CODE EVALUATION REPORT

CERUS-1039

PUBLISHED: May 2025
REVISED: May 2025
EXPIRATION: May 2027

PRODUCT: **MHS ALUMINUM STUCTURAL FRAME ASSEMBLY**

REPORT HOLDER: MHS Building Systems

CONTACT DETAILS:
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CSI DIVISION: 13 34 00 – Fabricated Engineered Structures

CSI SECTION: 13 34 19 – Metal Building Systems

APPLICABLE CODES:
2021, 2018, 2015 International Building Code (IBC)
2021, 2018, 2015 International Residential Code (IRC)
2022 California Building Code (CBC)

EVALUATED: Structural Properties

IAS ACCREDITED Product Certification Agency PCA-118

1.0 APPROVED FOR FOLLOWING:

APPROVED TYPES OFCONSTRUCTION:	Type V
APPROVED USE:	Structural Frame Assembly
APPROVED INSTALLATIONS:	Load Bearing and Non-Load Bearing Post and Beams

2.0 DESCRIPTION:

2.1 General:

MHS Aluminum Structural Frame Assembly consists of prefabricated MHS modular aluminum frame extrusions in conjunction with proprietary connection components for use as load bearing or non-load bearing column-to-beam assemblies. The MHS Aluminum Structural Frame Assembly is intended for use with structural insulated panels (SIPs) for form wall and floor/ceiling assemblies for use in Type V construction. See Section 9.0 for product drawings and connection details.

MHS Aluminum Structural Frame Assembly complies with the 2021 / 2018 / 2015 IBC requirements outlined in this report. For jurisdictions governed by the IRC, use of MHS Aluminum Structural Frame Assemblies require Engineering Design in accordance with Section R301.1.3 of the 2021 / 2018 / 2015 IRC.

MHS Aluminum Structural Frame Assembly complies for use in jurisdictions following the 2022 CBC. See Section 10 of this report for further details.

2.2 Product Description:

2.2.1 MHS Aluminum Extrusion (170-4W):

The 170-4W aluminum frame posts and beams are made of aluminum extrusions. The base material is 6061-T6 aluminum conforming to ASTM B221 and ASTM B308. The 170-4W extrusion has a 6.69 x 6.69-inch (170 x 170 mm) cross section, a wall thickness of 0.16-inch (4 mm) and a weight per unit length of 7.80 lbs/ft (11.6 kg/m). See Figure 2 and Table 5 in Section 9.0 for profile details and properties.

2.2.2 MHS Master Lock Set:

The MHS Master Lock Set is an internal clamping mechanism consisting of two extruded 6061 T-6 aluminum components conforming to ASTM B221. The two components are connected by a 3/8-inch (9.5 mm) diameter pin. See Figure 3 in Section 9.0 for component drawings.

2.2.3 MHS C-Clamp Type I:

The MHS C-Clamp Type I is an extruded 6061 T-6 aluminum C channel, conforming to ASTM B221, used to connect exterior and interior materials to the MHS 170-4W extrusions including the attachment of 2x4” (38 x 89 mm) dimensional lumber to accommodate SIPs. The bracket is 2 x 2 x 3/4-inches (51 x 51 x 19 mm) with a tapped hole to accommodate a 1/2”-13 bolts for attachment to frame. See Figure 4 in Section 9.0 for component drawings.

2.2.4 MHS C-Clamp Type II

The MHS C-Clamp Type II is an extruded 6061 T-6 aluminum C-channel, conforming to ASTM B221, used to connect the MHS L-Connection to the MHS 170-4W aluminum frame to ensure a stable connection. The bracket is 2 x 4-1/2 x 3/4-inches (51 x 114 x 19 mm) with two tapped holes to accommodate two 1/2”-13 bolts for attachment to frame See Figure 4 in Section 9.0 for component drawings.

