



# MIC-BAH 2179532

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.

# MIC-BAH Connector

Designation	Item number
<b>MIC-BAH</b>	<b>2179532</b>

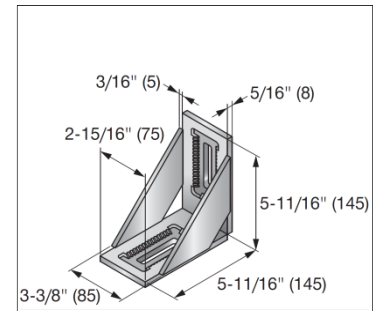
**Corrosion protection:**  
Hot dipped galvanized per DIN EN ISO 1461:

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:**  
4.91 lb (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.



Hardware included per connector



Material properties	Yield strength	Ultimate strength	E-modulus	Shear modulus
<b>Material</b> 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 $\frac{N}{\text{mm}^2}$ )	<b>29000 ksi</b> (200000 $\frac{N}{\text{mm}^2}$ )	<b>11000 ksi</b> (75845 $\frac{N}{\text{mm}^2}$ )
Backing plate: EN-GJMW-400-5 (DIN EN 1562 2006.8)	$f_y = 34.08 \text{ ksi}$ (235 $\frac{N}{\text{mm}^2}$ )	$f_u = 52.21 \text{ ksi}$ (360 $\frac{N}{\text{mm}^2}$ )	<b>29000 ksi</b> (200000 $\frac{N}{\text{mm}^2}$ )	<b>11000 ksi</b> (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 $\frac{N}{\text{mm}^2}$ )	<b>29000 ksi</b> (200000 $\frac{N}{\text{mm}^2}$ )	<b>11000 ksi</b> (75845 $\frac{N}{\text{mm}^2}$ )

**Instruction For Use:**

## MIC-BAH Connector

Approved loading cases		
Standard	Double One Side	Double Both Sides

### Governing Conditions

#### Methodology:

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

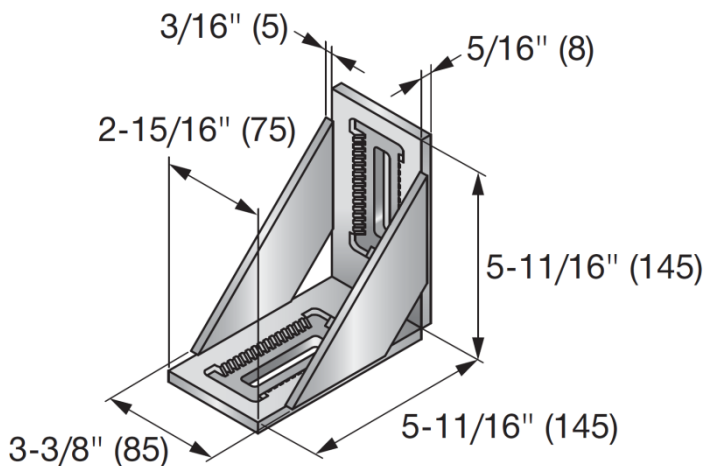
#### Standards and codes:

• ANSI/AISC 360-10	Specification for Structural Steel Buildings	
• ANSI/AISC 360-10 – Appendix 1	Inelastic analysis	
• 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

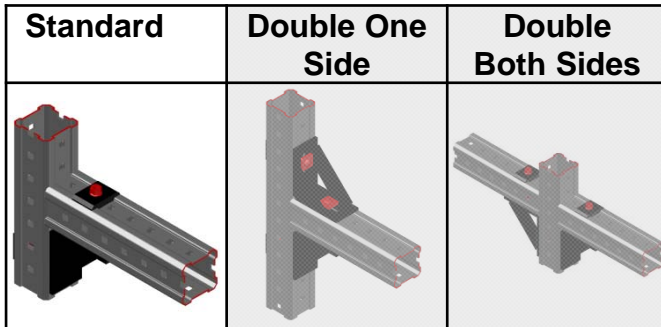
#### Validity:

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-BAH 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-BAH</b>                      <b>2179532</b></p> <p>For fixation on MI-120  <b>1x MIC-BAH</b>                      <b>2179532</b>  <b>1x MIA-EH120</b>                    <b>304888</b>                      MIA-EH90 remains 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

