



# MIC-90-L 304805

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-90-L Connector

Designation	Item number
MIC-90-L	304805

### Corrosion protection:

Hot dipped galvanized per DIN EN ISO 1461:

Connector: 2.2 mils (55  $\mu\text{m}$ )

Backing plate: 1.8 mils (45  $\mu\text{m}$ )

Tooth plate: 1.8 mils (45  $\mu\text{m}$ )

Bolt: 1.8 mils (45  $\mu\text{m}$ )

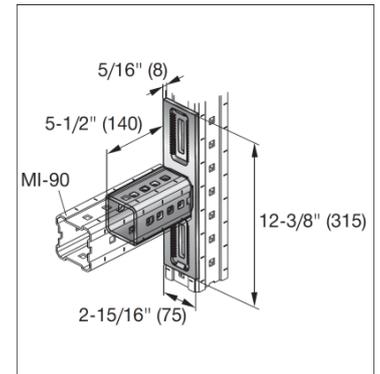
Nut: 1.8 mils (45  $\mu\text{m}$ )

### Weight:

8.93 lb (4.05kg) incl. components

### Description:

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.



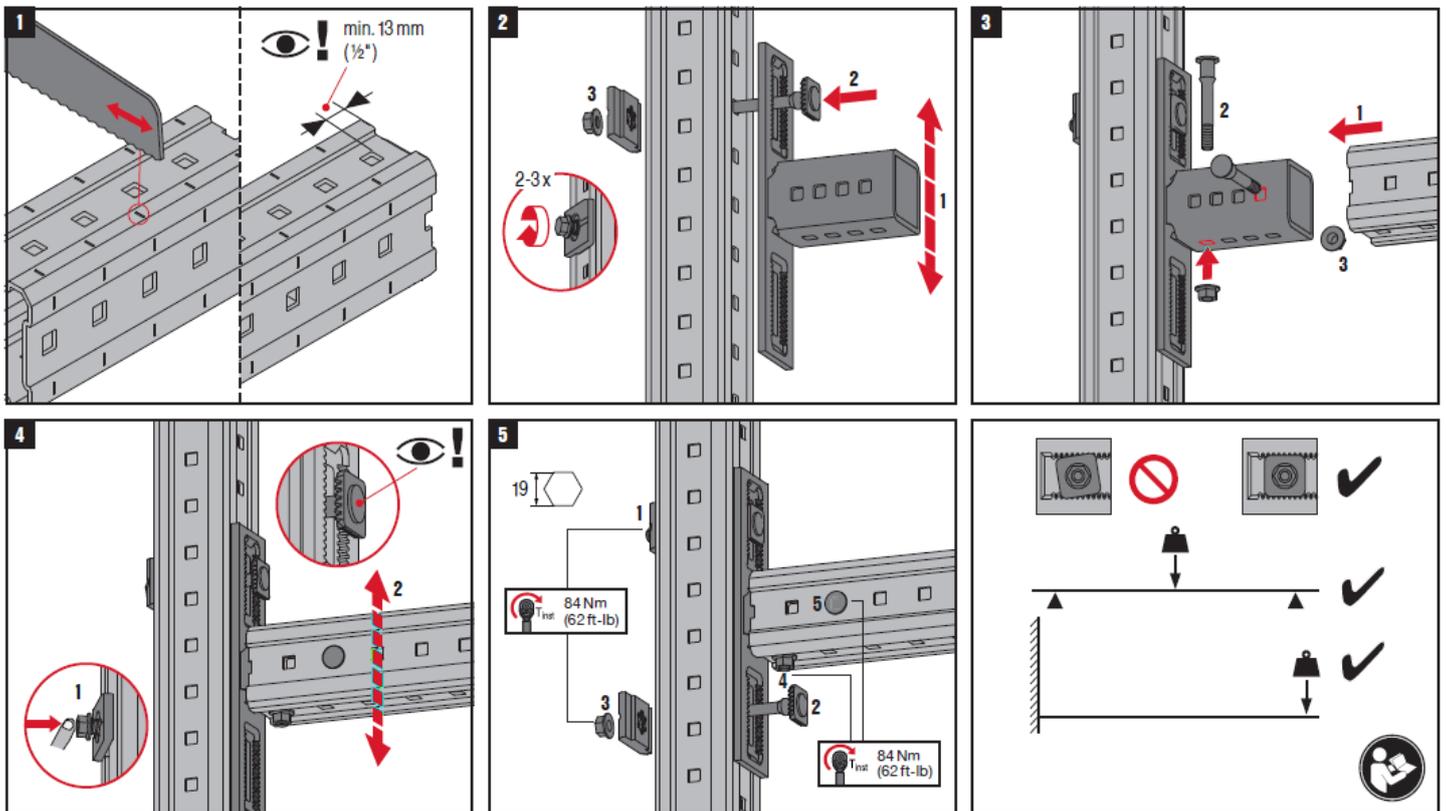
### Hardware included per connector



### Material properties

Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
Connector and Toothed plate: S235JR - DIN EN10025-2 2005.4	$f_y = 34.08 \text{ ksi} (235 \frac{N}{\text{mm}^2})$	$f_u = 52.21 \text{ ksi} (360 \frac{N}{\text{mm}^2})$	29000 ksi (200000 $\frac{N}{\text{mm}^2}$ )	11000 ksi (75845 $\frac{N}{\text{mm}^2}$ )