2.2.5 MHS L Metal Connectors:

The MHS L Metal Connectors are structural components fabricated from steel conforming to ASTM A36. Each connector is formed by welding two C-channel sections (measuring 3 x 1-3/8 x 1/4 inches (76 x 35 x 6 mm) and 7 inches (178 mm) in length) together at a 90-degree angle to form an L-shaped brace. The weld is a 1/4-inch (6 mm) fillet weld done in the fabrication shop using Gas Tungsten Arc Welding (GTAW) or Metal Inert Gas (MIG) welding techniques. The connector is designed to provide rigid, right-angle connections between MHS aluminum frame members. Each leg of the connector includes with two tapped holes to accommodate two 1/2”-13 bolts for attachment to frame. See Figure 5 in Section 9.0 for component drawings.

2.2.6 MHS Foundation Fixture:

The MHS Foundation Fixture consists of a 12 to 15-inch (305 to 381 mm) section of 3-1/2 x 3-1/2 x 1/4-inch (89 x 89 x 6 mm) HSS welded to a 12 x 12x 3/4-inch (305 x 305 x 19 mm) structural steel baseplate. The weld is a 1/4-inch (6 mm) fillet weld around the outer perimeter of the HSS. Welding is done in the fabrication shop using GTAW or MIG welding techniques. Steel components used conform to ASTM A36. The fixture serves as a foundation interface, providing a connection point between the MHS Aluminum Structural Frame Assembly and the building foundation. See Figure 7 in Section 9.0 for component drawings.

2.2.6 Fasteners:

2.2.6.1 Master Lock Bolt:

Master Lock Bolts used to connect the Master Lock to the Aluminum Structural Frame Assembly are 1/2”-13 x 3-inch (75 mm) galvanized or zinc plated steel hex head bolts. Bolts used are ASTM A307 Grade A or ASTM A354 Grade BD.

2.2.6.1 L and C Connection Screw:

Connection screws used to connect the MHS C-Clamps and L Metal Connectors to the Structural Frame Assembly are 1/2”-13 x 1.5-inch (38 mm) steel socket set flat point coarse thread screws. Screws used are compliant with ASME B18.3 and ASTM F912.

2.2.6.1 Foundation Fixture Connection Bolt:

Foundation Fixture Connection Bolts used to connect the Foundation Fixture to the Aluminum Structural Frame Assembly are 1/2”-13 x 2-inch (51 mm) galvanized or zinc plated steel hex head bolts. Bolts used are ASTM A307 Grade A or ASTM A354 Grade BD.

3.0 DESIGN:

3.1 Design Approval:

Construction documents, including engineering calculations and drawings providing floor plans, window details, door details, and connector details, shall be submitted to the code official when application is made for a permit. The individual preparing such documents shall possess the necessary qualifications as required by the applicable code and the professional registration laws of the state where the construction is undertaken. Approved construction documents shall be available at all times on the jobsite during installation. For jurisdictions governed by the IRC, use of MHS Aluminum Structural Frame Assemblies require Engineering Design in accordance with Section R301.1.3 of the 2021 / 2018 / 2015 IRC.

3.2 Design Loads:

Design loads to be resisted by the MHS Aluminum Structural Frame Assembly shall be as required under the applicable code. Loadings on the aluminum frame system shall not exceed the loads noted in Section 8.0 of this report.

Where loading conditions result in several modes of superimposed stressing, the sum of the ratio of actual loads over allowable loads shall not exceed 1. Calculations demonstrating that the loads applied are less than the allowable loads described in this report shall be submitted to the code official for approval.

Allowable loads of MHS frame connections are outlined in Table 1 of this report. Allowable axial loads for the 170-4W and uniform gravity distributed loads for the 170-4W post-and-beam connected assemblies at various span lengths are noted in Tables 2 through 4. The allowable capacities shall not be increased for wind and seismic loads. Maximum and minimum heights and spans are limited as provided in Tables 2 through 4. Unless otherwise noted, all allowable loads apply to the MHS Aluminum Structural Frame Assembly.