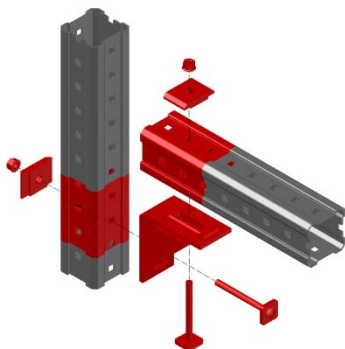
The Design Strength and Allowable Strength tables on the following pages include strength reduction factors:

- 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)

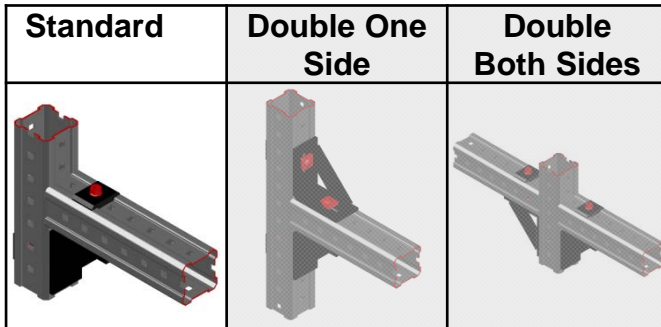
Factored loads are required for input to the given interaction equations. Factored loads are the responsibility of the user. Factored loads are noted as P, V and M

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

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



# MIC-BAH Connector

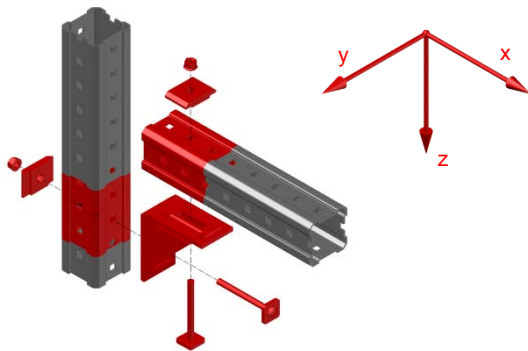


## Values for Design Strength and Allowable Strength

1/1

**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]
	2.90	4.33	1.37	1.37	4.33	2.90
ASD*	+Mx	-Mx	+My	-My	+Mz	-Mz
	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]
	0.46	0.46	0.00	0.00	0.00	0.00

LRFD*	+Fx	-Fx	+Fy	-Fy	+Fz	-Fz
	[kip]	[kip]	[kip]	[kip]	[kip]	[kip]
	1.93	2.89	0.91	0.91	2.89	1.93
ASD*	+Mx	-Mx	+My	-My	+Mz	-Mz
	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]	[kip*ft]
	0.30	0.30	0.00	0.00	0.00	0.00

#### Interaction for LRFD

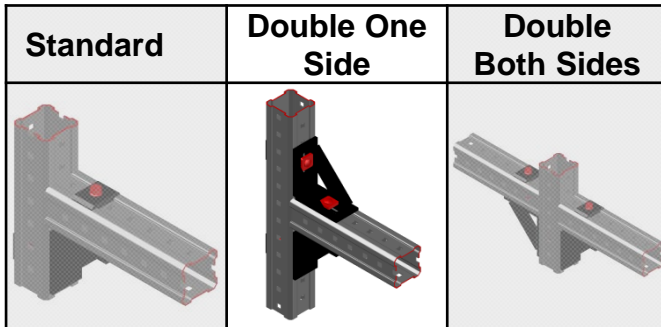
$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

#### 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-BAH Connector



Loading case: Double One Side	Combinations covered by loading case
<p><b>Bill of Material for this loading case:</b></p> <p>For fixation on MI-90 girder  <b>2x MIC-BAH</b>                      <b>2179532</b></p> <p>For fixation on MI-120  <b>2x MIC-BAH</b>                      <b>2179532</b>  <b>2x MIA-EH120</b>                    <b>304888</b>                      The 2x MIA-EH90 remain unused</p>	<p>Connector used in pair 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

