MIC-S90-AA
304811

Hilti North America
Installation Technical Manual
Technical Data
MI System

Version 1.2 **08.2017**

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The product technical data 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, values only apply to static loading conditions). Technical data applies to the component only -- suitability and capacity of all other components must be checked separately by the responsible engineer (e.g., other assembly components, attachments, base materials, and building structures).
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 optimum performance
(e.g. avoid 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, codes, and project specific requirements, prior to using them for any specific facility. This book only serves as an aid to interpret the capacity of the components listed, 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 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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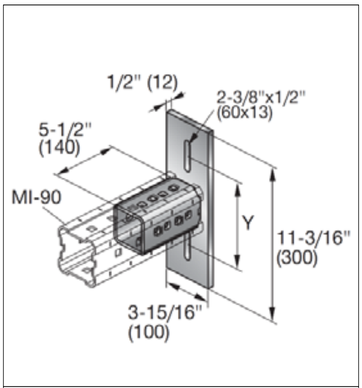
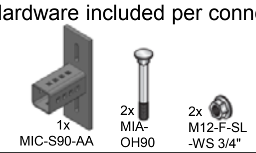
MIC-S90-AA Base Material Connector - Steel

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



Hardware included per connector



Corrosion protection:
Hot dipped galvanized per DIN EN ISO 1461:
Connector: 2.2 mils (55 µm)
Bolt: 1.8 mils (45 µm)
Nut: 1.8 mils (45 µm)

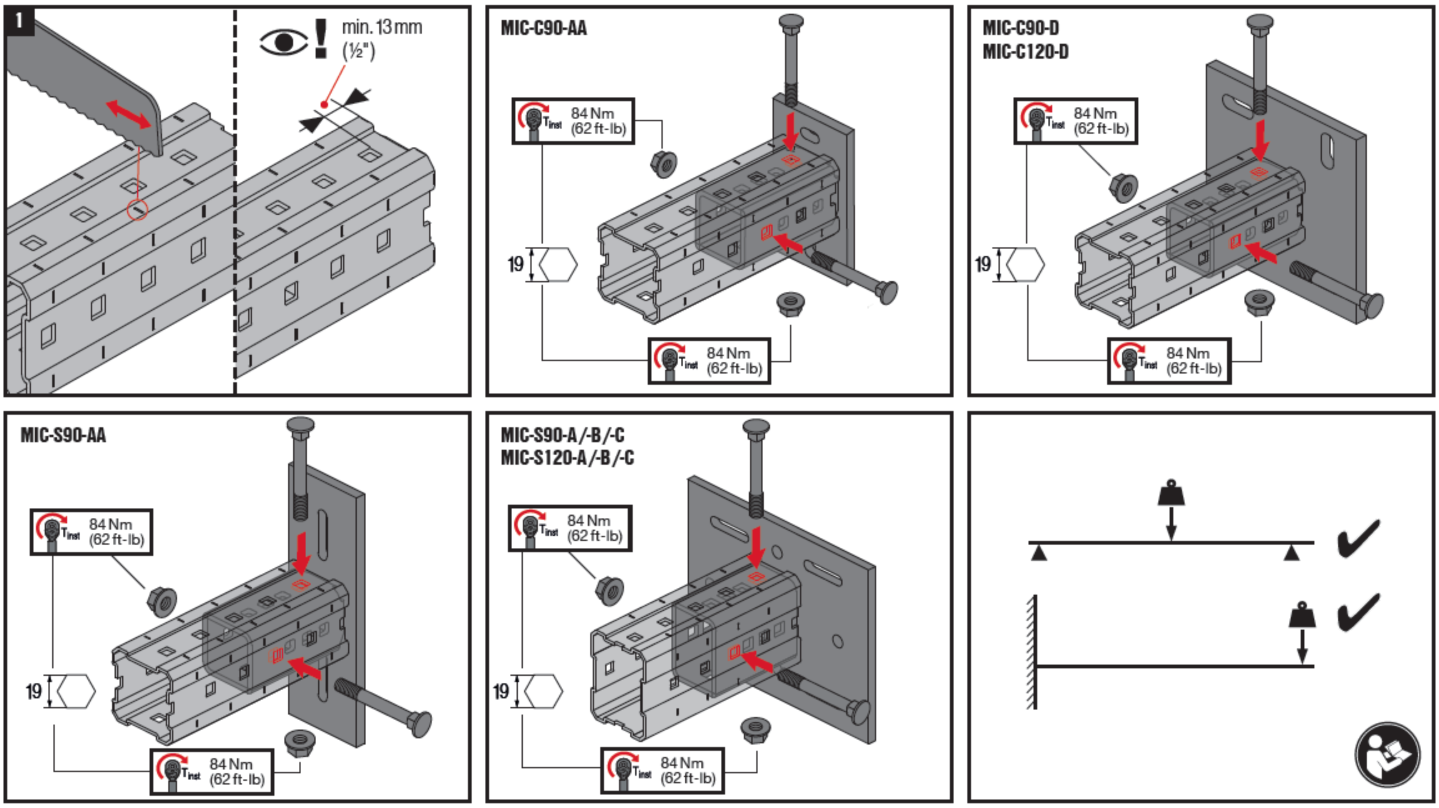
Weight:
9.63 lb (4370 g) incl. components