Axial loads shall be applied to the assembly through repetitive vertical members spaced at regular intervals of 48 in. on center or less, with loads applied concentrically to the top of the aluminum frame system. SIPs installed between the posts shall be considered non-load-bearing infill and therefore no increase in allowable uniform gravity loads will be permitted based on their presence.

Shear wall design is outside the scope of this report. Shear walls shall be sized to resist all code required wind and seismic loads.

For loading conditions not specifically addressed herein, the specific condition shall be supported by members designed in accordance with accepted engineering practice to meet applicable code requirements.

Extrapolation of allowable loads is not allowed and outside the scope of this report.

4.0 INSTALLATION:

4.1 General:

MHS aluminum frame members shall be fabricated, identified, and installed in accordance with the manufacturer's published installation instructions, the approved construction documents, this report and the applicable code. Where differences are found between documents, this report and the applicable building shall be followed. Approved construction documents shall be available at all times on the jobsite during installation.

4.1.1 Special Inspection:

Where MHS Aluminum Structural Frame Assemblies are used in applications as a part of a main wind force resisting system, special inspection is required in the following areas unless exempted by 2021 IBC Section 1704.2:

1. Wind Exposure Category B, where V_{Ult} is ≥ 150 mph (241 km/hr).
2. Wind Exposure Category C or D, where V_{Ult} is ≥ 140 mph (225 km/hr).

Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of elements of the main wind force-resisting system, including shear walls as specified in Section 1704.12.2 of the 2021 IBC.

Special inspection shall include the following but not limited to: extrusion connections, attachment of panels, and anchoring to foundation in accordance with Engineering Design and this report.

5.0 LIMITATIONS:

- MHS Aluminum Structural Frame Assemblies are to be installed per manufacturer's instructions and used in assemblies in accordance with the specifications of this report and the applicable code.
- Shear wall design is outside the scope of this report. Shear walls shall be sized to resist all code required wind and seismic loads.
- Seismic Design is outside the scope of this report.
- The panel and frame assembly shall be installed in buildings of Type V construction only.
- The performance of structurally insulated panels as part of the assembly is outside of scope of the report.
- MHS Aluminum Structural Frame Assemblies MHS are manufactured in Sun Valley, California with inspections performed by QAI Laboratories.

6.0 SUPPORTING INFORMATION:

The following data has been submitted for evaluation of MHS Aluminum Structural Frame Assemblies:

- Compliant data in accordance with the AA ADM-2020:
  - Connection Load Capacity
  - Axial Loading Capacity
  - Uniform Distributed Load Capacity

7.0 MARKING:

The MHS Aluminum Structural Frame Assembly and connectors complying with this report shall be labeled with the following information:

- Manufacturer's Name
- Manufacturing Address
- Product Name
- Date of Manufacture
- QAI CER$_{US}$-1039
- QAI Logo shown below:

8.0 RESULTS/RATINGS:

Table 1 below shows the allowable loads at the MHS Aluminum Structural Frame Assembly Connections at various loading directions as illustrated in Figure 1 below. The MHS 170-4W members are connected using MHS Master Lock Set, two L-connectors, and two C-connectors.

Table 1: Allowable Loads at MHS Frame Connections

Load Direction	Allowable Load[1]		Strength at 1/8" (3.2 mm) Deflection	
	Kips	kN	Kips	kN
P1	4.90	21.8	5.94	26.4
P2	5.17	23.0	4.52	20.1
P3	5.14	22.9	4.00	17.8

1. Allowable load based on a factor of safety of 2.1 applied to yield strength.

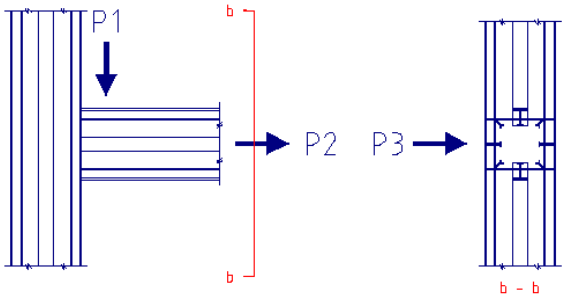

Figure 1 - Intersecting MHS 170-4W members Loading Point Directions

Table 2: Allowable Axial Loads on 170-4W Members

Member Length		Allowable Axial Forces			
		Compression		Tension[1]	
ft	m	Kips	kN	Kips	kN
3	0.9	114.4	508.9	98.8	439.5
6	1.8	100.6	447.5		
9	2.7	86.9	386.6		
12	3.7	68.6	305.1		
15	4.6	43.9	195.3		
18	5.5	30.5	135.7		
21	6.4	22.4	99.6		