One hand screw, prevail torque hex nut Class 8.8 - DIN EN 1993-1-8	$f_y = 92.82 \text{ ksi} (640 \frac{N}{\text{mm}^2})$	$f_u = 116.03 \text{ ksi} (800 \frac{N}{\text{mm}^2})$	29000 ksi (200000 $\frac{N}{\text{mm}^2}$ )	11000 ksi (75845 $\frac{N}{\text{mm}^2}$ )

### Instruction For Use:



## MIC-90-L Connector

Approved loading cases		
Standard	Double	

### Governing Conditions

#### Methodology:

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

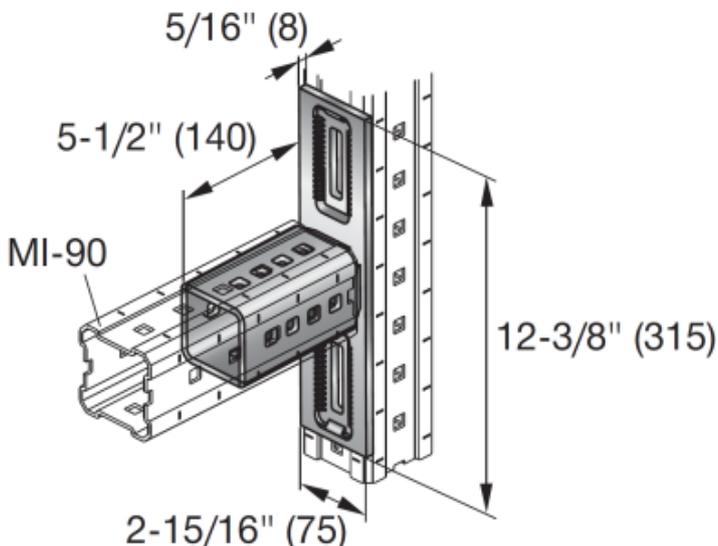
#### Standards and codes:

- ANSI/AISC 360-10 Specification for Structural Steel Buildings
- 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

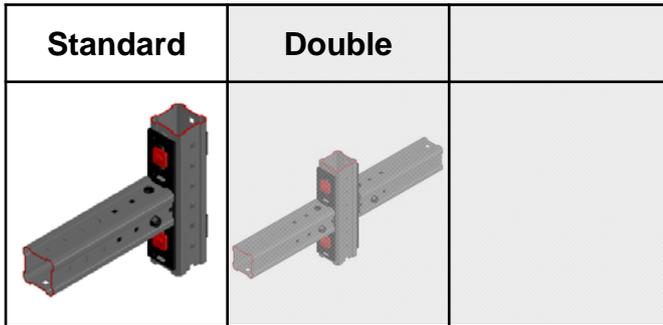
#### Validity:

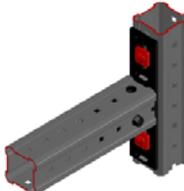
Temperature limits: -22°F (-30°C) to 200°F (+93°C).

