	MIC-90-UH	2179533	23
100 75 MI-120	MIC-120-UH	2179534	31
140-75	MIC-90-L	304805	39
140 50 315	MIC-90-L-AP	305710	43
	MIC-T	304807	47
	MIC-90-LH	2165050	53
a constraint and	MIC-90-E	304809	57
and the second s	MIC-120-E	304810	61

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Product	Designation	Item number	Page
MI System conn	ectors		
5 130 912.5 00	MIC-U-MA	304806	65
MI System base	material connec	tors - concrete	
N N N N N N N N N N N N N N N N N N N	MIC-C90-AA	304825	69
9-1/16" (230) 5-1/2" (140) MI-90 11/16" (17.88) 9-1/16"	MIC-C90-DH	2174661	73
9-1/16' (230) 5-1/2' (140) MI-120 9/16'' (15) 7'' 1/170 9-1/16	MIC-C120-DH	2174662	77
3-15/16' (100) 3-15/16' (100) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	MIC-C90-UH	2179535	81
1/2" (12.6) 1/2" (12.6) 1/4" (8) 1/4" (8)	557	2174664	87
MI System base	material connec	tors - structural ste	el profiles
M1-50-	MIC-S90-AA	304811	91
5-1/2' (140) MI-90 1/2' (12) MI-90 1/2' (12) 5-1/6' 1/2' (12) 5-1/2' (12) 5-1/2	MIC-S90-AH	2174665	97
5-1/2" (140) - 1/2" (12) M1-90 9(16" (14) 11/16"> 1/2" (12) 9(16" (14) 11/16"> 1/2" (12) 9(16" (14) 11/16"> 1/2" (12)	MIC-S90-BH	2174666	105
5-1/2" (140) MI-80 J/6" (14) J/6" (17,564) J/10" (17,564)	MIC-S90-CH	2174667	113
5-1/2" (140) MI-120 9(16' (14) 11/16'52-1/2" (17)x64)	MIC-S120-AH	2174668	121



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Product	Designation	Item number	Page
MI System base	material connecto	rs - structural st	eel profiles
5-1/2" (140 MI-120 19/16" (14) 10/16" (14) 11/16" 11/16" 11/16"	MIC-S120-BH	2174669	129
5-1/2" (140) MI-120 MI-	MIC-S120-CH	2174670	137
9/16' (14) 1/2' (12) 3-1/9' (00) 1/4' (0) 3-15/16' (10) 3-15/16' (10) 11/152+1/2' (17:64)	MIC-SA-MAH	2174671	145
8/16" (14) 1/2" (12) 3-1/8" (80) 3-1/8" (80) 3-15/16" (100) 11/16" (2-1/2" (12) 3-15/16" (100) 11/16" (2-1/2" (12) 11/16" (2-1/2" (12) 11/16" (2-1/2" (12) 11/16" (2-1/2" (12) 11/16" (12) 1	MIC-SB-MAH	2174672	155
9/16' (14) 1/2'' (12) 3-1/6'' (08) 3-15/16'' (10) 1/15'' (156) 1/15'' (156) 1/15'' (156) 1/15'' (156)	MIC-SC-MAH	2174673	165
	MI-DGC 90	233860	175
	MI-DGC 120	233861	179
MI System brac	kets - concrete		
	MIC-C90-DH- 500 MIC-C90-DH- 750 MIC-C90-DH-1000 MIC-C90-DH-1500 MIC-C90-DH-2000	2203573 2203574 2203575	183
230 1778 278 330	MIC-C120-DH- 50 MIC-C120-DH- 75 MIC-C120-DH-100 MIC-C120-DH-150 MIC-C120-DH-200	0 2203578 0 2203579 0 2203580	187
MI System brac	kets - structural ste	el profiles	
B 15 15 17x64	MIC-S90-AH- 500 MIC-S90-AH- 750 MIC-S90-AH-1000 MIC-S90-AH-1500 MIC-S90-AH-2000	2203583 2203584 2203585	191
B V 15 17x64	MIC-S90-BH- 500 MIC-S90-BH- 750 MIC-S90-BH-1000 MIC-S90-BH-1500 MIC-S90-BH-2000	2203588 2203589 2203590	199

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Product	Designation	Item number	Page
MI System brac	ckets - structural stee	el profiles	
B 15 155 17X64	MIC-S90-CH- 500 MIC-S90-CH- 750 MIC-S90-CH-1000 MIC-S90-CH-1500 MIC-S90-CH-2000	2203592 2203593 2203594 2203595 2203595	207
5-1/2" (140) Mi-120 9:19" (14) 9:19" (12) 9:19" (14) 11/10" (12) 9:19" (14) 11/10" (12) 11/10" (12)	MIC-S120-AH- 500 MIC-S120-AH- 750 MIC-S120-AH-1000 MIC-S120-AH-1500 MIC-S120-AH-2000	2203597 2203598 2203599 2203600 2203601	215
5-1/2' (140) M1-120 9-197 (14) 11/16'32-1/2' (17) 11/16'32-1/2' (17) 6-11/16' (22)	MIC-S120-BH- 500 MIC-S120-BH- 750 MIC-S120-BH-1000 MIC-S120-BH-1500 MIC-S120-BH-2000	2203602 2203603 2203604 2203605 2203606	223
5-1/2" (12) M6-120 10/16" (14) 11/16" 22-1/2" (17)66) 8-11/76" (22)	MIC-S120-CH- 500 MIC-S120-CH- 750 MIC-S120-CH-1000 MIC-S120-CH-1500 MIC-S120-CH-2000	2203607 2203608 2203609 2203570 2203571	231



MI-Girders

Designation		Item number	•	Yield strength 1.5
<u>MI-90 3m</u>		304798	Pe	rmissible stress Recommended capacity limit
MI-90 6m		304799	Characteristic load	Self weight
MI-120 3m MI-120 6m		<u> </u>		Live loads
		304001	-	Action Resistance
Technical data			MI-90	MI-120
For girder MI / cross section ncluding torsion				
			Y Y	V Z
Cross-sectional area	А	[mm ²]	1057.4	1456.24
Channel weight		[kg/m]	9.43	12.64
Material				
vield strength	f _{y,k}	[N/mm ²]	235.0	235.0
permissible stress*	σ_{rec}	[N/mm ²]	167.9	167.9
E-module		[N/mm ²]	210000	210000
hrust-module		[N/mm ²]	81000	81000
Surface				
not dip galvanized		[µm]	75	75
Cross-section values Y-axis				
Axis of gravity	e _y	[mm]	45.0	60.0
noment of inertia	l _y	[cm ⁴]	120.75	280.72
Section modulus	Wy	[cm ³]	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
noment of inertia	l _z	[cm ⁴]	120.75	181.65
Section modulus	Wz	[cm ³]	26.83	40.37
Radius of gyration	i _z	[cm]	3.38	3.53
Data to the torsion				
orsional moment of inertia	lt	[cm⁴]	164.82	314.97
orsional section modulus	W _t	[cm ³]	38.82	71.69

Corrosion protection: Hot-dip galvanized, 75 μm - ASTM A123

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Designation MIC-BA			<u>m number</u> 74677
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 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:







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:







Loading case: Standard	Combinations covered by loading case
Bill of Material for this loading case:For fixation on MI-90 girder1x MIC-BA2174677For fixation on MI-12021746771x MIC-BA21746771x MIC-BA2174677304888MIA-EH120MIA-EH90 remains unused	Connector used for Connecting MI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle





Design loading capacity - 3D	1/2
Method	
Vield sterright Design bad Capacity limit Design bad Line bad Action Repistance	
Limiting components of capacity evaluated	d in following tables:
1. Connection system including connector, hardware and affected p	ortion of MI-90 girders, per FEA simulation
	Installation Technical Manual - Technical Data - MI syster



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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

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

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

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













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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

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



Designation MIC-BAH			m number 79532
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)	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \ \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$\mathbf{G} = 80769 \frac{N}{mm^2}$
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:







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:





Standard	Double One Side	Double Both Sides		
Loading case: S	Standard		Combinations covered by load	ding case
Bill of Material f For fixation on M 1x MIC-BAH For fixation on M 1x MIC-BAH 1x MIA-EH120 MIA-EH90 remai	217953 I-120 217953 30488		Connector used for Connecting MI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle	
Recommende	ed loading cap	acity - simplifie	d for most common applie	cations
Method				
Vield strength Permissible stress Characteristic load Setf weight Live load Action Resistan	Recommended capacity limit		capacity limits.	[kN] [kN] 4.07 8.59 are individual one directional maximal For any combinations of multiple design values and their corresponding
Design loadir	ng capacity - 3	D		1/2
Method				
Veid stergth Design back Self-august 1.5 Live back Action Resistant	Design load capacity limit e			
Limiting com	ponents of cap	oacity evaluate	d in following tables:	
1. Connection system	n, including connector,	hardware and affected p	ortion of MI-90 girders, per FEA simulatio	n
			Installation Technical Manual - T	echnical Data - MI systen



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

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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:

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



Standard	Double One Side	Double Both Sides	
Loading case: D	Oouble One Side		Combinations covered by loading case
For fixation on M 2x MIC-BAH 1x MIA-TP 1xMI-EH90 and For fixation on M 2x MIC-BAH 1x MIA-TP 2x MIA-EH120	217953 305707 1xMIA-EH-P rema <u>I-120</u> 217953 305707	2 ain unused	Connector used in pair for Connecting MI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle



Design loading capacity - 3D	1/2
Method	
Veid storegh Design bad Design bad Design bad Design bad Design bad Design bad Acton Resistance	
Limiting components of capacity evaluated	d in following tables:
1. Connection system, including connector, hardware and affected p	portion of MI-90 girders, per FEA simulation
	Installation Technical Manual Technical Data MI syst



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

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

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

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



Standard	Double One Side	Double Both Sides	
Loading case: D	Oouble Both Sides	6	Combinations covered by loading case
For fixation on MI-S 2x MIC-BAH 1x MIA-TP 1x MI-EH90 and M unused For fixation on MI- 2x MIC-BAH 1x MIA-EH120 1x MIA-TP	2179532 305707 IIA-EH-P remain		Connector used in pair for Connecting 2xMI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle
Recommende	ed loading cap	acity - simplifie	ed for most common applications
Method			v 🔨 x







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

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**





Designation MIC-90-UH		lte	<u>m number</u> 2179533
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.