1. Tensile strength is governed by material yield strength and is therefore independent of member length.

Table 3: Allowable Uniform Distributed Gravity Loads on Connected 170-4W Beam-to-Column Members[1]

Span		Dead + Live Load[2]		Live Load[3]	
ft	m	psf	kPa	psf	kPa
3	0.9	3692	177	3692	177
4	1.2	2769	133	2769	133
5	1.5	2215	106	2215	106
6	1.8	1846	88.4	1846	88.4
7	2.1	1582	75.7	1216	58.2
8	2.4	1222	58.5	814	39.0
9	2.7	858	41.1	572	27.4
10	3.0	626	30.0	417	20.0
11	3.4	470	22.5	313	15.0
12	3.7	362	17.3	241	11.5
13	4.0	285	13.7	190	9.10
14	4.3	228	10.9	152	7.28
15	4.6	185	8.86	124	5.94
16	4.9	153	7.33	102	4.88

1. The safety factor of connections shear capacity is considered equal to 2.1. The columns are connected to the beams with the connection components as described in Section 2.2 of this report.
2. The deflection limit under the Dead + Live load combination is limited to L/240 as per the IBC.
3. The deflection limit under Live Loads is limited to L/360 as per the IBC.

Table 4: Allowable Uniform Distributed Gravity Loads on Floors and Roofs per Beam Spacing[1]

Beam Spacing (OC)	Beam Length		Dead + Live Loads[2]		Live Loads[3]	
	ft	m	psf	kPa	psf	kPa
3 ft (0.9 m)	4	1.2	2422	116	2172	104
	6	1.8	965	46.2	644	30.8
	8	2.4	407	19.5	272	13.0
	10	3	209	10.0	139	6.66
	12	3.7	121	5.79	80	3.83
	14	4.3	76	3.64	51	2.44
	16	4.9	51	2.44	34	1.63
4 ft (1.2 m)	4	1.2	1816	87.0	1629	78
	6	1.8	724	34.7	483	23.1
	8	2.4	305	14.6	204	9.77
	10	3	156	7.47	104	4.98
	12	3.7	91	4.36	60	2.87
	14	4.3	57	2.73	38	1.82
	16	4.9	38	1.82	25	1.20
5 ft (1.5 m)	4	1.2	1452	69.5	1303	62.4
	6	1.8	579	27.7	386	18.5
	8	2.4	244	11.7	163	7.80
	10	3	125	5.99	83	3.97
	12	3.7	72	3.45	48	2.30
	14	4.3	46	2.20	30	1.44
	16	4.9	31	1.48	20	0.96
6 ft (1.8 m)	4	1.2	1211	58.0	1086	52.0
	6	1.8	483	23.1	322	15.4
	8	2.4	204	9.77	136	6.51
	10	3	104	4.98	70	3.35
	12	3.7	60	2.87	40	1.92
	14	4.3	38	1.82	25	1.20
	16	4.9	25	1.20	17	0.81

1. The safety factor of connections shear capacity is considered equal to 2.1. The columns are connected to the beams with the connection components as described in Section 2.2 of this report.
2. The deflection limit under the Dead + Live load combination is limited to L/240 as per the IBC.
3. The deflection limit under Live Loads is limited to L/360 as per the IBC.

