MIC-S90-BH-L 2179507-11

Hilti North America
Installation Technical Manual
Technical Data
MI System

Version 1.2 **08.2017**

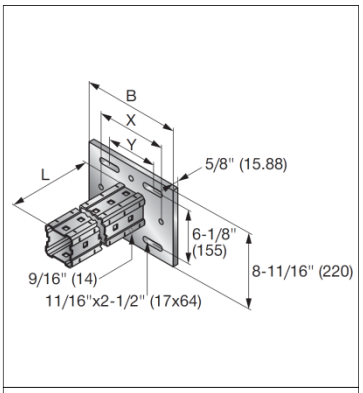
Terms of common cooperation / Legal disclaimer

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.

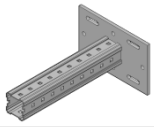
In any case the suitability of structures combining different products for specific applications need to be checked and cleared by an expert, particularly with regard to compliance with applicable norms, codes, and project specific requirements, prior to using them for any specific facility. This book 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.

MIC-S90-BH-L Bracket - Steel

Designation	Item number
MIC-S90-BH-500	**2179507**
MIC-S90-BH-750	**2179508**
MIC-S90-BH-1000	**2179509**
MIC-S90-BH-1500	**2179510**
MIC-S90-BH-2000	**2179511**



Hardware included per connector



Corrosion protection:
Hot dipped galvanized per ASTM A123
Girder - 2.95 mils (75 µm) minimum
Plate - 3.94 mils (100 µm) minimum

Weight:

MIC-S90-BH-500	30.25 lb (13720g)
MIC-S90-BH-750	35.45 lb (16080g)
MIC-S90-BH-1000	40.63 lb (18430g)
MIC-S90-BH-1500	51.01 lb (23140g)
MIC-S90-BH-2000	61.40 lb (27850g)

Description:

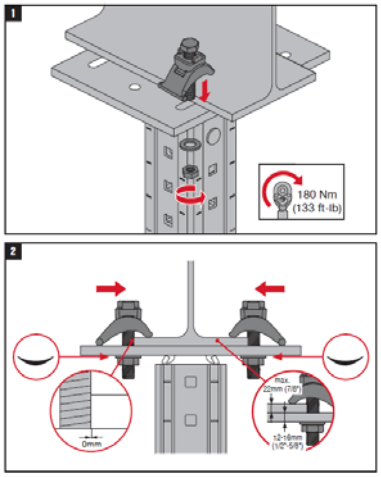
Hilti Hot-dipped galvanized bracket, typically used for fixation to a steel beam. The bracket is connected with beam clamps or using threaded rods through the slotted holes. Comes in different plate sizes to fit various steel beam sizes and in different lengths depending on application needs.

Material properties

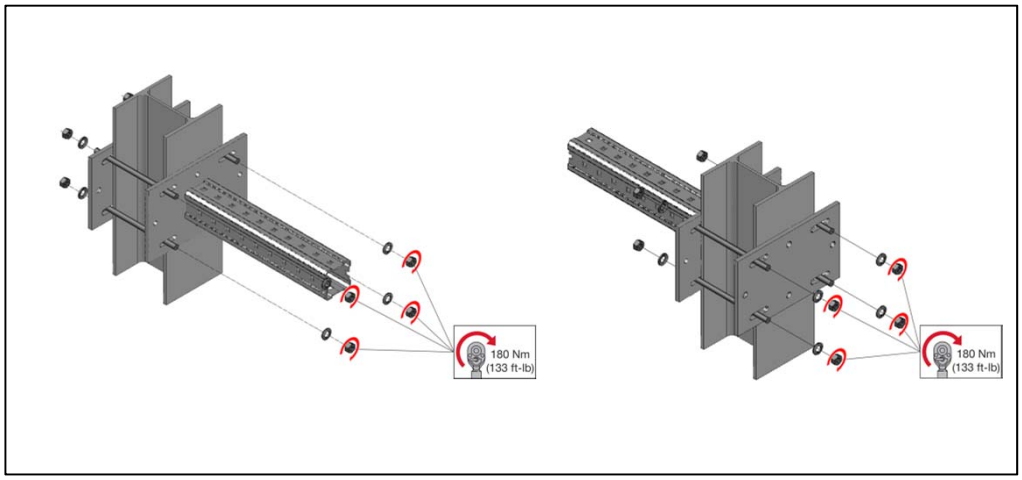
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
Bracket:				
ASTM A36 / A36M - 2014	**f_y = 36 ksi** (250 $\frac{N}{mm^2}$)	**f_u = 58 ksi** (400 $\frac{N}{mm^2}$)	**29000 ksi** (200000 $\frac{N}{mm^2}$)	**11000 ksi** (**75845** $\frac{N}{mm^2}$)