Description:
Hilti Hot-dipped galvanized baseplate connector, used for connecting a MI-90 girder to a steel beam using M12 mounting hardware. Two 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	E-modulus	Shear modulus
Connector: S235JR - DIN EN10025-2 2005.4	f_y = **34.08 ksi** (235 $\frac{N}{mm^2}$)	f_u = **52.21 ksi** (360 $\frac{N}{mm^2}$)	**29000 ksi** (200000 $\frac{N}{mm^2}$)	**11000 ksi** (**75845** $\frac{N}{mm^2}$)
One hand screw, prevail torque hex nut Class 8.8 - DIN EN 1993-1-8	f_y = **92.82 ksi** (640 $\frac{N}{mm^2}$)	f_u = **116.03 ksi** (800 $\frac{N}{mm^2}$)	**29000 ksi** (200000 $\frac{N}{mm^2}$)	**11000 ksi** (**75845** $\frac{N}{mm^2}$)

Instruction For Use:



MIC-S90-AA Base Material Connector - Steel

Approved loading cases		
Clamped	**Boxed**	
		

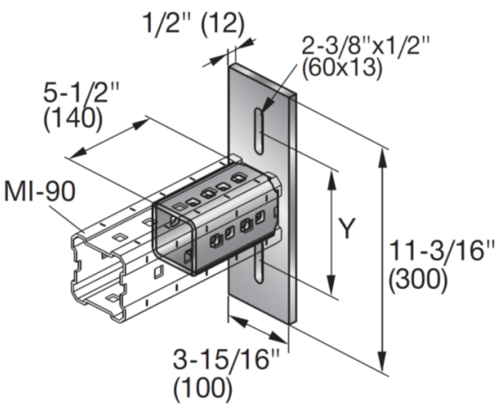
Governing Conditions

Methodology:
Connection strength values are determined with a combination of simulation (ANSYS®), calculation (Microsoft Excel and Mathcad) and testing.

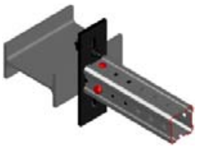
Standards and codes:

• ANSI/AISC 360-10	Specification for Structural Steel Buildings	
• ANSI/AISC 360-10– Appendix 1	Inelastic analysis	
• AISC Steel Design Guide Series 1	Column Base Plates	
• AISI S100 - 2007/2010	North American Specification for the Design of cold formed Steel Structural Members	
• ACI 318-08/11	Building Code Requirement for Structural Concrete	
• EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings	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

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



MIC-S90-AA Base Material Connector - Steel

Clamped		
		

Loading case: Clamped	**Combinations covered by loading case**
Bill of Material for this loading case: **1x MIC-S90-AA 304811** Hardware not included in packaging: **Beam clamps** **2x MI-SGC M12 233859** 	Connector used for a perpendicular connection of MI-90 girder to flange of structural steel profiles. For flange width 2.95'' (75mm) -6.47'' (165mm). 