9.0 PRODUCT DETAILS:

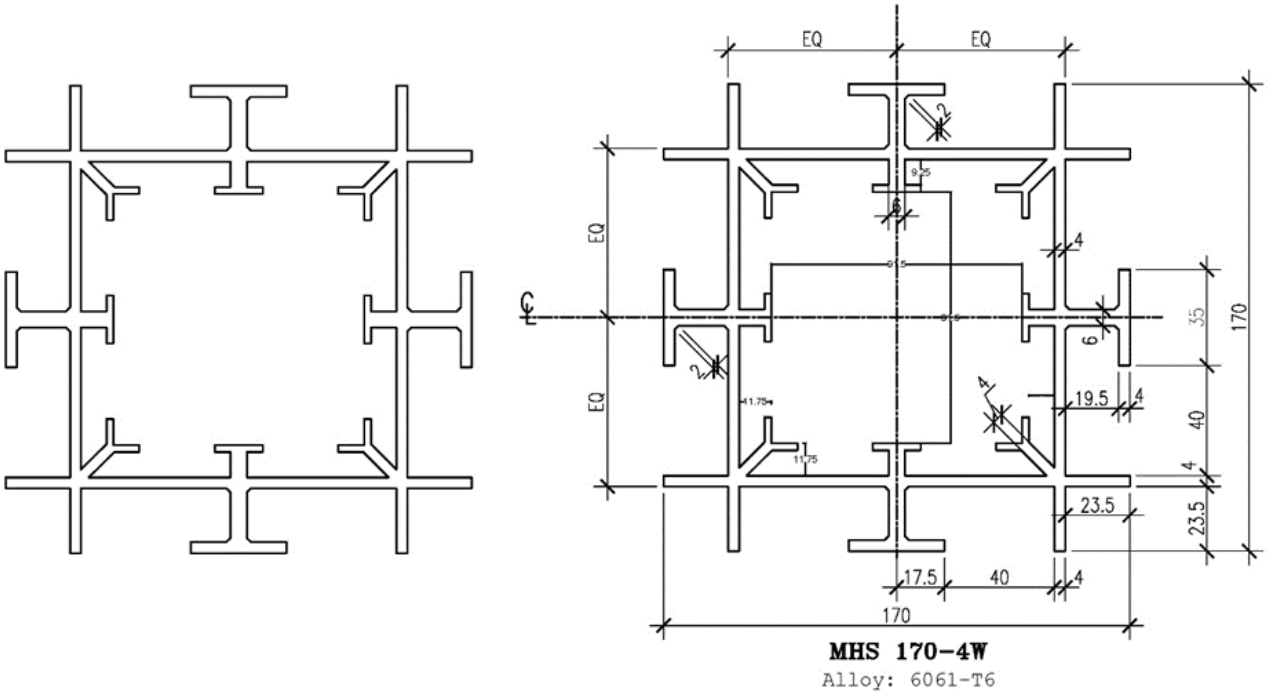

Figure 2 - MHS 170-4W Cross Section

Table 5: MHS Aluminum Extrusion (170-4W) Properties:

Section Properties			
Property		**Value**	
Cross Sectional Area	A	6.39 in^2	41.2 cm^2
Moment of Inertia	I_x, I_y	27.87 in^4	11,590 cm^4
Section Modulus	S_x , S_y	8.38 in^3	137 cm^3
Radius of Gyration	r_x , r_y	2.09 in	5.31 cm
Material Properties (6061-T6 Aluminum)			
Property		**Value**	
Young's Modulus	E	10,000 ksi	68.9 GPa
Shear Modulus	G	3,800 ksi	26.2 GPa
Yield Strength	F_y	35 ksi	240 MPa