MI-90	8			92
Hardwa	re inclu	ded per	conne	ctor
		Ŷ		8
1x	2x	1x	1x	3x

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:



Installation Technical Manual - Technical Data - MI system



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:**







Loading case: Standard		Combinations covere	d by loading case
For fixation on MI-120 1x MIC-90-UH 21	179533 179533 304888	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





Installation Technical Manual - Technical Data - MI system



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

Summary of design loads*

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

1. Steel connector



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

includes cross section resistance of steel plate and contact pressure Interaction: $F_{x,Ed} = F_{x,Ed} = F_{z,Ed} = M_{x,Ed}$

¹ x.Ed	y.Ed	$\frac{1}{z.Ed}$	$\frac{\mathbf{W}\mathbf{x}.\mathbf{Ed}}{\mathbf{z}} < 1$
F _{x.Rd}	F _{y.Rd}	F _{z.Rd}	M _{x.Rd}



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 26

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



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

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

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



F_{x.Rd} F_{z.Rd}

Installation Technical Manual - Technical Data - MI system

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Installation Technical Manual - Technical Data - MI system



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

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
nteraction	:				-

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

2. Individual Welds



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system

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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

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Designation MIC-120-UH		Ite	m number 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	

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.

MI-120	100 .			20
Hardwa	re inclu	ded per	connec	ctor
	Ĩ	0		9
1x	2x	1x	1x	Зx

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 Élasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations

Instruction For Use:



Installation Technical Manual - Technical Data - MI system



Possible loadi	ng 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:**







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







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

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

2. Welds



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

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

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

+Fx,Rd [kN] 336.02 +Mx,Rd [kNm]

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

Interaction:

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 34

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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



+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:

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

4. Easy hand screw- in connection MIC-90-U to M

ll90/120-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:

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 35

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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.



Design loading capacity - 3D

Summary of design loads*

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

1. Individual Steel connector



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

F _{x.Ed}	F _{y.Ed}	F _{z.Ed}	$\frac{M_{x.Ed}}{1} < 1$
F _{x.Rd}	F _{v.Rd}	F _{z.Rd}	$M_{x.Rd} \leq 1$

2. Individual Welds



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system

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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.



Design loading capacity - 3D



* Explanation how to apply resistance values

 F_{7} , Rd = 9.00 kN

 F_{x} ,Rd = 2.59 kN

 F_{7} , Rd = 9.00 kN

 F_{x} , Rd = 2.59 kN

+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:

F _{x.Ed}	Fy.Ed	F _{z.Ed}	$\frac{M_{x.Ed}}{M_{x.Ed}} \leq 1$
			M _{x Rd}

4. Easy hand screw for double connection - resistance	values for	one conne	ctor* in cor	nection MI	C-90-U to N	1190/120-cha
	+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]
Z	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:

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 38

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Designation MIC-90-L			m number 04805
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:



Installation Technical Manual - Technical Data - MI system



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:



Installation Technical Manual - Technical Data - MI system





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







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

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.





[kN]	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
	[kN]	[kN]	[kN]	[kN]	[kN]
14.10	63.30	25.30	25.30	32.00	32.00
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[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		
1	Interaction:							

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

Installation Technical Manual - Technical Data - MI system

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Hardware included per connector

MIC-90-L-AP Connector



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 Medulus of Electicity and Shear Medul	up are according to EN 1002	1.1 and used for all Europed	o coloulationa	

Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations

Instruction For Use:





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	
•	EN 1993-1-8	structural elements Eurocode 3: Design of steel structures –Part 1-8: Design	03.2012
•	EN 10025-2	of joints Hot rolled products of structural steels- Part 2: technical	03.2012
		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:



Installation Technical Manual - Technical Data - MI system





Loading case: Standard	Combinations covered by loading case	
Bill of Material for this loading case:1x MIC-90-L-AP305710Components not included2x MIA-EH-P3048912x MIA-CH90304889For fixation on MI-90 girder2x MIA-EH90304887For fixation on MI-1202x MIA-EH120304888	Connector used for Connecting MI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle	







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

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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
14.10	63.30	25.30	25.30	32.00	32.00
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[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
nteraction.					

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 46

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Designation MIC-T			<u>m number</u> 04807
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:			

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 Élasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calculations

Instruction For Use:





Possible loading cases					
MIC-T 90-90					

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	00.2011
		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.







]
Combinations covered

Bill of Material for this loading case:

Angle incl. all components **1x MIC-T (pair)**



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







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





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

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

Interaction:

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



MIC-T 90-90	MIC-T 120-120	
Loading case: M	IIC-T 120-120	Combinations covered by loading case
Bill of Material for the	nis loading case:	Connector used For perpendicular

Angle incl. all components **1x MIC-T (pair)**



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





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





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

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

Interaction:

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



Designation MIC-90-LH			m number 65050
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)	$f_y = 250 \frac{N}{mm^2}$	$f_u = 480 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$\mathbf{G} = 80769 \frac{N}{mm^2}$
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) Values for Modulus of Elasticity and Shoar Modulus	$f_y = 640 \ \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	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:



Installation Technical Manual - Technical Data - MI system



Possible loadii	ng cases	
Standard		

Design criteria used for loading capacity

Methodology:

- Analytic calculation
- Finite element analysis
- Hardware tests

Standards and codes:

EN 1991-1-1Eurocode 1: Actions on structures – Part 1-1: General actions – densities, self-weight, imposed loads for buildings09.2011EN 1993-1-1Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings03.2012
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 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 655Pipe Supports04.2008

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:**









Loading case: Standard	Combinations covered by loading case		
Bill of Material for this loading case: 1x MIC-90-LH connector 2048107 Connector incl. all connecting hardware	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



Design loading capacity - 3D	1/2
Method	
Visid strength Design load Design load 1.5 Live load Action Resistance	
Limiting components of capacity evaluated	
1. Connection system, including connector, hardware and affect	ted portion of MI girders, per FEA simulation
	Installation Technical Manual - Technical Data - MI system



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

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

Interaction:

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

Installation Technical Manual - Technical Data - MI system

2/2



ess, min.
15

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 $\frac{N}{mm^2}$

Instruction For Use:



Installation Technical Manual - Technical Data - MI system



MIC-90-E



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, ٠ including those resulting from thermal or other expansion must be taken into account during design. Simplified drawing:







Recommended loading capacity - simplified for most common applications







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

Summary of design loads*

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

1. Steel connector



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system

2/2



Hardware included per connector

4x

1x

MI-120

8x

4x

MIC-120-E Connector

esignation IIC-120-E			em number 304810	
Corrosion protection:				250
Material	HDG per	Zinc thickness, min. (µm)		
Connector, Plate	ISO 1461	55		10000T
Bolt; Nut	ISO 1461	40; 45		S 109 100

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) Values for Modulus of Elasticity and Shear Modul	$f_y = 640 \ \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	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 calculatio

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:**





Installation Technical Manual - Technical Data - MI system



1x MIC-120-E

304810

Connector incl. all connecting hardware

MIC-120-E Connector



Connector used for extension of MI-120 girder



Recommended loading capacity - simplified for most common applications





Installation Technical Manual - Technical Data - MI system



MIC-120-E Connector

Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F). ٠
- 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

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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
118.82	118.82	19.00	19.00	28.00	28.00
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[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 MIC-U-MA			<u>m number</u> 04806
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

130 ø1;	2.5			97.5
Hardwa	are inc	luded	per c	onnector
			١	ALCONTRACTOR OF
2x	1x	1x	2x	1x

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:



Installation Technical Manual - Technical Data - MI system



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:**



Installation Technical Manual - Technical Data - MI system



MIC-U-MA Connector



 Bill of Material for this loading case:

 1x MIC-U-MA (pair)
 304806

 Connector incl. all connecting hardware

 Image: Connector incl. all connecting hardware

Recommended loading capacity - simplified for most common applications







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

Summary of design loads*

 F_{α}

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 con

y2	+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	FEA simulat -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

x-direction of the inclined profile in plane x/z.

Interaction:

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

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 68

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			<u>m number</u> 4825
Corrosion protection:			
Material	HDG per	Zinc thickness, min. (µm)	
Connector, Plate	ISO 1461	55	
Bolt; Nut	ISO 1461	40; 45	

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) Values for Modulue of Electicity and Shorr Modul	$f_y = 640 \ \frac{N}{mm^2}$	$f_u = 800 \ \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	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:



Installation Technical Manual - Technical Data - MI system



Possible loadi	ng 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:



Installation Technical Manual - Technical Data - MI system







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

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



31.60	31.60	31.60	31.60
d +My,Rd] [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.81	1.81	1.00	1.00
] [kNm]] [kNm] [kNm]] [kNm] [kNm] [kNm]

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

Interaction:

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

Installation Technical Manual - Technical Data - MI system

2/<u>2</u>


esignation IIC-C90-DH			<u>m numbei</u> 74661
Corrosion protection:			
Material	HDG per	Zinc thickness, min. (μm)	
Connector, Plate	ISO 1461	55	
Bolt; Nut	ISO 1461	40; 45	

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 Modu	us are according to EN 1993-	1-1 and used for all Eurocod	e calculations	

Instruction For Use:





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:**



Installation Technical Manual - Technical Data - MI system





Loading case: Standard	Combinations covered by loading case
Bill of Material for this loading case: 1x MIC-C90-DH 2174661 Connector incl. all connecting hardware	Baseplate connector used for a perpendicular connection of an MI-90 girder to concrete

Recommended loading capacity - simplified for most common applications







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

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

Interaction:

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

Installation Technical Manual - Technical Data - MI system



Designation		Ite	m number
MIC-C120-DH		21	74662
Corrosion protection:			
Material	HDG per	Zinc thickness, min. (μm)	
Connector, Plate	ISO 1461	55	
Bolt; Nut	ISO 1461	40; 45	

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:







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:**







Loading case: Standard	Combinations covered by loading case	
Bill of Material for this loading case: Angle incl. all components 1x MIC-C120-DH 2174662	Baseplate connector used for a perpendicular connection of an MI-90 girder to concrete	

Recommended loading capacity - simplified for most common applications



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





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

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

Interaction:

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



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 80



Designation			m number
MIC-C90-UH		21	79535
Corrosion protection:			
Material	HDG per	Zinc thickness, min. (µm)	
Connector, Plate	ISO 1461	55	
Bolt; Nut	ISO 1461	40; 45	

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.



2x M12-F-SL-WS 3/4" MIA-OH90

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) Values for Modulus of Elasticity and Shear Modul	$f_y = 640 \ \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$

ulus are according to EN 1993-1-1

Instruction For Use:





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:**



Installation Technical Manual - Technical Data - MI system



 \pm Fz,rec.