Instruction For Use:
No IFU attached to the package

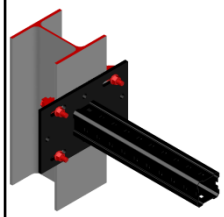
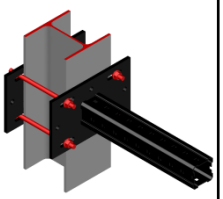
For clamped loading case



For boxed loading case (not attached to the packaging)



MIC-S90-BH-L Bracket - Steel

Approved loading cases		
Clamped	**Boxed**	
		

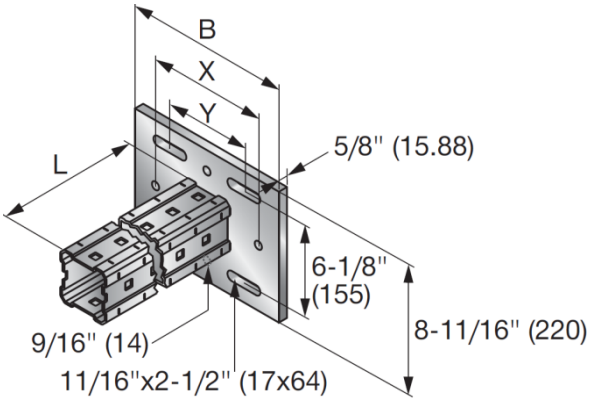
Governing Conditions

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

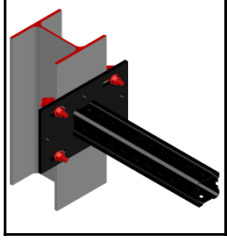
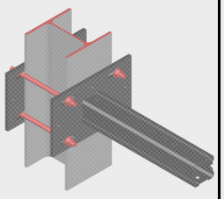
Standards and codes:

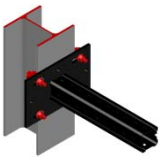
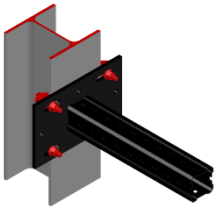
• ANSI/AISC 360-10	Specification for Structural Steel Buildings	
• ANSI/AISC 360-10–Appendix 1	Inelastic analysis	
• AISC Steel Design Guide Series 1	Column Base Plates	
• AISI S100 - 2007/2010	North American Specification for the Design of cold formed Steel Structural Members	
• EN 1993-1-1	Eurocode 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-BH-L Bracket - Steel

Clamped	Boxed	
		

Loading case: Clamped	Combinations covered by loading case
Bill of Material for this loading case: Bracket **1x MIC-S90-BH-500 2179507** **MIC-S90-BH-750 2179508** **MIC-S90-BH-1000 2179509** **MIC-S90-BH-1500 2179510** **MIC-S90-BH-2000 2179511** Hardware not included in packaging: **Beam clamps** **4x MI-SGC M16 387398** 	Bracket used for a perpendicular connection to flange of structural steel profiles. For flange width 6.5 ’’ (165mm) - 9.25’’ (235mm). 