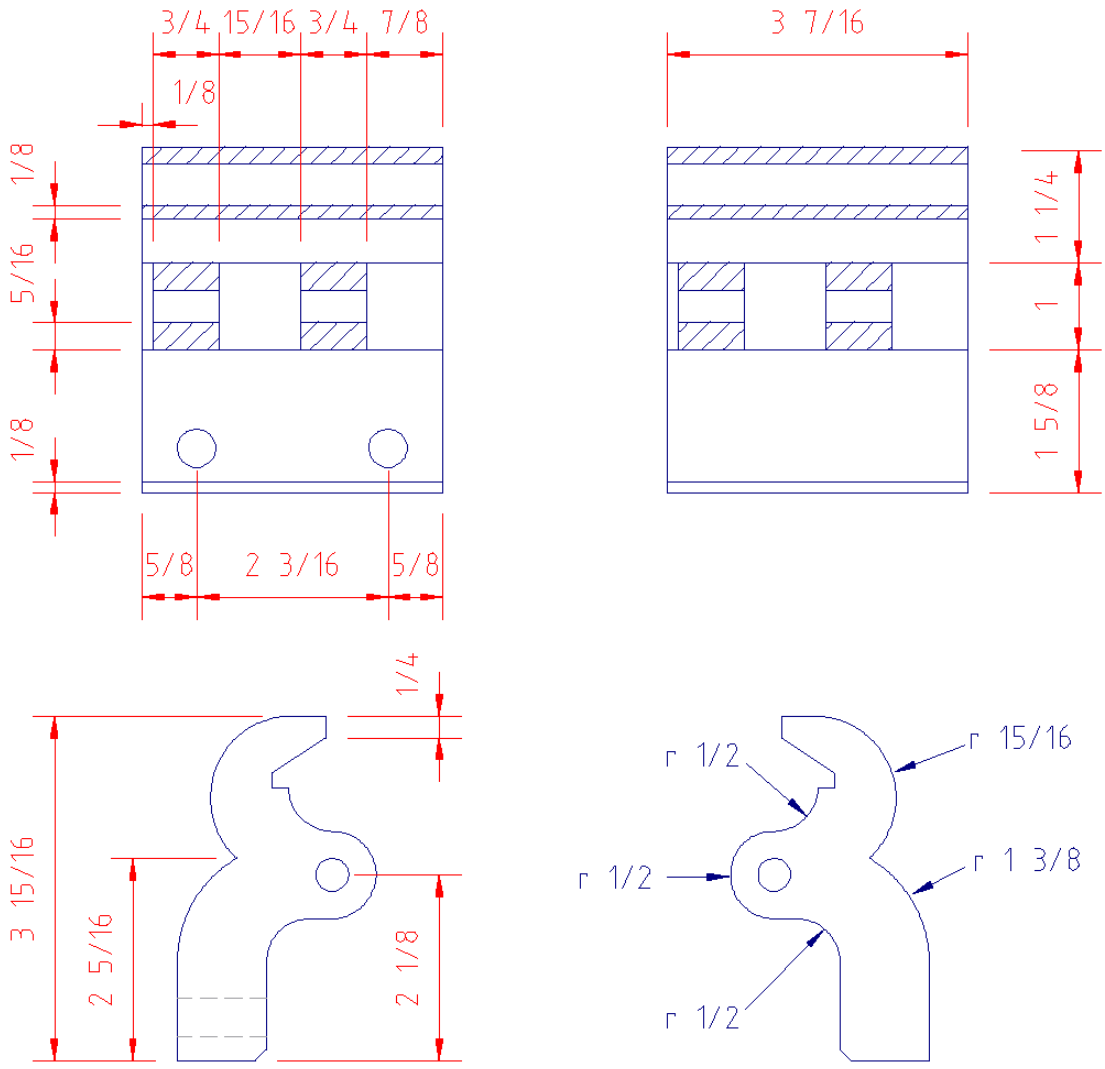

Figure 3 - MHS – Master Lock Set

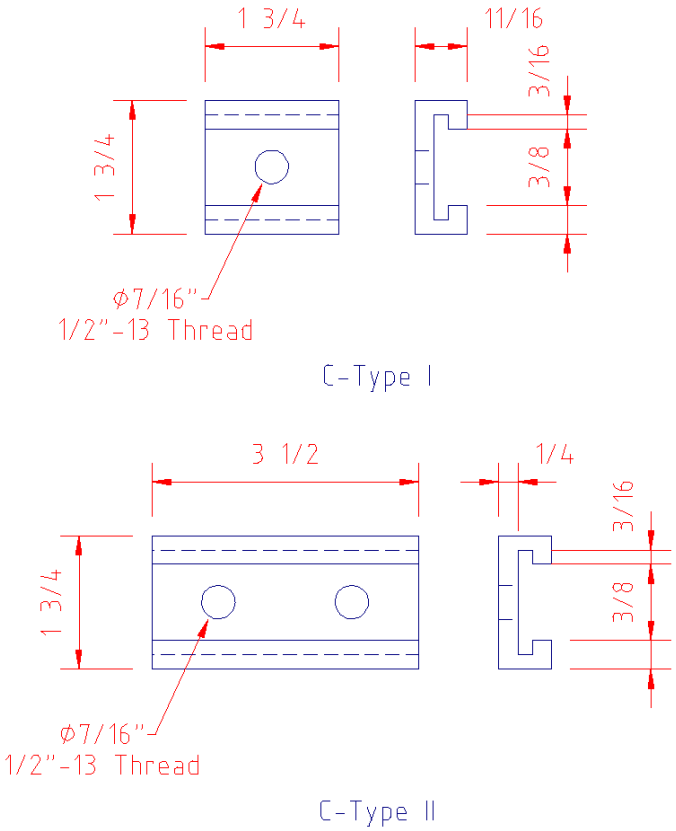