[kN]

16.66

MIC-C90-UH Base Material Connector - Concrete



Recommended loading capacity - simplified for most common applications





Installation Technical Manual - Technical Data - MI system



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

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

Interaction:

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

2. Welds - per analytical calculation



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system



Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
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Standard	

Design loading capacity - 3D

3. Screws – per analytical calculation



+Fx,R [kN]	d -Fx,F [kN	3 ·	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.25	2.25	36.29	36.29	36.29	36.29
+Mx,R [kNm	,	3.	I -My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
1.20	1.20	0.00	0.00	0.00	0.00

Interaction:

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

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Designation		Ite	<u>m number</u>
MIC-CU-MAH		21	74664
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

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.

Yield strength	Ultimate strength	Modulus of elasticity	Shear modulus
$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \ \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
$f_y = 640 \ \frac{N}{mm^2}$	$f_u = 800 \ \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
	$f_y = 235 \frac{N}{mm^2}$	$f_y = 235 \frac{N}{mm^2}$ $f_u = 360 \frac{N}{mm^2}$	$f_y = 235 \frac{N}{mm^2}$ $f_u = 360 \frac{N}{mm^2}$ $E = 210000 \frac{N}{mm^2}$

Instruction For Use:







Possible loadii	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:**



Installation Technical Manual - Technical Data - MI system





Loading case: Standard	Combinations covered by loading case	
Bill of Material for this loading case: Angle incl. all components 1x MIC-CU-MAH 2174664	Baseplate connector used for an angled connection of an MI-90 girder to concrete (bracing)	



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





Validity:

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- 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

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	nteraction:					

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

Interaction:

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

Installation Technical Manual - Technical Data - MI system

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Y = 170 mm

Hardware included per connector

2x

300

2x

MIC-S90-AA Base Material Connector - Steel

Designation MIC-S90-AA			em number 14811	
Corrosion protection:				
Material	HDG per	Zinc thickness, min. (µm)		
Connector, Plate	ISO 1461	55		
Bolt; Nut	ISO 1461	40; 45		
Weight: 1370 g incl. components				

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) Values for Modulus of Electicity and Shear Modul	$f_y = 640 \ \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	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:



Installation Technical Manual - Technical Data - MI system



Possible loadi	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:**







Recommended loading capacity - simplified for most common applications





Installation Technical Manual - Technical Data - MI system



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

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



and anecle	na anected portion of Mi-30 girder, per I LA Sindiadon							
+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:

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

2. Welds - per analytical calculation



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system



Validity:

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Design loading capacity - 3D

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.

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{vEd} * ey}{\dot{M}_{zRd}} + \frac{F_{zEd} * ez}{\dot{M}_{yRd}} + \frac{M_{vEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

- Shear Interaction Equation is <u>only</u> valid for TENSILE $F_{x, Ed}$ loads ($F_{x, Ed} > 0$). Equation is <u>not</u> valid for

compressive $F_{x, Ed}$ loads ($F_{x, Ed} < 0$). - For Shear interaction, user must ADDITIONALLY verify: $F_{x, Ed} / F_{x, Rd} < 1$.

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

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Hardware included per connector

MIC-S90-AH

(12)

1v 🕥

M12-F-SL

8-11/16" (220)

MIC-S90-AH Base Material Connector - Steel

Designation MIC-S90-AH			rem number
Corrosion protection:			
Material	HDG per	Zinc thickness, min. (μm)	5-1/2" (140)
Connector, Plate	ISO 1461	55	101-50
Bolt; Nut	ISO 1461	40; 45	
Veight:			9/16" (1 11/16"x2-1/2"
511 g incl. components			
5			B = 280 mm
Description:			X = 200 mm
			Y = 140 mm

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.

Yield strength	Ultimate strength	Modulus of elasticity	Shear modulus
$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \ \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$\mathbf{G} = 80769 \frac{N}{mm^2}$
$f_y = 640 \ \frac{N}{mm^2}$	$f_u = 800 \ \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
	$f_y = 235 \frac{N}{mm^2}$	$f_y = 235 \frac{N}{mm^2}$ $f_u = 360 \frac{N}{mm^2}$	$f_y = 235 \frac{N}{mm^2}$ $f_u = 360 \frac{N}{mm^2}$ $E = 210000 \frac{N}{mm^2}$

Instruction For Use:

For both loading cases



For clamped loading case

For boxed loading case (not attached to the packaging)



Installation Technical Manual - Technical Data - MI system



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:**



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Loading case: CI	Loading case: Clamped		Combinations covered by loading case		
Bill of Material for thi Connector incl. all asso components 1x MIC-S90-AH Beam clamps 4x MI-SGC M16	•		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





Installation Technical Manual - Technical Data - MI system



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- 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

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
nteraction					

```
\frac{F_{\mathbf{x}Ed}}{F_{\mathbf{x}Rd}} + \frac{F_{\mathbf{y}}Ed}{F_{\mathbf{y}}Rd} + \frac{F_{\mathbf{z}}Ed}{F_{\mathbf{z}}Rd} + \frac{M_{\mathbf{x}Ed}}{M_{\mathbf{x}Rd}} + \frac{M_{\mathbf{y}}Ed}{M_{\mathbf{y}}Rd} + \frac{M_{\mathbf{z}}Ed}{M_{\mathbf{z}}Rd} \leq 1
```

2. Welds – per analytical calculation



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

Interaction:

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

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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. 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

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.

$$\frac{F_{x \, Ed}}{F_{x \, Rd}} + \frac{F_{y \, Ed} * ey}{\dot{M}_{z \, Rd}} + \frac{F_{z \, Ed} * ez}{\dot{M}_{y \, Rd}} + \frac{M_{y \, Ed}}{M_{y \, Rd}} + \frac{M_{z \, Ed}}{M_{z \, Rd}} \le 1$$

Shear force interaction:

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

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

Installation Technical Manual - Technical Data - MI system





Loading case: Boxed	Combinations covered by loading case
Bill of Material for this loading case: Connector incl. all associated components1x MIC-S90-AH2174665Base plate1x MIB-SAH1x MIB-SAH2174674Threaded rods cut to particular length 4x AM16x1000 8.8 HDGm419104Lock washer8x LW M16 HDG plus washer 2185343Nut8x M16-F nut304767	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





Installation Technical Manual - Technical Data - MI system



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

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



	•	U	<i>,</i> .		
+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:

 $\frac{F_{\mathbf{x}} \mathbf{E} \mathbf{d}}{F_{\mathbf{x}} \mathbf{R} \mathbf{d}} + \frac{F_{\mathbf{y}} \mathbf{E} \mathbf{d}}{F_{\mathbf{y}} \mathbf{R} \mathbf{d}} + \frac{F_{\mathbf{z}} \mathbf{E} \mathbf{d}}{F_{\mathbf{z}} \mathbf{R} \mathbf{d}} + \frac{M_{\mathbf{x}} \mathbf{E} \mathbf{d}}{M_{\mathbf{x}} \mathbf{R} \mathbf{d}} + \frac{M_{\mathbf{y}} \mathbf{E} \mathbf{d}}{M_{\mathbf{y}} \mathbf{R} \mathbf{d}} + \frac{M_{\mathbf{z}} \mathbf{E} \mathbf{d}}{M_{\mathbf{z}} \mathbf{R} \mathbf{d}} \leq 1$

2. Welds - per analytical calculation



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

Interaction:

 $\frac{F_{xEd}}{F_{xRd}} + \frac{F_{yEd}}{F_{yRd}} + \frac{F_{zEd}}{F_{zRd}} + \frac{M_{xEd}}{M_{xRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \leq 1$

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 103



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. 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	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.

$$\frac{F_{x Ed}}{F_{x Rd}} + \frac{F_{y Ed} * ey}{\dot{M}_{z Rd}} + \frac{F_{z Ed} * ez}{\dot{M}_{y Rd}} + \frac{M_{y Ed}}{M_{y Rd}} + \frac{M_{z Ed}}{M_{z Rd}} \le 1$$

Shear force interaction:

- Shear Interaction Equation is <u>only</u> 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: $F_{x, Ed} / F_{x, Rd} < 1$.

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 104



Zinc thickness, min. (μm)		5-1/2" (140)
55		MI-90
40; 45		
	55	55

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.

Yield strength	Ultimate strength	Modulus of elasticity	Shear modulus
$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \ \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
$f_y = 640 \ \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
	$f_y = 235 \frac{N}{mm^2}$	$f_y = 235 \frac{N}{mm^2}$ $f_u = 360 \frac{N}{mm^2}$	$f_y = 235 \frac{N}{mm^2}$ $f_u = 360 \frac{N}{mm^2}$ $E = 210000 \frac{N}{mm^2}$

Instruction For Use:

For both loading cases



For clamped loading case

For boxed loading case (not attached to the packaging)



Installation Technical Manual - Technical Data - MI system





Possible loadi	ng 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:**



Installation Technical Manual - Technical Data - MI system





Loading case: Clamped	Combinations covered by loading case
Bill of Material for this loading case: Connector incl. all associated components 1x MIC-S90-BH 2174666 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 165-235mm.

Recommended loading capacity - simplified for most common applications







capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.



Installation Technical Manual - Technical Data - MI system



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

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

Interaction:

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

2. Welds - per analytical calculation



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system


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. 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	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.

$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{v,Ed} * ey}{\dot{M}_{z,Rd}} + \frac{F_{z,Ed} * ez}{\dot{M}_{y,Rd}} + \frac{M_{v,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \le 1$$

Shear force interaction:

١

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

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 109





Loading case: Boxed	Combinations covered by loading case
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 HDGm 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 165-235mm.

Recommended loading capacity - simplified for most common applications







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

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					-

Interaction:

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



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system



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





+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.

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{vEd} * ey}{\dot{M}_{zRd}} + \frac{F_{zEd} * ez}{\dot{M}_{vRd}} + \frac{M_{vEd}}{M_{vRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

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

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

Installation Technical Manual - Technical Data - MI system



1

M12-F-SL

WS 3/4

MIC-S90-CH

MIC-S90-CH Base Material Connector - Steel

Designation //IC-S90-CH			ltem number	
Corrosion protection:				B
Material	HDG per	Zinc thickness, min (µm)	ı.	5-1/2" (140)
Connector, Plate	ISO 1461	55		MI-90
Bolt; Nut	ISO 1461	40; 45		6-1/8"
Veight:				9/16" (14) 11/16"x2-1/2" (17x64)
0624 g incl. compone	nts			
J				B = 430 mm
Description:				X = 350 mm
•				Y = 290 mm
lilti Hot-dipped galvani MI-90 girder to a stee			-	Hardware included per connect

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.