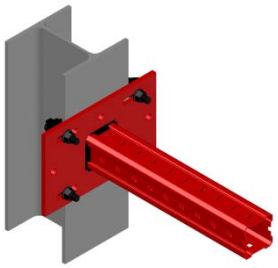
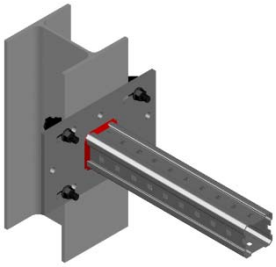
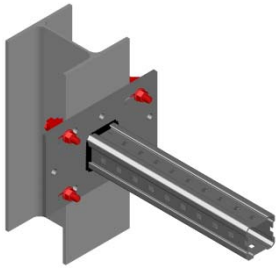
Usage of Values for Design Strength and Allowable Strength

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

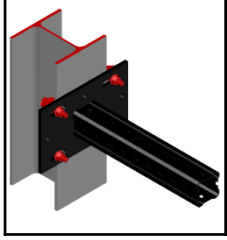
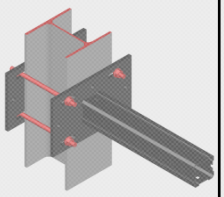
1. **ASD:** Safety Factor (omega) > 1.0 as per AISC specifications.
2. **LRFD:** Strength Reduction Factor (phi) < 1.0 as per AISC specifications. $\Omega = \frac{1.5}{\phi}$ (Reference AISC 360 C-B3-5)

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. Bracket per FEA simulation	2. Welds – per analytical calculation	3. Beam Clamps - per analytical calculation
		

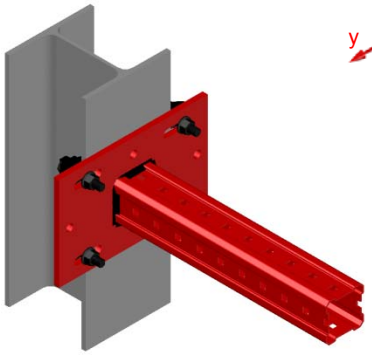
MIC-S90-BH-L Bracket - Steel

Clamped	Boxed	
		

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. Bracket per FEA simulation



	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
LRFD*	16.61	13.31	11.51	11.51	11.51	11.51
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	3.02	3.02	4.19	4.19	4.19	4.19

	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
ASD*	11.05	15.51	7.66	7.66	7.66	7.66
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	2.01	2.01	2.79	2.79	2.79	2.79

Interaction for LRFD

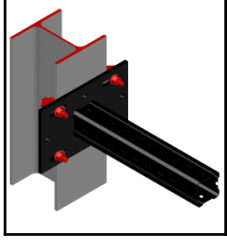
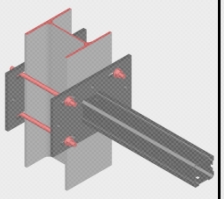
$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

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.

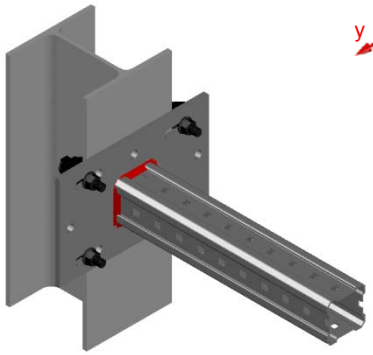
MIC-S90-BH-L Bracket - Steel

Clamped	Boxed	
		

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*	58.00	58.00	27.34	27.34	27.34	27.34
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	7.36	7.36	4.56	4.56	4.56	4.56

	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
ASD*	38.67	38.67	18.23	18.23	18.23	18.23
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	4.90	4.90	3.04	3.04	3.04	3.04

Interaction for LRFD

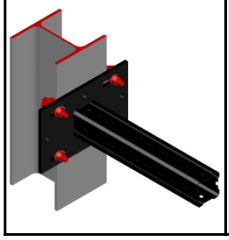
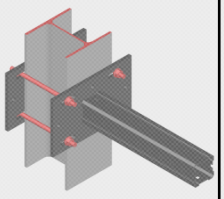
$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

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.