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-90-L Connector



Loading case: Standard	Combinations covered by loading case
<p><b>Bill of Material for this loading case:</b></p> <p>For fixation on MI-90 girder  <b>1x MIC-90-L</b>                      <b>304805</b></p> <p>For fixation on MI-120  <b>1x MIC-90-L</b>                      <b>304804</b>  <b>2x MIA-EH120</b>                    <b>304888</b>                      The 2xMIA-EH90 remain unused</p> 	<p>Connector used for Connecting MI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle</p> 

### Usage of Values for Design Strength and Allowable Strength

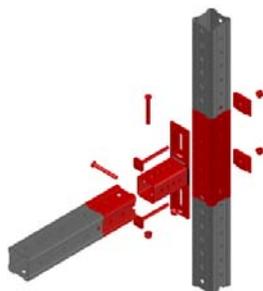
The Design Strength and Allowable Strength tables on the following pages include strength reduction factors:

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

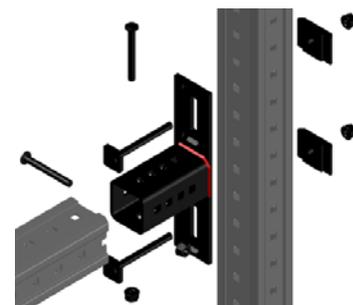
Factored loads are required for input to the given interaction equations. Factored loads are the responsibility of the user. Factored loads are noted as P, V and M

### Limiting components of capacity evaluated in following tables:

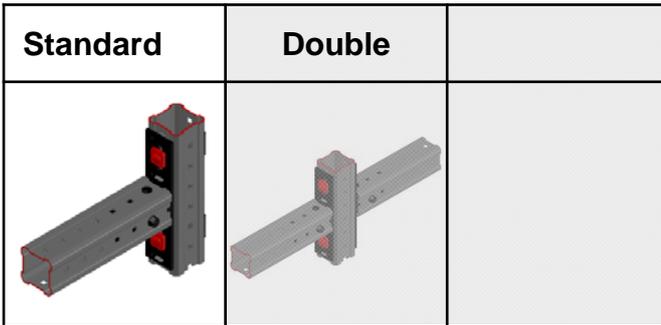
1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation



2. Welds – per analytical calculation



# MIC-90-L Connector

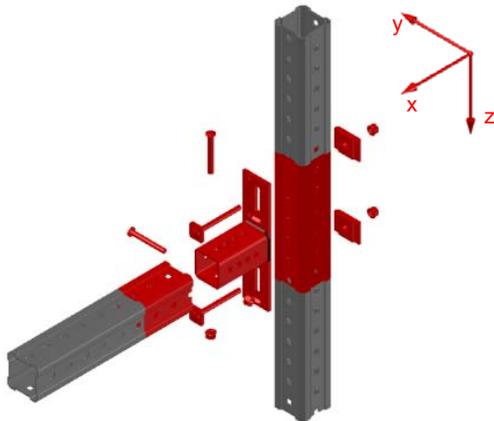


## Values for Design Strength and Allowable Strength

1/2

**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 girders, per FEA simulation



LRFD*	+Fx	-Fx	+Fy	-Fy	+Fz	-Fz
	[kip]	[kip]	[kip]	[kip]	[kip]	[kip]
	2.92	14.23	5.55	5.55	6.69	6.69
ASD*	+Mx	-Mx	+My	-My	+Mz	-Mz
	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]
	2.10	2.10	0.88	0.88	0.37	0.37
LRFD*	+Fx	-Fx	+Fy	-Fy	+Fz	-Fz
	[kip]	[kip]	[kip]	[kip]	[kip]	[kip]
	1.94	9.47	3.69	3.69	4.45	4.45
ASD*	+Mx	-Mx	+My	-My	+Mz	-Mz
	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]
	1.40	1.40	0.58	0.58	0.25	0.25