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 1995-1-1 and used for all Eurocode Calc

Instruction For Use:

For both loading cases



For clamped loading case

For boxed loading case (not attached to the packaging)



Installation Technical Manual - Technical Data - MI system



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:**



Installation Technical Manual - Technical Data - MI system





Bill of Material for this loading case: 1x MIC-S90-CH 2174667 Hardware not included in packaging:	Connector used for a perpendicular connection of MI-90 girder to flange
Beam clamps	of structural steel profiles.
4x MI-SGC M16 387398	For flange width 235-300mm.

Recommended loading capacity - simplified for most common applications





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



Installation Technical Manual - Technical Data - MI system



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

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

Interaction:

F _{xEd}	F _{y.Ed}	F _{z.Ed}	M _{xEd}	M _{y.Ed}	$\frac{M_{z.Ed}}{1} \leq 1$
				M _{y.Rd}	

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 116



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. Beam Clamps - per analytical calculation



with $e_v = e_z = 0.070$ m

+Fx,R [kN]		-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
102.4	0	Not decisive	10.31	10.31	10.31	10.31
+Mx,F [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.

$$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{F_{v,Ed} * ey}{\dot{M}_{z,Rd}} + \frac{F_{z,Ed} * ez}{\dot{M}_{y,Rd}} + \frac{M_{v,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \le 1$$

Shear force interaction:

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

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

Installation Technical Manual - Technical Data - MI system





Loading case: Boxed	Combinations covered by loading case
Bill of Material for this loading case:1x MIC-S90-CH2174667Hardware not included in packaging:Base plate1x MIB-SCH2174676Threaded rods cut to particular length4x AM16x1000 8.8 HDGm419104Lock washer8x LW M16 HDG plus washer 2185343Nut8x M16-F nut304767	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





Installation Technical Manual - Technical Data - MI system



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

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:

F _{xEd}	Fy.Ed	F _{z.Ed}	M _{xEd}	My.Ed	$\frac{M_{z.Ed}}{1} \leq 1$
FxRd	Fy.Rd	F _{z.Rd}	M _{xRd}	My.Rd	M _{z.Rd}



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system



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



+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.

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{yEd}*ey}{\dot{M}_{zRd}} + \frac{F_{zEd}*ez}{\dot{M}_{yRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

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

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

Installation Technical Manual - Technical Data - MI system



Designation			<u>n number</u>
MIC-S120-AH		21	74668
Corrosion protection:			
Material	HDG per	Zinc thickness, min. (µm)	
Connector, Plate	ISO 1461	55	
Bolt; Nut	ISO 1461	40; 45	
Veight:			

7911 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.

Yield strength	Ultimate strength	Modulus of elasticity	Shear modulus
$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \ \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
$f_y = 640 \ \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
	$f_y = 235 \frac{N}{mm^2}$	$f_y = 235 \frac{N}{mm^2}$ $f_u = 360 \frac{N}{mm^2}$	$f_y = 235 \frac{N}{mm^2}$ $f_u = 360 \frac{N}{mm^2}$ $E = 210000 \frac{N}{mm^2}$

Values for Modulus of Elasticity and Shear Modulus are according to EN 1993-1-1 and used for all Eurocode calcu

Instruction For Use:

For both loading cases:



For clamped loading case

For boxed loading case (not attached to the packaging)



Installation Technical Manual - Technical Data - MI system





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:



Installation Technical Manual - Technical Data - MI system





Loading case: Clamped	Combinations covered by loading case	
Bill of Material for this loading case: 1x MIC-S120-AH 2174668 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 75-165mm.	

Recommended loading capacity - simplified for most common applications









Installation Technical Manual - Technical Data - MI system



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

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

Interaction:

```
\frac{F_{\mathbf{x}\mathbf{Ed}}}{F_{\mathbf{x}\mathbf{Rd}}} + \frac{F_{\mathbf{y}}\underline{Ed}}{F_{\mathbf{y}}\underline{Rd}} + \frac{F_{\mathbf{z}}\underline{Ed}}{F_{\mathbf{z}}\underline{Rd}} + \frac{M_{\mathbf{x}\mathbf{Ed}}}{M_{\mathbf{x}\mathbf{Rd}}} + \frac{M_{\mathbf{y}}\underline{Ed}}{M_{\mathbf{y}}\underline{Rd}} + \frac{M_{\mathbf{z}}\underline{Ed}}{M_{\mathbf{z}}\underline{Rd}} \leq 1
```

2. Welds - per analytical calculation



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system



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. 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	7.48	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.

$$\frac{F_{x \, Ed}}{F_{x \, Rd}} + \frac{F_{v \, Ed} * ey}{\dot{M}_{z \, Rd}} + \frac{F_{z \, Ed} * ez}{\dot{M}_{y \, Rd}} + \frac{M_{v \, Ed}}{M_{y \, Rd}} + \frac{M_{z \, Ed}}{M_{z \, Rd}} \le 1$$

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: $F_{x, Ed} / F_{x, Rd} < 1$.

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

Installation Technical Manual - Technical Data - MI system





Loading case: Boxed	Combinations covered by loading case		
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 HDGm 419104 Lock washer 8x LW M16 HDG plus washer 2185343 Nut 8x M16-F nut 304767	Connector used for a perpendicular connection of MI-120 girder to flange of structural steel profiles. For flange width 75-165mm.		







×	±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					

capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.



Installation Technical Manual - Technical Data - MI system



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

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

Interaction:

```
\frac{F_{\mathbf{x}\mathbf{Ed}}}{F_{\mathbf{x}\mathbf{Rd}}} + \frac{F_{\mathbf{y}\cdot\mathbf{Ed}}}{F_{\mathbf{y}\cdot\mathbf{Rd}}} + \frac{F_{\mathbf{z}\cdot\mathbf{Ed}}}{F_{\mathbf{z}\cdot\mathbf{Rd}}} + \frac{M_{\mathbf{x}\cdot\mathbf{Ed}}}{M_{\mathbf{x}\cdot\mathbf{Rd}}} + \frac{M_{\mathbf{y}\cdot\mathbf{Ed}}}{M_{\mathbf{y}\cdot\mathbf{Rd}}} + \frac{M_{\mathbf{z}\cdot\mathbf{Ed}}}{M_{\mathbf{z}\cdot\mathbf{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:					
$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{yEd}}{F_{yRd}} + \frac{F_{zEd}}{F_{zRd}} + \frac{M_{xEd}}{M_{xRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$					

Installation Technical Manual - Technical Data - MI system



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. 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	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.

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{vEd}*ey}{\dot{M}_{zRd}} + \frac{F_{zEd}*ez}{\dot{M}_{vRd}} + \frac{M_{vEd}}{M_{vRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

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

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

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Designation MIC-S120-BH			m number 1 74669
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.



Instruction For Use:

For both loading cases:



For clamped loading case

For boxed loading case (not attached to the packaging)



Installation Technical Manual - Technical Data - MI system





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:



Installation Technical Manual - Technical Data - MI system





Loading case: Clamped	Combinations covered by loading case	
Bill of Material for this loading case: 1x MIC-S120-BH 2174669 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 165-235mm.	

Recommended loading capacity - simplified for most common applications







interaction formulas



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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

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

Interaction:

```
\frac{F_{xEd}}{F_{xRd}} + \frac{F_{yEd}}{F_{yRd}} + \frac{F_{zEd}}{F_{zRd}} + \frac{M_{xEd}}{M_{xRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1
```



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

Interaction:

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

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Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 132



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. 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	7.48	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.

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{vEd} * ey}{M_{zRd}} + \frac{F_{zEd} * ez}{M_{yRd}} + \frac{M_{vEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

١

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

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 133





Loading case: Boxed	Combinations covered by loading case
Bill of Material for this loading case:1x MIC-S120-BH2174669Hardware not included in packaging:Base plate1x MIB-SBH2174675Threaded rods cut to particular length4191044x AM16x1000 8.8 HDGm419104Lock washer8x LW M16 HDG plus washer8x LW M16 HDG plus washer2185343Nut304767	Connector used for a perpendicular connection of MI-120 girder to flange of structural steel profiles. For flange width 165-235mm.









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

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					-

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

2. Welds - per analytical calculation



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

Interaction:

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{yEd}}{F_{yRd}} + \frac{F_{zEd}}{F_{zRd}} + \frac{M_{xEd}}{M_{xRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \leq 1$$

Installation Technical Manual - Technical Data - MI system



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



+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.

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{yEd}*ey}{\dot{M}_{zRd}} + \frac{F_{zEd}*ez}{\dot{M}_{yRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

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

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

Installation Technical Manual - Technical Data - MI system



Designation MIC-S120-CH		Item number 304820		
Corrosion protection:				
Material	HDG per	Zinc thickness, min. (μm)		
Connector, Plate	ISO 1461	55		
Bolt; Nut	ISO 1461	40; 45		
Voight:				

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 $\frac{N}{mm^2}$

Instruction For Use:

For both loading cases:



For clamped loading case

For boxed loading case (not attached to the packaging)



Installation Technical Manual - Technical Data - MI system





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:



Installation Technical Manual - Technical Data - MI system





Loading case: Clamped	Combinations covered by loading case		
Bill of Material for this loading case:1x MIC-S120-CH2174670Hardware not included in packaging: Beam clamps 4x MI-SGC M16387398	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





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

capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.



Installation Technical Manual - Technical Data - MI system



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

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

Interaction:

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{yEd}}{F_{vRd}} + \frac{F_{zEd}}{F_{zRd}} + \frac{M_{xEd}}{M_{xRd}} + \frac{M_{yEd}}{M_{vRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

2. Welds - per analytical calculation



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

Interaction:

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

Installation Technical Manual - Technical Data - MI system



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. 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

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.

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{vEd} * ey}{\dot{M}_{zRd}} + \frac{F_{zEd} * ez}{\dot{M}_{yRd}} + \frac{M_{vEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{yRd}} \le 1$$

Shear force interaction:

- Shear Interaction Equation is <u>only</u> valid for TENSILE $F_{x, Ed}$ loads ($F_{x, Ed} > 0$). Equation is <u>not</u> valid for

$$\int_{V}^{F} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Ed}}{F_{y, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{integraduon}_{x, Rd}}{F_{z, Rd} \times \left(1 - \frac{F_{x, Ed}}{F_{x, Rd}}\right)} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{Shear} \operatorname{Shear} \left(1 - \frac{F_{x, Rd}}{F_{x, Rd}}\right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \operatorname{Shear} \left(1 - \frac{F_{x, Rd}}{F_{x, Rd}}\right)^{+} \left(1 - \frac{F_{x, Rd}}{F_{x, Rd}}\right)^{+} \right)^{+} \left(\frac{\sigma \operatorname{Shear} \left(1 - \frac{F_{x, Rd}}{F_{x, Rd}}\right)^{+} \left(1 - \frac{F_{x, Rd}}{F_{x, Rd}}\right)^{+} \right)^{+} \left(1 - \frac{F_{x, Rd}}{F_{x, Rd}}\right)^{+} \left(1 - \frac{F_{x,$$

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MIC-S120-CH Base Material Connector - Steel



Loading case: Boxed	Combinations covered by loading case
Bill of Material for this loading case:1x MIC-S120-CH2174670Hardware not included in packaging:Base plate1x MIB-SCH21746761x MIB-SCH2174676Threaded rods cut to particular length4x AM16x1000 8.8 HDGm419104Lock washer8x LW M16 HDG plus washer2185343Nut8x M16-F nut304767	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





Installation Technical Manual - Technical Data - MI system



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

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

Interaction:

```
\frac{F_{\mathbf{x}\mathbf{Ed}}}{F_{\mathbf{x}\mathbf{Rd}}} + \frac{F_{\mathbf{y}}\underline{Ed}}{F_{\mathbf{y}}\underline{Rd}} + \frac{F_{\mathbf{z}}\underline{Ed}}{F_{\mathbf{z}}\underline{Rd}} + \frac{M_{\mathbf{x}}\underline{Ed}}{M_{\mathbf{x}}\underline{Rd}} + \frac{M_{\mathbf{y}}\underline{Ed}}{M_{\mathbf{y}}\underline{Rd}} + \frac{M_{\mathbf{z}}\underline{Ed}}{M_{\mathbf{z}}\underline{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:						

$$\frac{\frac{1}{2} \frac{xEd}{F_xRd}}{F_xRd} + \frac{\frac{1}{2} \frac{xEd}{F_zRd}}{F_zRd} + \frac{\frac{M_xEd}{M_xRd}}{M_xRd} + \frac{\frac{M_yEd}{M_zRd}}{M_yRd} + \frac{\frac{M_zEd}{M_zRd}}{M_zRd} \le 1$$

Installation Technical Manual - Technical Data - MI system



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



+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.

$$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{yEd} * ey}{\dot{M}_{zRd}} + \frac{F_{zEd} * ez}{\dot{M}_{yRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

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

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

Installation Technical Manual - Technical Data - MI system

Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 144


Designation MIC-SA-MAH			<u>m number</u> 74671
Corrosion protection:			
Material	HDG per	Zinc thickness, min. (µm)	
Connector, Plate	ISO 1461	55	
Bolt; Nut	ISO 1461	40; 45	
Weight			

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.

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 Modulu	us are according to EN 1993-	1-1 and used for all Eurocod	e calculations	

Instruction For Use:

For both loading cases:



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



Installation Technical Manual - Technical Data - MI system





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:**



Installation Technical Manual - Technical Data - MI system





Loading case: Clamped	Combinations covered by loading case		
Bill of Material for this loading case:MIC-SA-MAH2174671Hardware not included in packaging:Beam clamps4x MI-SGC M16387398	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





Installation Technical Manual - Technical Data - MI system



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

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 α x-axis (M_{α 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:

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

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:

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



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.

Installation Technical Manual - Technical Data - MI system



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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

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	
Z Z	+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]	
all and a	2.30	2.30	0.00	0.00	0.00	0.00	
	are v Values inclu	alid for any de verificati	bracing ang	le.	about the a	xx-axis (M _{ax})	
M	Interaction:		-	F	14		
F _{ax}		,	,	,	+ $\frac{M_{x EC}}{M_{x RC}}$		
	Use of $F_{\alpha x}$: I determinate $F_{x, Ed, \alpha} = F_{\alpha} x$ $Fz'_{Ed, \alpha} = F_{\alpha} x$	load compo			ce axis (<i>ax</i>)	is known,	
	$F_{Z_{Ed,\alpha}} = F_{\alpha}$ $M'_{x,Ed} = M_{ax}$	c sin (α)				1	
						f, α F_{α} F_{α} $F_{x, Ed, \alpha}$	
		ist be check	ed appropri	ately by the	client. For	nector MIC-SA-MAH determination of igid.	l is



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

Summary of design loads*

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



+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[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 $e_y = e_z = 0.070 \text{ m}$

Shear force interaction:

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

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

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

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

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.

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.

Installation Technical Manual - Technical Data - MI system







Loading case: Boxed	Combinations covered by loading case
Bill of Material for this loading case:1x MIC-SA-MAH2174671Hardware not included in packaging:Base plate1x MIB-SAH2174674Threaded rods cut to particular length4x AM16x1000 8.8 HDGm419104Lock washer8x LW M16 HDG plus washer2185343Nut8x M16-F nut304767	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





Installation Technical Manual - Technical Data - MI system



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

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 α x-axis (M_{α 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:

$$\left(\frac{F_{x E d \alpha}}{F_{x R d}^{'}}\right)^{2} + \left(\frac{F_{z E d \alpha}}{F_{z R d}^{'}}\right)^{2} + \frac{F_{v E d}}{F_{y R d}^{'}} + \frac{M_{x E d}}{M_{x R d}^{'}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:

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

 $F_{x, Ed, \alpha}$

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.

Installation Technical Manual - Technical Data - MI system



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

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

Note: Design Strength values for girder Torsion about the α x-axis (M_{α x}) are valid for any bracing angle.

Values include verification of hexagonal bolt

Interaction:

$$\frac{F_{x E d \alpha}}{F_{x R d}} + \frac{F_{z E d \alpha}}{F_{z R d}} + \frac{F_{y E d}}{F_{y R d}} + \frac{M_{x E d}}{M_{x R d}} \le 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:

$$\begin{split} F_{x, Ed, \alpha} &= F_{\alpha} \times \cos \left(\alpha \right) \\ Fz'_{Ed, \alpha} &= F_{\alpha} \times \sin \left(\alpha \right) \\ M'_{x, Ed} &= M_{ax} \end{split}$$

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.

Installation Technical Manual - Technical Data - MI system



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

Summary of design loads*

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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.





Designation MIC-SB-MAH			m number 74672
Corrosion protection:			
Material	HDG per	Zinc thickness, min. (µm)	
Connector, Plate	ISO 1461	55	
Bolt; Nut	ISO 1461	40; 45	
Mainht.			

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.

Yield strength	Ultimate strength	Modulus of elasticity	Shear modulus
$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \ \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
$f_y = 640 \ \frac{N}{mm^2}$	$f_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
	$f_y = 235 \frac{N}{mm^2}$	$f_y = 235 \frac{N}{mm^2}$ $f_u = 360 \frac{N}{mm^2}$	$f_y = 235 \frac{N}{mm^2}$ $f_u = 360 \frac{N}{mm^2}$ $E = 210000 \frac{N}{mm^2}$

Instruction For Use:

For both loading cases:



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



Installation Technical Manual - Technical Data - MI system





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:**



Installation Technical Manual - Technical Data - MI system





Loading case: Clamped	Combinations covered by loading case
Bill of Material for this loading case: MIC-SB-MAH 2174672 Hardware not included in packaging: Beam clamps 4x MI-SGC M16 387398	Connector used for an angled connection of MI-90 to structural steel profiles (bracing). For flange width 165-235mm.







Installation Technical Manual - Technical Data - MI system



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

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 $\alpha x\text{-axis}~(M_{\alpha x})$ 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:

$$\left(\frac{F_{x E d \alpha}}{F_{x R d}^{'}}\right)^{2} + \left(\frac{F_{z E d \alpha}}{F_{z R d}^{'}}\right)^{2} + \frac{F_{v E d}}{F_{y R d}^{'}} + \frac{M_{x E d}}{M_{x R d}^{'}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:

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



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.

Installation Technical Manual - Technical Data - MI system



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

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





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

Summary of design loads*

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

$$\begin{split} & M_{x, Ed} = M_{\alpha x} \, \mathbf{x} \, \cos \, (\alpha) \\ & M_{z, Ed} = M_{\alpha x} \, \mathbf{x} \, \sin \, (\alpha) \end{split}$$

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



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

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

with $e_y = e_z = 0.070 \text{ m}$

Shear force interaction:

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

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

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

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

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.

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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4.40

90°

60°

MIC-SB-MAH Base Material Connector - Steel



Bill of Material for this loading case: 1x MIC-SB-MAH 2174672	Connector used for
Hardware not included in packaging: Base plate 1x MIB-SBH 2174675 Threaded rods cut to particular length 4x AM16x1000 8.8 HDGm 419104 Lock washer 8x LW M16 HDG plus washer 2185343 Nut 8x M16-F nut 304767	an angled connection of MI-90 to structural steel profiles (bracing). For flange width 165-235mm.









Installation Technical Manual - Technical Data - MI system



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

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 α x-axis (M_{α 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:

$$\left(\frac{F_{x E d \alpha}}{F_{x R d}^{'}}\right)^{2} + \left(\frac{F_{z E d \alpha}}{F_{z R d}^{'}}\right)^{2} + \frac{F_{v E d}}{F_{y R d}^{'}} + \frac{M_{x E d}}{M_{x R d}^{'}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:

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



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.

Installation Technical Manual - Technical Data - MI system



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

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

1						
	+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
	[KIN]	[KIN]	[KIN]	[KIN]	[KIN]	[KIN]
	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 α x-axis (M_{α x}) are valid for any bracing angle.

Values include verification of hexagonal bolt

Interaction:

 $\frac{F_{xEd\,\alpha}}{F_{xRd}} + \frac{F_{zEd\,\alpha}}{F_{zRd}} + \frac{F_{yEd}}{F_{yRd}} + \frac{M_{xEd}}{M_{xRd}} \le 1$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:

 $\begin{aligned} F_{x, Ed, \alpha} &= F_{\alpha} \times \cos \left(\alpha \right) \\ Fz'_{Ed, \alpha} &= F_{\alpha} \times \sin \left(\alpha \right) \\ M'_{x, Ed} &= M_{ax} \end{aligned}$

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.

Installation Technical Manual - Technical Data - MI system



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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

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.





Designation MIC-SC-MAH			m number 74673
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.

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 Modul	us are according to EN 1993-	1-1 and used for all Eurocod	e calculations	

Instruction For Use:

For both loading cases:



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



Installation Technical Manual - Technical Data - MI system





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:**



Installation Technical Manual - Technical Data - MI system





Loading case: Clamped	Combinations covered by loading case		
Bill of Material for this loading case:MIC-SC-MAH2174673Hardware not included in packaging:Beam clamps4x MI-SGC M16387398	Connector used for an angled connection of MI-90 to structural steel profiles (bracing). For flange width 235-300mm.		