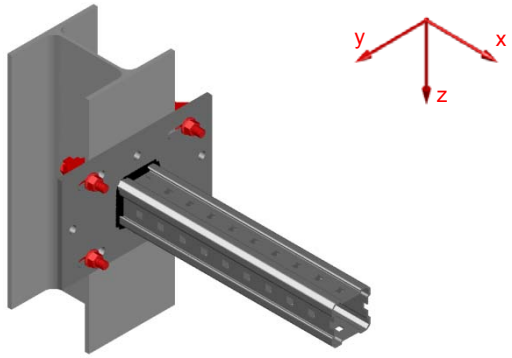
MIC-S90-BH-L Bracket - Steel

Clamped	Boxed	
		

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



	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
LRFD*	21.58	Not decisive	2.32	2.32	2.32	2.32
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	0.83	0.83	5.10	5.10	4.71	4.71

	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
ASD*	14.39	Not decisive	1.55	1.55	1.55	1.55
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	0.55	0.55	3.40	3.40	3.14	3.14

Interaction for LRFD

Normal force interaction:

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

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:

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

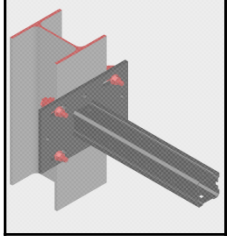
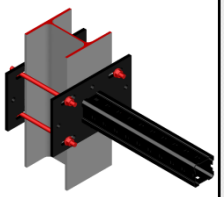
Shear force interaction:

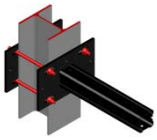
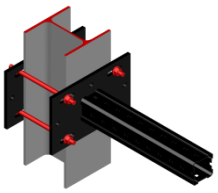
- Shear Interaction Equation is only valid for TENSILE P_{ax} loads ($P_{ax} > 0$). Equation is not valid for compressive P_{ax} loads ($P_{ax} < 0$).
- For Shear interaction, user must ADDITIONALLY verify: $P_{ax} / F_x < 1$.

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

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

MIC-S90-BH-L Bracket - Steel

Clamped	Boxed	
		

Loading case: Boxed	Combinations covered by loading case
Bill of Material for this loading case: Bracket **1x MIC-S90-BH-500 2179507** **MIC-S90-BH-750 2179508** **MIC-S90-BH-1000 2179509** **MIC-S90-BH-1500 2179510** **MIC-S90-BH-2000 2179511** Hardware not included in packaging: **Base plate** **1x MIB-SBH 2174675** **Threaded rods cut to particular length** **4x AM16x1000 8.8 HDG…m 419104** **Lock washer** **8x LW M16 HDG plus washer 2185343** **Nut** **8x M16-F nut 304767** 	Bracket used for a perpendicular connection to flange of structural steel profiles. For flange width 6.5 ’’ (165mm) - 9.25’’ (235mm). 

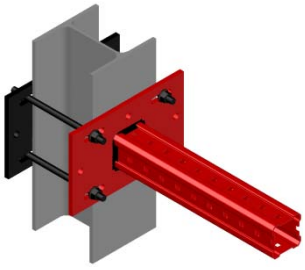
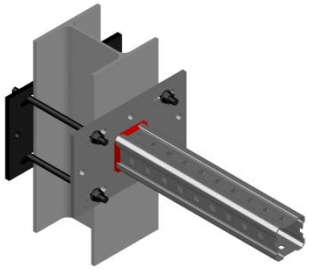
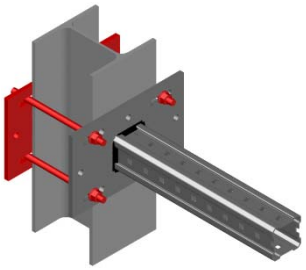
Usage of Values for Design Strength and Allowable Strength

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

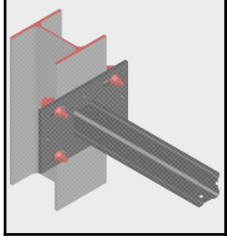
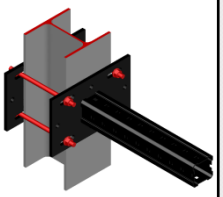
1. **ASD:** Safety Factor (omega) > 1.0 as per AISC specifications.
2. **LRFD:** Strength Reduction Factor (phi) < 1.0 as per AISC specifications. $\Omega = \frac{1.5}{\phi}$ (Reference AISC 360 C-B3-5)