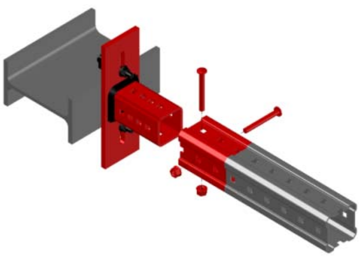
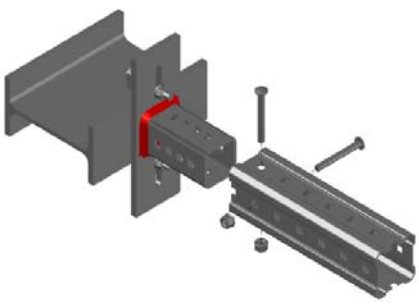
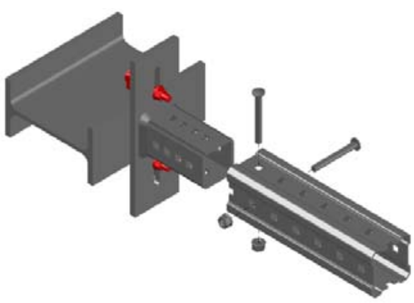
Usage of Values for Design Strength and Allowable Strength

The Design Strength and Allowable Strength tables on the following pages include strength reduction factors:

1. **ASD:** Safety Factor (omega) > 1.0 as per AISC specifications.
2. **LRFD:** Strength Reduction Factor (phi) < 1.0 as per AISC specifications. $\Omega = \frac{1.5}{\phi}$ (Reference AISC 360 C-B3-5)

Factored loads are required for input to the given interaction equations. Factored loads are the responsibility of the user. Factored loads are noted as P, V and M

Limiting components of capacity evaluated in following tables:

1. Connection system, including connector, hardware and affected portion of MI-90 girder, per FEA simulation	2. Welds - per analytical calculation	3. Beam Clamps - per analytical calculation
		

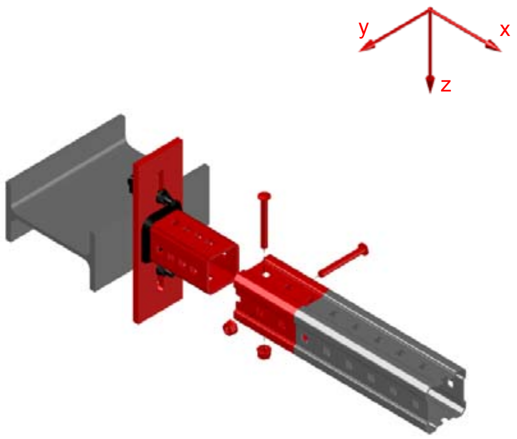
MIC-S90-AA Base Material Connector - Steel

Clamped		
		

Values for Design Strength and Allowable Strength 1/3

NOTE: Calculate interaction separately for each group only using values from that group. Limiter is defined by highest interaction. Use absolute values. Values refer to the coordinate system shown.

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



LRFD*	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
	4.92	14.22	5.84	5.84	7.64	7.64
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	2.10	2.10	1.40	1.40	1.34	1.34
ASD*	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
	3.28	9.48	3.9	3.9	5.09	5.09
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	1.40	1.40	0.93	0.93	0.89	0.89

Interaction for LRFD

$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

Interaction for ASD:

$$\frac{P_{ax}}{F_x} + \frac{V_{ay}}{F_y} + \frac{V_{az}}{F_z} + \frac{M_{ax}}{M_x} + \frac{M_{ay}}{M_y} + \frac{M_{az}}{M_z} \leq 1$$

*Values already include LRFD strength reduction (Φ) or ASD safety (Ω) factors in accordance with AISC, and are based on nominal geometry.

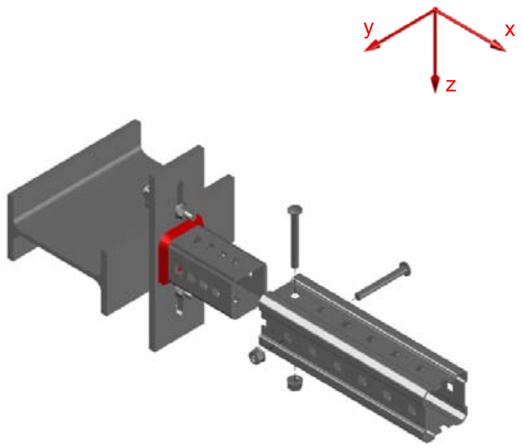
MIC-S90-AA Base Material Connector - Steel

Clamped		
		

Values for Design Strength and Allowable Strength 2/3

NOTE: Calculate interaction separately for each group only using values from that group. Limiter is defined by highest interaction. Use absolute values. Values refer to the coordinate system shown.