Installation Technical Manual - Technical Data - MI system



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

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 $\alpha x\text{-axis}~(M_{\alpha x})$ 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:

$$\left(\frac{F_{x E d \alpha}}{F_{x R d}^{'}}\right)^{2} + \left(\frac{F_{z E d \alpha}}{F_{z R d}^{'}}\right)^{2} + \frac{F_{v E d}}{F_{y R d}^{'}} + \frac{M_{x E d}}{M_{x R d}^{'}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:

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



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.

Installation Technical Manual - Technical Data - MI system



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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

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
Z	+Mx,Rd [kNm]	-Mx,Rd [kNm]	+My,Rd [kNm]	-My,Rd [kNm]	+Mz,Rd [kNm]	-Mz,Rd [kNm]
de la	2.30	2.30	0.00	0.00	15.80	15.80
	are v Values inclu	alid for any de verificati	bracing ang	le.	about the a	xx-axis (M _{ax})
M	Interaction		F	Г	14	
Fax		,	,	+ $\frac{F_{vEd}}{F_{yRd}}$,	
	Use of $F_{\alpha x}$: determinate $F_{x, Ed, \alpha} = F_{\alpha} x$ $Fz'_{Ed, \alpha} = F_{\alpha} x$	load compo			ce axis (αx)	is known,
	$Fz_{Ed} = F_{\alpha}$	κ sin (α)				
	<i>x,EU</i> – <i>UX</i>					F_{α}
		ust be check	ked appropri	iately by the	client. For	nector MIC-SA-MAH determination of igid.



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

Summary of design loads*

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

$$\begin{split} & M_{x, Ed} = M_{\alpha x} \, \mathbf{x} \, \cos \, (\alpha) \\ & M_{z, Ed} = M_{\alpha x} \, \mathbf{x} \, \sin \, (\alpha) \end{split}$$

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



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

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

with $e_y = e_z = 0.070 \text{ m}$

Shear force interaction:

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

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

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

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

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.

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.

Installation Technical Manual - Technical Data - MI system



90°

60°

45

MIC-SC-MAH Base Material Connector - Steel



Bill of Material for this loading case:1x MIC-SC-MAH2174673Hardware not included in packaging:Base plate1x MIB-SCH2174676Threaded rods cut to particular length4x AM16x1000 8.8 HDGm419104Lock washer8x LW M16 HDG plus washer2185343Nut8x M16-F nut304767	Loading case: Boxed	Combinations covered by loading case
	1x MIC-SC-MAH2174673Hardware not included in packaging:Base plate1x MIB-SCH2174676Threaded rods cut to particular length4x AM16x1000 8.8 HDGm419104Lock washer8x LW M16 HDG plus washer2185343Nut	an angled connection of MI-90 to structural steel profiles (bracing).







Installation Technical Manual - Technical Data - MI system



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

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 α x-axis (M_{α 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:

$$\left(\frac{F_{x E d \alpha}}{F_{x R d}^{'}}\right)^{2} + \left(\frac{F_{z E d \alpha}}{F_{z R d}^{'}}\right)^{2} + \frac{F_{v E d}}{F_{y R d}^{'}} + \frac{M_{x E d}}{M_{x R d}^{'}} \leq 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:

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



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.

Installation Technical Manual - Technical Data - MI system



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

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

Note: Design Strength values for girder Torsion about the α x-axis (M_{α x}) are valid for any bracing angle.

Values include verification of hexagonal bolt

Interaction:

$$\frac{F_{x E d \alpha}}{F_{x R d}} + \frac{F_{z E d \alpha}}{F_{z R d}} + \frac{F_{y E d}}{F_{y R d}} + \frac{M_{x E d}}{M_{x R d}} \le 1$$

Use of $F_{\alpha x}$: In case only the force along the brace axis (αx) is known, determinate load components as follows:

 $\begin{aligned} F_{x, Ed, \alpha} &= F_{\alpha} \times \cos \left(\alpha \right) \\ Fz'_{Ed, \alpha} &= F_{\alpha} \times \sin \left(\alpha \right) \\ M'_{x, Ed} &= M_{ax} \end{aligned}$

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.

Installation Technical Manual - Technical Data - MI system



4/4

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

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.





Designation MI-DGC 90	<u>m number</u> 3860		
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:



Installation Technical Manual - Technical Data - MI system





Possible loading cases			
Standard			

Design criteria used for loading capacity

Methodology:

- Analytic calculation
- Hardware tests

Standards and codes:

٠	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:**







Loading case: Standard		Combinations covered by loading case		
BOM:			Connector used for horizontal connection	
Connector incl. all a	associated		of MI-90 or MIQ-90 to the flanges	
components MI-DGC 90	233860		of structural steel profiles.	
	233000		Flange thickness 3-36mm.	
Associated MI System girders (channels)		Flange linckness 5-50mm.		
MI-90 3m	304799			
MI-90 6m	304798			

Recommended loading capacity - simplified for most common applications







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

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.



Installation Technical Manual - Technical Data - MI system



Designation MI-DGC 120	<u>m number</u> 3861		
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	
Mainht.			

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:



Installation Technical Manual - Technical Data - MI system





Possible loadi	ng cases	
Standard		

Design criteria used for loading capacity

Methodology:

- Analytic calculation
- Hardware tests

Standards and codes:

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

Software:

- Mathcad 15.0
- Microsoft Excel

Environmental conditions:

- indoors, outdoors
- static loads
- no fatigue loads

Simplified drawing:




MI-DGC 120 Base Material Connector - Steel



Loading case: Standard		Combinations covered by loading case		
BOM: Connector incl. all as components			Connector used for horizontal connection of MI-120 to the flanges	
MI-DGC 120 Associated MI Syste	233861 m girders (channels)		of structural steel profiles. Flange thickness 3-36mm.	
MI-120 3m	304800			
MI-120 6m	304801			

Recommended loading capacity - simplified for most common applications







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.



Design loading capacity - 3D

Summary of design loads*

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



Installation Technical Manual - Technical Data - MI system



MIC-C90-DH-500-2000 Bracket - Concrete

Designation		Ite	em number	
MIC-C90-DH- 500			2203572	230
MIC-C90-DH- 750			2203573	178
MIC-C90-DH-1000			2203574	0 15
MIC-C90-DH-1500			2203575	
MIC-C90-DH-2000			2203576	
Corrosion protection:				178
Material	HDG per	Zinc thickness, min. (μm)		
Bracket	ISO 1461	55		Ø18
Weight:				
MIC-C90-DH- 500	11086g			
MIC-C90-DH- 750	13473g			Hardware included per conne
MIC-C90-DH-1000	15860g			
MIC-C90-DH-1500	20634g			
MIC-C90-DH-2000	25407g			State of the second
Submittal text:				Designation L[mm]

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.

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

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



Possible loadi	ng 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:



Installation Technical Manual - Technical Data - MI system













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:

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

2. Welds - per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
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:					
Fx.Ed Fy.Ed Fz.Ed Mx.Ed My.Ed Mz.Ed					

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

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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

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 propert

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 Modul	us are according to EN 1993-	1-1 and used for all Eurocod	e calculations	

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





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



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:



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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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
132.00	132.97	62.60	62.60	94.80	94.80
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
6.80	6.80	10.00	10.00	8.72	8.72

includes cross section resistance of steel base plate and channel Interaction:

F _{x.Ed}	F _{y.Ed}	F _{z.Ed}	M _{x.Ed}	M _{y.Ed}	M _{z.Ed}
F _{x.Rd} +	F _{v.Rd}	Fz.Rd	M _{x.Rd}	M _{v.Rd}	M _{z.Rd} S1

2. Welds – pe	er analytical	calculation
E	si anaiyaoai	ouroundion



+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
346.20	346.20	116.39	116.39	166.28	166.28
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
13.34	13.34	11.91	11.91	10.28	10.28

Interaction:

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



Designation MIC-S90-AH- 500 MIC-S90-AH- 750 MIC-S90-AH-1000 MIC-S90-AH-1500 MIC-S90-AH-2000			tem number 2203582 2203583 2203584 2203585 2203586		B 15 155 220
Material	HDG per	Zinc thickness, min			17x64
		(μm)		D = 280mm	
Bracket	ISO 1461	55		B = 280mm X = 200mm	-
Weight: MIC-S90-AH- 500 MIC-S90-AH- 750 MIC-S90-AH-1000 MIC-S90-AH-1500 MIC-S90-AH-2000	11773g 14160g 16546g 21320g 26094g			Y = 140mn Hardware	n included per connector
Submittal text:				Designatio	
Hilti Hot-dipped galvaniz The fixation could be don First principle is clamping structural steel profile.	ne by two differen	t principles.		MIC-S90-/ MIC-S90-/ MIC-S90-/ MIC-S90-/ MIC-S90-/	AH- 750 750 AH-1000 1000 AH-1500 1500
Material properties					
Material	١	/ield 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) Values for Modulus of Elasticity a		$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$ 1 and used for all Eurocod	$E = 210000 \frac{N}{mm^2}$ e calculations	G = 80769 $\frac{N}{mm^2}$

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Instruction For Use:

No IFU attached to the packaging

For clamped loading case

For boxed loading case (not attached to the packaging)





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 Designation L[mm] MIC-S90-AH- 500 500 MIC-S90-AH- 750 750 12 MIC-S90-AH-1000 1000 MIC-S90-AH-1500 1500 MIC-S90-AH-2000 2000 B = 280mm 155 220 X = 200mm Y = 140mm Ø14 60x13

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Loading case: Clamped		Combinations covered by loading case
BOM: Brackets: 1x MIC-S90-AH- 500 MIC-S90-AH- 750 MIC-S90-AH-1000 MIC-S90-AH-1500 MIC-S90-AH-2000 Beam clamps 4x MI-SGC M16	2203582 2203583 2203584 2203585 2203586 387398	Pre-fab bracket for perpendicular connection to structural steel profiles flanges. Flange width 75-165mm.