#### Interaction for LRFD

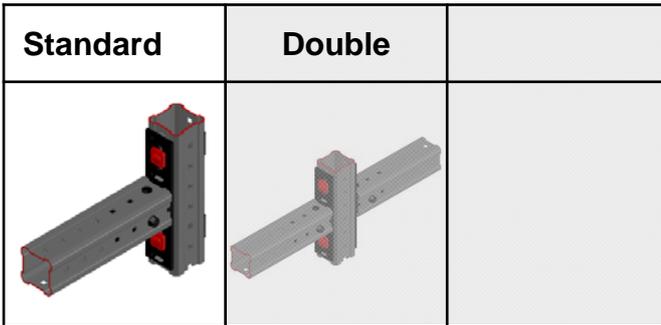
$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

#### 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 ( $\Phi$ ) or ASD safety ( $\Omega$ ) factors in accordance with AISC, and are based on nominal geometry.

# MIC-90-L Connector

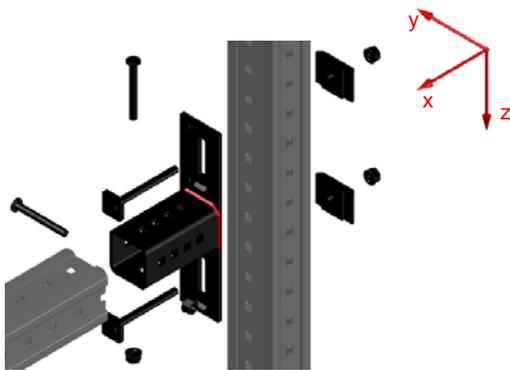


## Values for Design Strength and Allowable Strength

2/2

**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



LRFD*	+Fx	-Fx	+Fy	-Fy	+Fz	-Fz
	[kip]	[kip]	[kip]	[kip]	[kip]	[kip]
	41.43	41.43	13.60	13.60	13.60	13.60
ASD*	+Mx	-Mx	+My	-My	+Mz	-Mz
	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]
	3.84	3.84	2.04	2.04	2.04	2.04
LRFD*	+Fx	-Fx	+Fy	-Fy	+Fz	-Fz
	[kip]	[kip]	[kip]	[kip]	[kip]	[kip]
	27.62	27.62	9.07	9.07	9.07	9.07
ASD*	+Mx	-Mx	+My	-My	+Mz	-Mz
	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]
	2.56	2.56	1.36	1.36	1.36	1.36

#### Interaction for LRFD

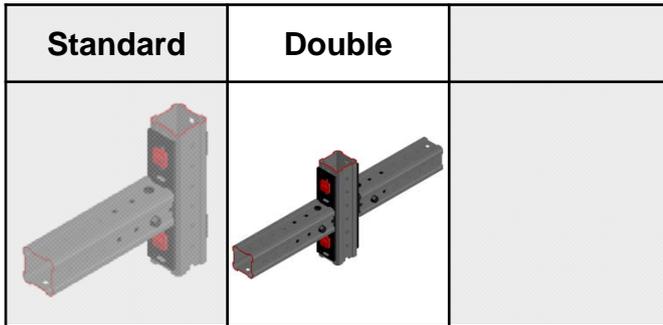
$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

#### 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 ( $\Phi$ ) or ASD safety ( $\Omega$ ) factors in accordance with AISC, and are based on nominal geometry.