Figure 4 - MHS – C Clamp Type I and Type II

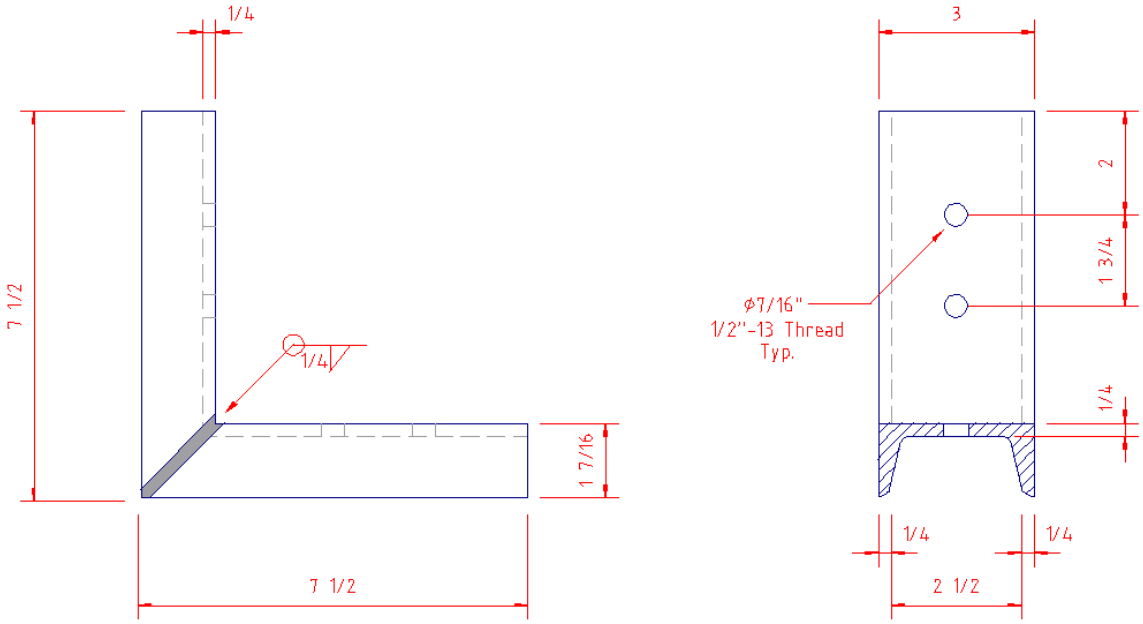