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

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



- J-	,		, -	-,, -		
+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 cro	oss section r	esistance of	f steel base	plate and c	hannel	
$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{yE}}{F_{yE}}$	-++	· + _	$\frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.E}}{M_{z.E}}$	<u>8d</u> ≤ 1 Rd		
+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	

2. Welds – per analytical calculation

^r xRd ^r yRd ^r z.Rd ^M xRd ^M y.Rd ^M z.Rd						
	+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:					
$\frac{F_{\mathbf{x}}Ed}{F_{\mathbf{x}}Rd} + \frac{F_{\mathbf{y}}Ed}{F_{\mathbf{y}}Rd} + \frac{F_{\mathbf{z}}Ed}{F_{\mathbf{z}}Rd} + \frac{M_{\mathbf{x}}Ed}{M_{\mathbf{x}}Rd} + \frac{M_{\mathbf{y}}Ed}{M_{\mathbf{y}}Rd} + \frac{M_{\mathbf{z}}Ed}{M_{\mathbf{z}}Rd} \leq 1$						

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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

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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
0.84	0.84	7.37	7.37	4.25	4.25

Interaction: Normal force interaction:

$$\frac{F_{xEd}}{F_{xRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

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

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.

Installation Technical Manual - Technical Data - MI system



MIC-S90-AH-500-2000 Bracket - Steel



Loading case: Boxed		Combinations covered by loading case
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-1500 2203586 Base plate 1x MIB-SBH 1x MIB-SBH 2174675 Threaded rods cut to particular length 4x AM16x1000 8.8 HDGm 419104 Lock washer 8x LW M16 HDG plus washer 2185343 Nut 8x M16-F nut 304767	C F	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	y x +Fx,rec. ±Fy,rec. ±Fz,rec. [kN] [kN] [kN]					
Vield strength Permissible stress Characteristic load Beferweight Live Load	z 67.07 13.77 ±My,rec. [kNm] 4.05					
Action Resistance	These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.					





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

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]
y x	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
4	includes cro		resistance of			hannel
	$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{yEd}}{F_{yRd}}$	-++-	$\frac{M_{xEd}}{M_{xRd}} + \frac{M_{y.E}}{M_{y.E}}$	-+	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
× z	+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					
	F _{xEd} F _{v.E}	Ed Fz.Ed	M.E.	M ET M		

Installation Technical Manual - Technical Data - MI system



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

3/3

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



a	lion					
	+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:

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

Shear force interaction:

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

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.



Designation MIC-S90-BH- 500 MIC-S90-BH- 750 MIC-S90-BH-1000 MIC-S90-BH-1500 MIC-S90-BH-2000			tem number 2203587 2203588 2203589 2203590 2203591		B 15 155
Corrosion protection: Material	UDC nor	Zine thickness, mis		AL.	220
wateriai	HDG per	Zinc thickness, mir (µm)			17x64
Bracket	ISO 1461	55		B = 350mn	-
Weight:				X = 300mn Y = 210mn	
MIC-S90-BH- 500	13666g			1 - 21011	1
MIC-S90-BH- 750	16052g			Hardware	included per connector
MIC-S90-BH-1000	18439g				Contraction of the second
MIC-S90-BH-1500	23213g				
MIC-S90-BH-2000	27986g				C.C. Cold
Submittal text: Hilti Hot-dipped galvaniz The fixation could be dor First principle is clamping structural steel profile.	ne by two differe	nt principles.		Designati MIC-S90- MIC-S90- MIC-S90- MIC-S90- MIC-S90- MIC-S90-	BH- 500 500 BH- 750 750 BH-1000 1000 BH-1500 1500
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) Values for Modulus of Elasticity a		$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$

city and She ar modulus are according to

Instruction For Use:

No IFU attached to the packaging

For clamped loading case

For boxed loading case (not attached to the packaging)





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

В

Software:

- Ansys 18.2
- Microsoft Excel
- Mathcad 15

Validity:

- Temperature limits: -30'
- Published allowable loa
- including those resulting Simplified drawing:

B = 350mm

- X = 300mm
- Y = 210mm

Designation	L[mm]	
MIC-S90-BH- 500	500	
MIC-S90-BH- 750	750	ALL
MIC-S90-BH-1000	1000	
MIC-S90-BH-1500	1500	·
MIC-S90-BH-2000	2000	17×64

conditions. Non-static forces, en into account during design.

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Loading case: Clamped Combinations covered by loading case BOM: Pre-fab bracket for perpendicular connection to structural steel Brackets: profiles flanges. 1x MIC-S90-BH- 500 2203587 Flange width 165-235mm. 2203588 MIC-S90-BH- 750 MIC-S90-BH-1000 2203589 2203590 MIC-S90-BH-1500 MIC-S90-BH-2000 2203591 Beam clamps 4x MI-SGC M16 387398





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

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...



	+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
x	72.00	101.54	57.20	57.20	57.20	57.20
	+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
	4.50	4.50	6.08	6.08	6.08	6.08

includes cross section resistance of steel base plate and channel **Interaction:**

FxEd	Fy.Ed	F _{z.Ed}	M _{xEd}	M _{y.Ed}	$\frac{M_{z.Ed}}{1} \leq 1$
				M _{y.Rd}	



+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
285.11	285.11	116.39	116.39	116.39	116.39
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
9.54	9.54	6.84	6.84	6.84	6.84

Interaction:

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

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Validity:

- Temperature limits: -30°C (-22°F) to +93°C (200°F).
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Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm...



_						
	+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:

$$\frac{F_{xEd}}{F_{xRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

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

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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MIC-S90-BH-500-2000 Bracket - Steel



Loading case: Boxed	Combinations covered by loading case
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 1x MIB-SBH 2174675 Threaded rods cut to particular length 4x AM16x1000 8.8 HDGm 4x AM16x1000 8.8 HDGm 419104 Lock washer 8x LW M16 HDG plus washer 2185343 Nut 304767	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]				
Vield strength		49.93	13.34	13.34				
Permissible stress Characteristic load Soft weight Characteris			±My,rec. [kN]					
Suf weight Live load			4.05					
Action Resistance	These values are individual one directional maximal use design values and their corresponding interaction		any combinations of	of multiple directions,				





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

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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
74.90	101.54	57.20	57.20	57.20	57.20
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
4.50	4.50	6.08	6.08	6.08	6.08

includes cross section resistance of steel base plate and channel Interaction:

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

2. Welds - per analytical calculation



+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
285.11	285.11	116.39	116.39	116.39	116.39
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
9.54	9.54	6.84	6.84	6.84	6.84

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

Installation Technical Manual - Technical Data - MI system



Validity:

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- 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

3/3

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:

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

Shear force interaction:

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

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.



Designation MIC-S90-CH- 500 MIC-S90-CH- 750 MIC-S90-CH-1000 MIC-S90-CH-1500 MIC-S90-CH-2000		lte	em number 2203592 2203593 2203594 2203595 2203596		B 15 155
Corrosion protection:				A.	220
Material	HDG per	Zinc thickness, min. (μm)			17x64
Bracket	ISO 1461	55		B = 430n	
Weight:				X = 350n Y = 290n	
MIC-S90-CH- 500 MIC-S90-CH- 750 MIC-S90-CH-1000 MIC-S90-CH-1500 MIC-S90-CH-2000	15808g 18195g 20582g 25355g 30129g				re included per connector
Submittal text:				Designa MIC So	tion L[mm])-CH- 500 500
Hilti Hot-dipped galvaniz			al steel profiles.)-CH- 750 750
The fixation could be don First principle is clamping structural steel profile.			on flange of the	MIC-S9	0-CH-1000 1000 0-CH-1500 1500 0-CH-2000 2000
Material properties					
Material	Y	/ield strength	Ultimate strength	Modulus of elasticity	Shear modulus
Plate S235JR - (DIN EN10025-2) or DD11 MOD (EN 10111)		$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$\mathbf{G} = 80769 \frac{N}{mm^2}$
Girder DD11 MOD (EN 10111) Values for Modulus of Elasticity of		$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	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 Fo

ase For boxed loading case (not attached to the packaging)



Installation Technical Manual - Technical Data - MI system



Possible loading cases					
Clamped					

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:

Simplified drawing:



Installation Technical Manual - Technical Data - MI system





Loading case: Clamped	Combinations covered by loading case	
BOM: Brackets: 1x MIC-S90-CH- 500 2203592 MIC-S90-CH- 750 2203593 MIC-S90-CH-1500 2203594 MIC-S90-CH-1500 2203595 MIC-S90-CH-2000 2203596 Beam clamps 387398	Pre-fab bracket for perpendicular connection to structural steel profiles flanges. Flange width 235-300mm.	



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Validity:

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Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing 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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
44.90	101.54	57.20	57.20	57.20	57.20
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
4.50	4.50	6.08	6.08	6.08	6.08

includes cross section resistance of steel base plate and channel Interaction:

FxEd	Fy.Ed	F _{z.Ed}	M _{xEd}	My.Ed	$+\frac{M_{z.Ed}}{1} \leq 1$
F _{xRd}	Fy.Rd	F _{z.Rd}	M _{xRd}	My.Rd	M _{z.Rd}

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

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Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing and independent from the cantilever length. So they are valid equally for L=500, 750, 1000, 1500, 2000mm...



+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:

$$\frac{F_{xEd}}{F_{xRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

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

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.

Installation Technical Manual - Technical Data - MI system





Loading case: Boxed		Combinations covered by loading case
BOM: Brackets: 1x MIC-S90-CH- 500 MIC-S90-CH- 750 MIC-S90-CH-1500 MIC-S90-CH-1500 MIC-S90-CH-2000 Base plate 1x MIB-SBH Threaded rods cut to particula 4x AM16x1000 8.8 HDGm Lock washer 8x LW M16 HDG plus washer Nut 8x M16-F nut	2203592 2203593 2203595 2203596 2174675 r length 419104 2185343 304767	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	y x	±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]			
Videl strength Permissible stress Characteristic load Start weight Live load	z	31.27	12.67 ±My,rec. [kNm] 4.05	12.67			
Action Resistance	These values are individual one directional maximal use design values and their corresponding interaction		any combinations	of multiple directions,			



Installation Technical Manual - Technical Data - MI system



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 resulting from thermal or other expansion must be taken into account during design.



Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing 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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
46.90	91.00	57.20	57.20	57.20	57.20
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
4.50	4.50	6.08	6.08	6.08	6.08

includes cross section resistance of steel base plate and channel Interaction:

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

2. Welds - per analytical calculation



+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
285.11	285.11	116.39	116.39	116.39	116.39
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
9.54	9.54	6.84	6.84	6.84	6.84

Interaction:

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

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Validity:

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- 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

3/3

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:

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

Shear force interaction:

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

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.