## MIC-90-L Connector



Loading case: Double	Combinations covered by loading case
<p><b>Bill of Material for this loading case:</b></p> <p><u>For fixation on MI-90 girder</u></p> <p><b>2x MIC-90-L</b>                    <b>304805</b>  <b>2x MIA-TP</b>                        <b>305707</b>                      2x MI-EH90; 4x MIA-EH-P; 2x nuts remain unused</p> <p><u>For fixation on MI-120</u></p> <p><b>2x MIC-90-L</b>                    <b>304804</b>  <b>2x MIA-EH120</b>                   <b>304888</b>  <b>2x MIA-TP</b>                        <b>305707</b>                      The 4x MIA-EH90, 4x MIA-EH-P, 2x nuts remain unused</p>	<p>Connector used for Connecting 2xMI-90 girder on either MI-90 or MI-120 girder in a 90-degree angle</p>

### Usage of Values for Design Strength and Allowable Strength

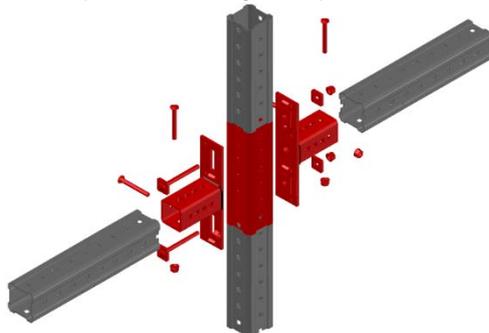
The Design Strength and Allowable Strength tables on the following pages include strength reduction factors:

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

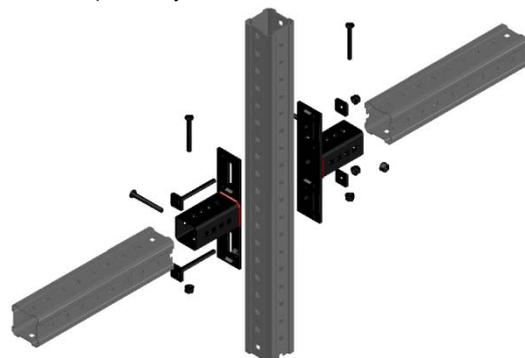
Factored loads are required for input to the given interaction equations. Factored loads are the responsibility of the user. Factored loads are noted as P, V and M

### Limiting components of capacity evaluated in following tables:

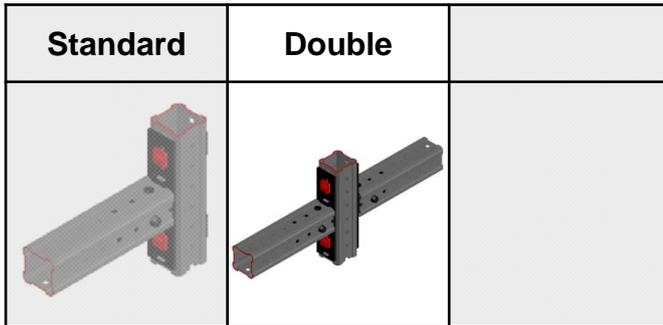
1. Connection system, including connector, hardware and affected portion of MI-90 girders, per FEA simulation



2. Welds – per analytical calculation



# MIC-90-L Connector

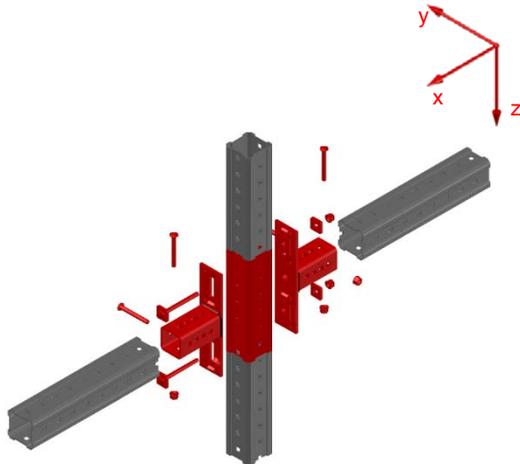


## Values for Design Strength and Allowable Strength

1/2

**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 girders, per FEA simulation Resistance values for one side of the connection system\*\*



	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
LRFD*	2.92**	14.23**	5.55**	5.55**	4.05**	4.05**
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	2.10**	2.10**	0.88**	0.88**	0.37**	0.37**
	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
ASD*	1.94**	9.47**	3.69**	3.69**	4.20**	4.20**
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	1.40**	1.40**	0.58**	0.58**	0.25**	0.25**