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. Bracket per FEA simulation	2. Welds - per analytical calculation	3. Base plate and through bolts - per analytical calculation
		

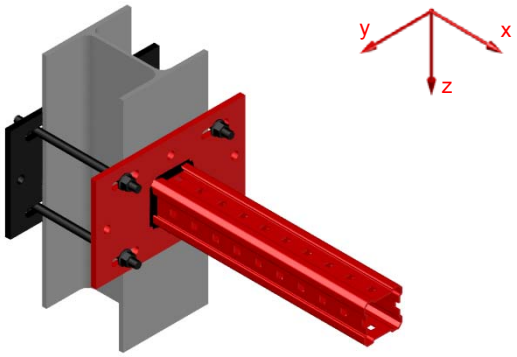
MIC-S90-BH-L Bracket - Steel

Clamped	Boxed	
		

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. Bracket per FEA simulation



LRFD*	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
	16.84	23.31	11.51	11.51	11.51	11.51
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	3.02	3.02	4.19	4.19	4.19	4.19

ASD*	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
	11.20	15.51	7.66	7.66	7.66	7.66
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	2.01	2.01	2.79	2.79	2.79	2.79

Interaction for LRFD

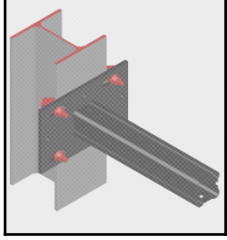
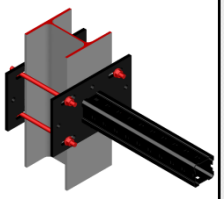
$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

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.

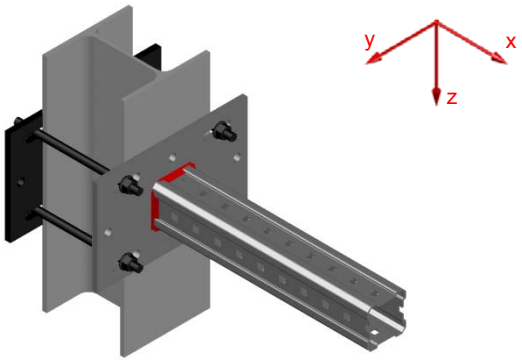
MIC-S90-BH-L Bracket - Steel

Clamped	Boxed	
		

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*	58.00	58.00	27.34	27.34	27.34	27.34
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	7.36	7.36	4.56	4.56	4.56	4.56

	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
ASD*	38.67	38.67	18.23	18.23	18.23	18.23
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	4.90	4.90	3.04	3.04	3.04	3.04

Interaction for LRFD

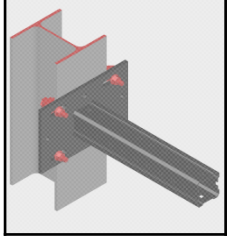
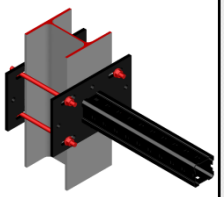
$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

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.

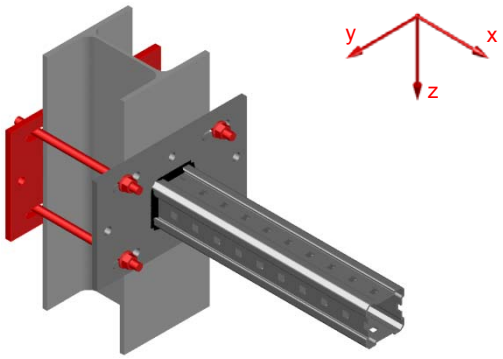
MIC-S90-BH-L Bracket - Steel

Clamped	Boxed	
		

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. Base plate and through bolts - per analytical calculation



	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
LRFD*	33.45	Not decisive	7.03	7.03	7.03	7.03
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	2.37	2.37	7.79	7.79	7.30	7.30

	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
ASD*	22.30	Not decisive	4.68	4.68	4.68	4.68
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	1.58	1.58	5.19	5.19	4.87	4.87

Interaction for LRFD

Normal force interaction:

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

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:

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

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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