2. Welds - per analytical calculation



	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
LRFD*	49.72	49.72	11.30	11.30	11.30	11.30
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	4.61	4.61	2.45	2.45	2.45	2.45

	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
ASD*	33.14	33.14	7.53	7.53	7.53	7.53
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	3.08	3.08	1.63	1.63	1.63	1.63

Interaction for LRFD

$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

Interaction for ASD:

$$\frac{P_{ax}}{F_x} + \frac{V_{ay}}{F_y} + \frac{V_{az}}{F_z} + \frac{M_{ax}}{M_x} + \frac{M_{ay}}{M_y} + \frac{M_{az}}{M_z} \leq 1$$

*Values already include LRFD strength reduction (Φ) or ASD safety (Ω) factors in accordance with AISC, and are based on nominal geometry.

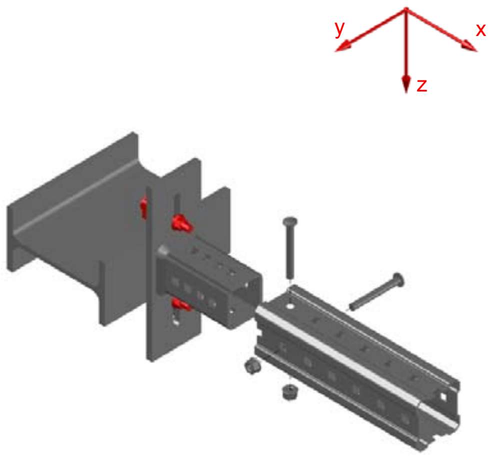
MIC-S90-AA Base Material Connector - Steel

Clamped		
		

Values for Design Strength and Allowable Strength 3/3

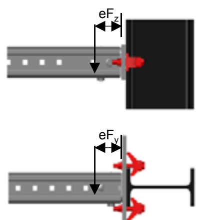
NOTE: Calculate interaction separately for each group only using values from that group. Limiter is defined by highest interaction. Use absolute values. Values refer to the coordinate system shown.

3. Beam Clamps - per analytical calculation



LRFD*	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
	3.52	Not decisive	0.74	0.74	0.74	0.74
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	0.13	0.13	0.60	0.60	0.52	0.52
ASD*	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
	2.35	Not decisive	0.49	0.49	0.49	0.49
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	0.08	0.08	0.40	0.40	0.34	0.34

Interaction for LRFD



__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.

$$\frac{P_{ux}}{F_x} + \frac{V_{uy}*ey}{M_z} + \frac{V_{uz}*ez}{M_y} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

__Shear force interaction:__

- Shear Interaction Equation is __only__ valid for TENSILE P_{ux} loads (P_{ux} > 0). Equation is __not__ valid for compressive P_{ux} loads (P_{ux} < 0).
- For Shear interaction, user must ADDITIONALLY verify: $P_{ux} / F_x < 1$.

$$\sqrt{\left(\frac{V_{uy}}{F_y \times \left(1-\frac{P_{ux}}{F_x}\right)}\right)^2 + \left(\frac{V_{uz}}{F_z \times \left(1-\frac{P_{ux}}{F_x}\right)}\right)^2} + \frac{M_{ux}}{M_x \times \left(1-\frac{P_{ux}}{F_x}\right)} \leq 1$$

Interaction for ASD:

__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.

$$\frac{P_{ax}}{F_x} + \frac{V_{ay}*ey}{M_z} + \frac{V_{az}*ez}{M_y} + \frac{M_{ay}}{M_y} + \frac{M_{az}}{M_z} \leq 1$$

with e_y=e_z=0.070 m

__Shear force interaction:__

- Shear Interaction Equation is __only__ valid for TENSILE P_{ax} loads (P_{ax} > 0). Equation is __not__ valid for compressive P_{ax} loads (P_{ax} < 0).
- For Shear interaction, user must ADDITIONALLY verify: $P_{ax} / F_x < 1$.

$$\sqrt{\left(\frac{V_{ay}}{F_y \times \left(1-\frac{P_{ax}}{F_x}\right)}\right)^2 + \left(\frac{V_{az}}{F_z \times \left(1-\frac{P_{ax}}{F_x}\right)}\right)^2} + \frac{M_{ax}}{M_x \times \left(1-\frac{P_{ax}}{F_x}\right)} \leq 1$$

*Values already include LRFD strength reduction (Φ) or ASD safety (Ω) factors in accordance with AISC, and are based on nominal geometry.

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