#### Interaction for LRFD

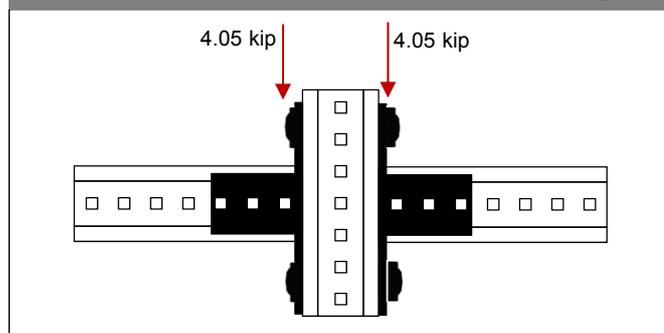
$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

#### Interaction for ASD:

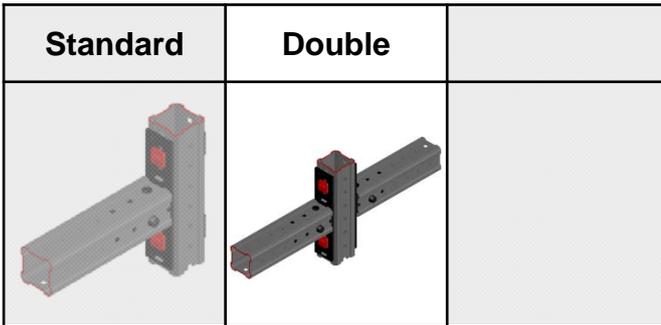
$$\frac{P_{ax}}{F_x} + \frac{V_{ay}}{F_y} + \frac{V_{az}}{F_z} + \frac{M_{ax}}{M_x} + \frac{M_{ay}}{M_y} + \frac{M_{az}}{M_z} \leq 1$$

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

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



# MIC-90-L Connector



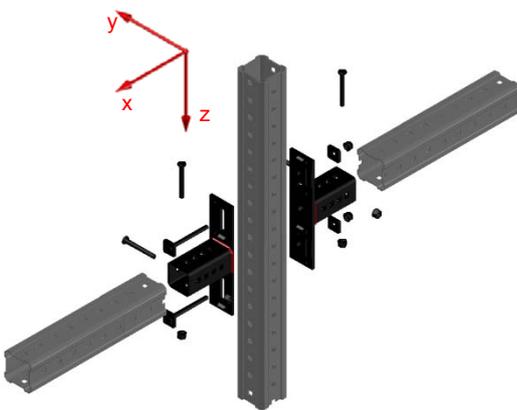
## Values for Design Strength and Allowable Strength

2/2

**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

Resistance values for one side of the connection system\*\*



	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
LRFD*	41.43**	41.43**	13.60**	13.60**	13.60**	13.60**
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	3.84**	3.84**	2.04**	2.04**	2.04**	2.04**
	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
ASD*	27.62**	27.62**	9.07**	9.07**	9.07**	9.07**
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	2.56**	2.56**	1.36**	1.36**	1.36**	1.36**

#### Interaction for LRFD

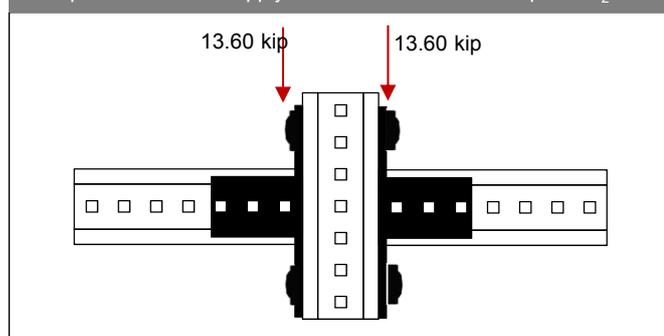
$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

#### 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 ( $\Phi$ ) or ASD safety ( $\Omega$ ) factors in accordance with AISC, and are based on nominal geometry.

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







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[www.hilti.ca](http://www.hilti.ca)

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