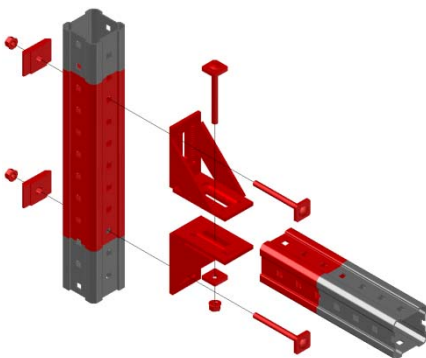
The Design Strength and Allowable Strength tables on the following pages include strength reduction factors:

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)

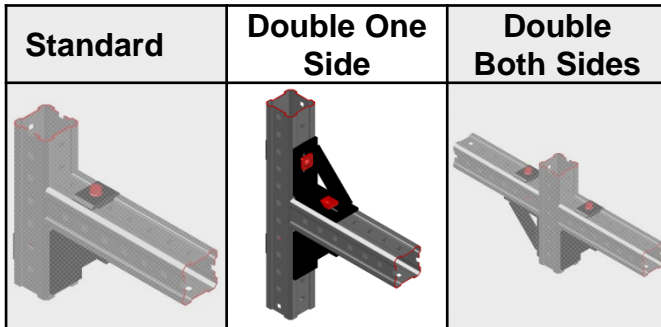
Factored loads are required for input to the given interaction equations. Factored loads are the responsibility of the user. Factored loads are noted as P, V and M

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

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



# MIC-BAH Connector

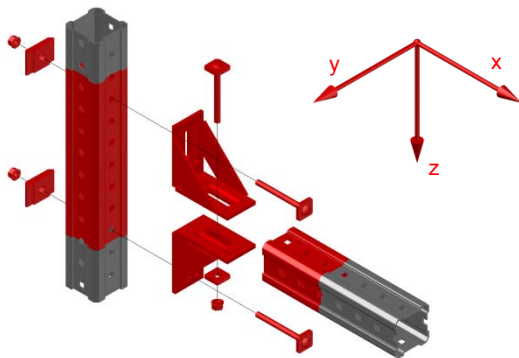


## Values for Design Strength and Allowable Strength

1/1

**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



	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
LRFD*	5.36	5.36	2.74	2.74	7.66	7.66
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	1.23	1.23	1.38	1.38	0.86	0.86
	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
ASD*	3.57	3.57	1.82	1.82	5.09	5.09
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	0.82	0.82	0.92	0.92	0.57	0.57

#### Interaction for LRFD

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

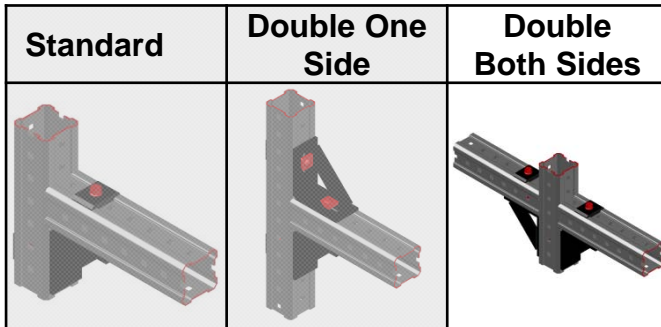
#### Interaction for ASD:


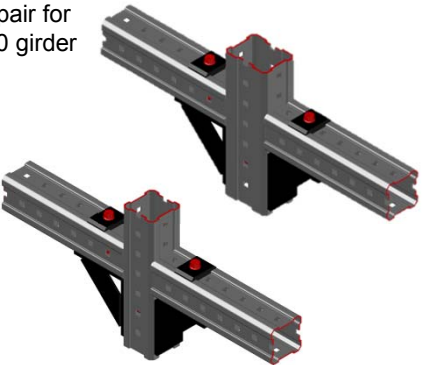
$$\frac{P_{ax}}{F_x} + \frac{V_{ay}}{F_y} + \frac{V_{az}}{F_z} + \frac{M_{ax}}{M_x} + \frac{M_{ay}}{M_y} + \frac{M_{az}}{M_z} \leq 1$$

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



## MIC-BAH Connector



Loading case: Double Both Sides	Combinations covered by loading case
<p><b>Bill of Material for this loading case:</b></p> <p>For fixation on MI-90 girder                      2x MIC-BAH                      2179532                      1x MIA-TP                         305707                      1x MI-EH90 and MIA-EH-P remain unused</p> <p>For fixation on MI-120                      2x MIC-BAH                      2179532                      1x MIA-EH120                    304888                      1x MIA-TP                         305707                      The 2x MIA-EH90 and 2x MIA-EH-P remain unused</p> 	<p>Connector used in pair 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