Designation MIC-S120-AH- 500 MIC-S120-AH- 750 MIC-S120-AH-1000 MIC-S120-AH-1500 MIC-S120-AH-2000			Item number 2203597 2203598 2203599 2203600 2203601		B 155
Corrosion protection:					220
Material	HDG per	Zinc thickness, min (µm)	n.		17x64
Bracket	ISO 1461	55		B = 280mr	
Weight: MIC-S120-AH- 500 MIC-S120-AH- 750 MIC-S120-AH-1000 MIC-S120-AH-1500 MIC-S120-AH-2000	13374g 16562g 19750g 26125g 32500g			X = 200mr Y = 140mr Hardware	
Submittal text: Hilti Hot-dipped galvaniz The fixation could be do First principle is clampin structural steel profile.	ne by two differe	nt principles.	·	MIC-S120 MIC-S120 MIC-S120	on L[mm] D-AH- 500 500 D-AH- 750 750 D-AH-1000 1000 D-AH-1500 1500 D-AH-2000 2000
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)





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, ٠ including those resulting from thermal or other expansion must be taken into account during design.

Simplified drawing:



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Loading case: Clamped	Combinations covered by loading case
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 387398	Pre-fab bracket for perpendicular connection to structural steel profiles flanges. Flange width 75-165mm.



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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

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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
105.20	132.97	62.60	62.60	94.80	94.80
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
6.80	6.80	10.17	10.17	8.03	8.03

includes cross section resistance of steel base plate and channel Interaction:

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

2. Welds – per analytical calculation



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
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:					
$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{y}Ed}{F_{v}Rd} + \frac{F_{z}Ed}{F_{z}Rd} + \frac{M_{x}Ed}{M_{xRd}} + \frac{M_{y}Ed}{M_{v}Rd} + \frac{M_{z}Ed}{M_{z}Rd} \le 1$					

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Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 218



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

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...



+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:

$$\frac{F_{xEd}}{F_{xRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

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

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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Loading case: Boxed		Combinations covered by loading case
MIC-S120-AH- 750 MIC-S120-AH-1000 MIC-S120-AH-1500	2174674 ular length 419104	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	y x [kN] [kN] [kN]				
Vield strength	z 78.13 13.77 13.77				
Permissible stress Characteristic load Ball weight	±My,rec. [kNm]				
Action Resistance	These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.				

Design loading capacity - 3D	1/3
Method	
Comparison Consign total Consign total T.5 Low Kurt Action Comparison C	

Limiting components of capacity evaluated in following tables:

1. Bracket per FEA simulation



3. Base plate and through bolts - per analytical calculation

Installation Technical Manual - Technical Data - MI system



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 ٠ resulting from thermal or other expansion must be taken into account during design.



Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing 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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
117.20	132.97	62.60	62.60	94.80	94.80
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[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_{\mathbf{x}}Ed}{F_{\mathbf{x}}Rd} + \frac{F_{\mathbf{y}}Ed}{F_{\mathbf{y}}Rd} + \frac{F_{\mathbf{z}}Ed}{F_{\mathbf{z}}Rd} + \frac{M_{\mathbf{x}}Ed}{M_{\mathbf{x}}Rd} + \frac{M_{\mathbf{y}}Ed}{M_{\mathbf{y}}Rd} + \frac{M_{\mathbf{z}}Ed}{M_{\mathbf{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:					
$\frac{F_{\mathbf{x}}Ed}{F_{\mathbf{x}}Rd} + \frac{F_{\mathbf{y}}Ed}{F_{\mathbf{y}}Rd} + \frac{F_{\mathbf{z}}Ed}{F_{\mathbf{z}}Rd} + \frac{M_{\mathbf{x}}Ed}{M_{\mathbf{x}}Rd} + \frac{M_{\mathbf{y}}Ed}{M_{\mathbf{y}}Rd} + \frac{M_{\mathbf{z}}Ed}{M_{\mathbf{z}}Rd} \leq 1$					

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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

3/3

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:

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

Shear force interaction:

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

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.



Designation MIC-S120-BH- 500 MIC-S120-BH- 750 MIC-S120-BH-1000 MIC-S120-BH-1500 MIC-S120-BH-2000		2	em number 2203602 2203603 2203604 2203605 2203605		B 15 155 220
Material	HDG per	Zinc thickness, min			
Bracket	ISO 1461	(μm) 55		B = 350mm	17x64
Weight: MIC-S120-BH- 500 MIC-S120-BH- 750 MIC-S120-BH-1000 MIC-S120-BH-1500 MIC-S120-BH-2000 Submittal text: Hilti Hot-dipped galvaniz The fixation could be dor First principle is clamping structural steel profile.	15267g 18455g 21642g 28018g 34393g ed bracket used ne by two differen	as fixed to structu nt principles.		X = 300mn Y = 210mn Hardware Designatic MIC-S120 MIC-S120	n included per connector on L[mm] -BH- 500 500 -BH- 750 750 -BH-1000 1000 -BH-1500 1500
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 Élasticity 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)





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).

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Published allowable loads for applications are based on static loading conditions. Non-static forces, ٠ including those resulting from thermal or other expansion must be taken into account during design. Simplified drawing:







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1.5

MIC-S120-BH-500-2000 Bracket - Steel



Loading case: Clamped	Combinations covered by loading case	
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	Pre-fab bracket for perpendicular connection to structural steel profiles flanges. Flange width 165-235mm.	





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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

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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
71.90	132.97	62.60	62.60	94.80	94.80
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
6.80	6.80	8.80	8.80	8.03	8.03

includes cross section resistance of steel base plate and channel Interaction:

FxEd	Fy.Ed	F _{z.Ed}	M _{xEd}	My.Ed	$\frac{M_{z.Ed}}{1} \leq 1$
				My.Rd	

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:						
$\frac{F_{xEd}}{F_{xRd}} + \frac{F_{yEd}}{F_{yRd}} + \frac{F_{zEd}}{F_{zRd}} + \frac{M_{xEd}}{M_{xRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$						

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Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 226



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

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...



+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
102.40	Not decisive	10.31	10.31	10.31	10.31
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
1.12	1.12	7.37	7.37	6.81	

includes cross section resistance of steel base plate and channel Interaction:

Normal force interaction:

$$\frac{F_{xEd}}{F_{xRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

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

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.

Installation Technical Manual - Technical Data - MI system





Loading case: Boxed	Combinations covered by loading case
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 HDGm 419104 Lock washer 8x LW M16 HDG plus washer 2185343 Nut 304767	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	y x [kN] [kN] [kN]							
Visit strength	z 51.40 13.34 13.34							
Permissible stress Characteristic load Gati weight	±My,rec. [kNm]							
Live toad Action Resistance	These values are individual one directional maximal capacity limits. For any combinations of multiple directions,							
	use design values and their corresponding interaction formulas.							

Design loading capacity - 3D	1/3
Method	
Composition Consign tool Consign tool T.5 Live food T.5 Live food Constrained T.5 Live food	

Limiting components of capacity evaluated in following tables:

1. Bracket per FEA simulation



3. Base plate and through bolts - per analytical calculation

Installation Technical Manual - Technical Data - MI system



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

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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
77.10	132.97	62.60	62.60	94.80	94.80
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
6.80	6.80	9.27	9.27	8.03	8.03

includes cross section resistance of steel base plate and channel Interaction:

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

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

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:						

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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

3/3

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:

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

Shear force interaction:

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

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.



Designation MIC-S120-CH- 500 MIC-S120-CH- 750 MIC-S120-CH-1000 MIC-S120-CH-1500 MIC-S120-CH-2000		2 2 2 2 2	em number 203607 203608 203609 203570 203571	L	B 15 155
Corrosion protection: Material	HDG per	Zinc thickness, min.		A	220
Material	HDG per	zinc trickness, min. (μm)			17x64
Bracket	ISO 1461	55		B = 430mm	
Weight: MIC-S120-CH- 500 MIC-S120-CH- 750 MIC-S120-CH-1000 MIC-S120-CH-1500 MIC-S120-CH-2000 Submittal text: Hilti Hot-dipped galvaniz The fixation could be don First principle is clamping structural steel profile.	ne by two differer	nt principles.		X = 350mm Y = 290mm Hardware Designatic MIC-S120 MIC-S120 MIC-S120 MIC-S120 MIC-S120	included per connector on L[mm] -CH- 500 500 -CH- 750 750 -CH-1000 1000 -CH-1500 1500
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 Élasticity 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)





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, ٠ including those resulting from thermal or other expansion must be taken into account during design. Simplified drawing:



X = 300mm

```
Y = 210mm
```



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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 387398	Pre-fab bracket for perpendicular connection to structural steel profiles flanges. Flange width 235-300mm.	



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- 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

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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
47.70	132.97	62.60	62.60	94.80	94.80
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[kNm]
6.80	6.80	8.03	8.03	8.03	

includes cross section resistance of steel base plate and channel Interaction:

^r xEd	^F y.Ed	rz.Ed	MxEd	My.Ed	Mz.Ed
F _{xRd}	Fy.Rd	F _{z.Rd}	M _{xRd}	M _{y.Rd}	M _{z.Rd}

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

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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

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...



+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:

$$\frac{F_{xEd}}{F_{xRd}} + \frac{M_{yEd}}{M_{yRd}} + \frac{M_{zEd}}{M_{zRd}} \le 1$$

Shear force interaction:

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

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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Loading case: Boxed	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 Hardware not included in packaging: Base plate 1x MIB-SAH 2174674 Threaded rods cut to particular length 4x AM16x1000 8.8 HDGm 419104 Lock washer 8x LW M16 HDG plus washer 2185343 Nut 8x M16-F nut 304767	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	y x [kN] [kN] [kN]							
Yield strength	z 32.73 12.67 12.67							
Permissible stress Characteristic load Live load	± My,rec. [kNm] 5.48							
Action Resistance	These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.							

Design loading capacity - 3D	1/3
Method	
Design load County brief County brief County brief County brief County brief County brief County brief County brief	

Limiting components of capacity evaluated in following tables:

1. Bracket per FEA simulation



3. Base plate and through bolts - per analytical calculation

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Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing 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	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
49.10	97.70	62.60	62.60	94.80	94.80
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNm]	[kNm]	[kNm]	[kNm]	[kNm]	[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_{\mathbf{x}}Ed}{F_{\mathbf{x}}Rd} + \frac{F_{\mathbf{y}}Ed}{F_{\mathbf{y}}Rd} + \frac{F_{\mathbf{z}}Ed}{F_{\mathbf{z}}Rd} + \frac{M_{\mathbf{x}}Ed}{M_{\mathbf{x}}Rd} + \frac{M_{\mathbf{y}}Ed}{M_{\mathbf{y}}Rd} + \frac{M_{\mathbf{z}}Ed}{M_{\mathbf{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:								

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

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 resulting from thermal or other expansion must be taken into account during design.



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:

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

Shear force interaction:

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

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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