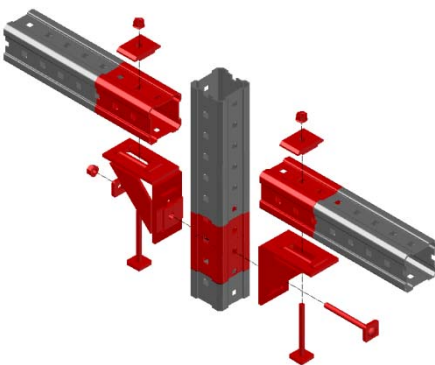
The Design Strength and Allowable Strength tables on the following pages include strength reduction factors:

- 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)

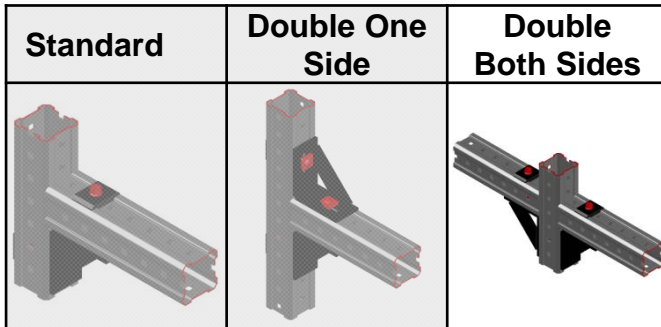
Factored loads are required for input to the given interaction equations. Factored loads are the responsibility of the user. Factored loads are noted as P, V and M

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

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



# MIC-BAH Connector

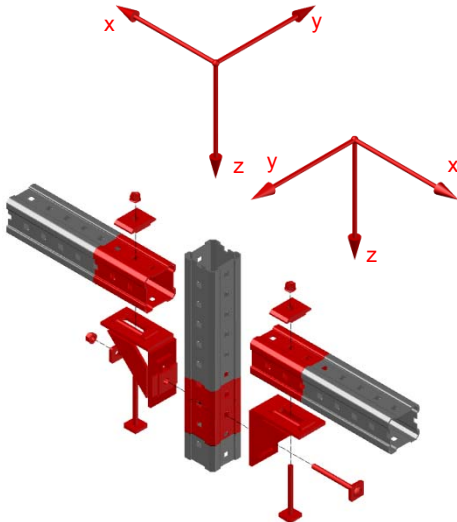


## Values for Design Strength and Allowable Strength

1/1

**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*	2.57**	3.90**	1.37**	1.37**	1.89**	1.89**
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	0.46**	0.46**	0.00	0.00	0.00	0.00
	+Fx [kip]	-Fx [kip]	+Fy [kip]	-Fy [kip]	+Fz [kip]	-Fz [kip]
ASD*	1.71**	2.60**	0.91**	0.91**	1.26**	1.26**
	+Mx [kip*ft]	-Mx [kip*ft]	+My [kip*ft]	-My [kip*ft]	+Mz [kip*ft]	-Mz [kip*ft]
	0.30**	0.30**	0.00	0.00	0.00	0.00

#### Interaction for LRFD

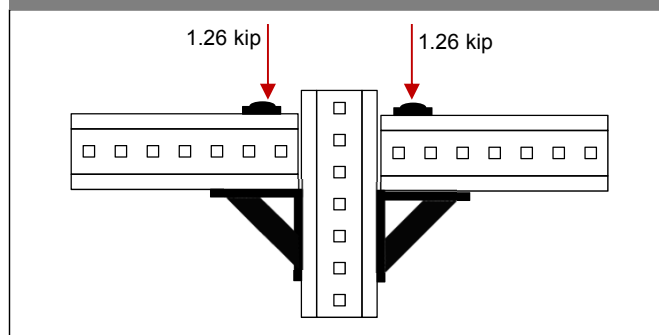
$$\frac{P_{ux}}{F_x} + \frac{V_{uy}}{F_y} + \frac{V_{uz}}{F_z} + \frac{M_{ux}}{M_x} + \frac{M_{uy}}{M_y} + \frac{M_{uz}}{M_z} \leq 1$$

#### 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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