Figure 5 - MHS – L Metal Connectors

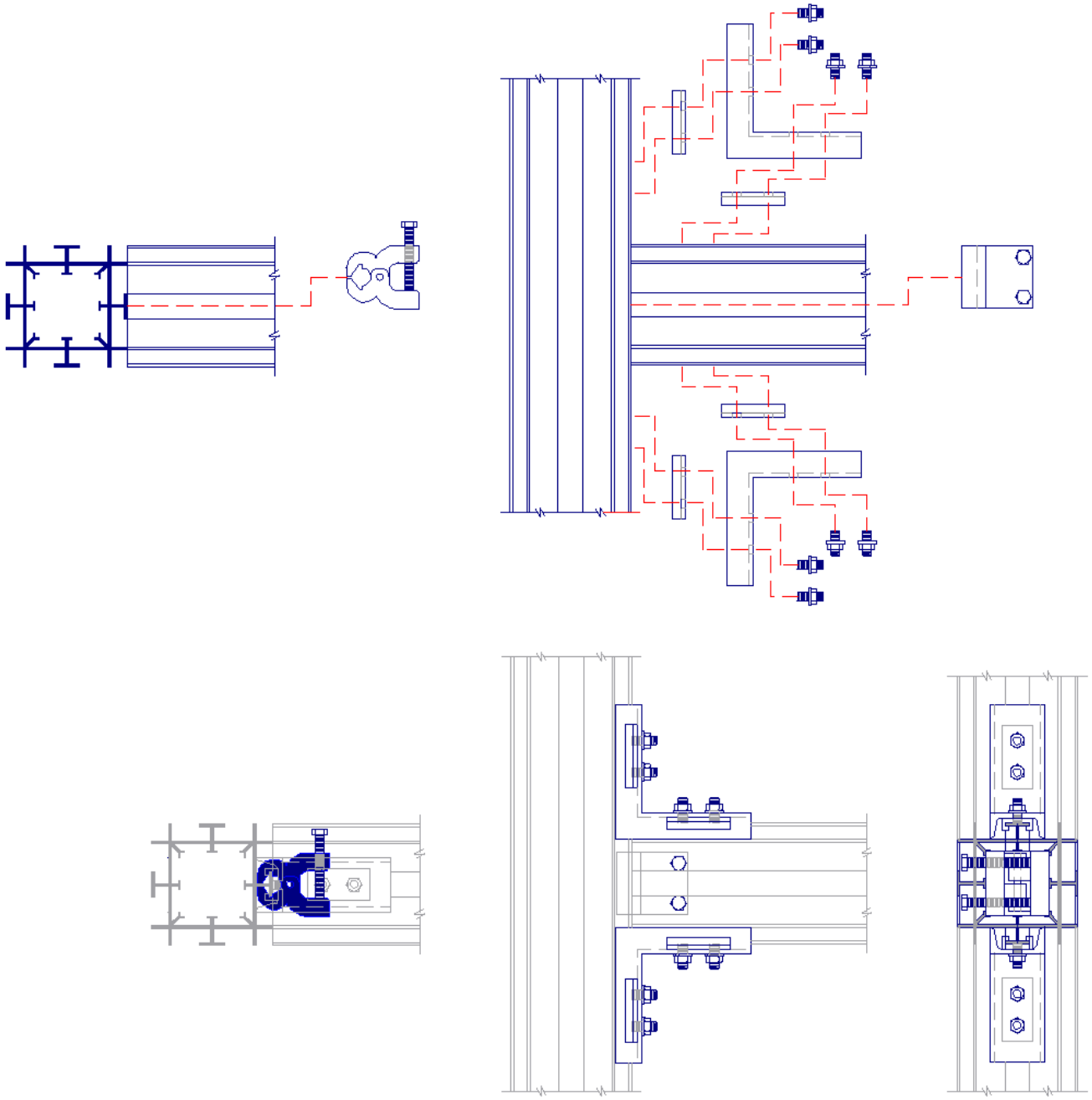

Figure 6 - MHS – Connection Assembly

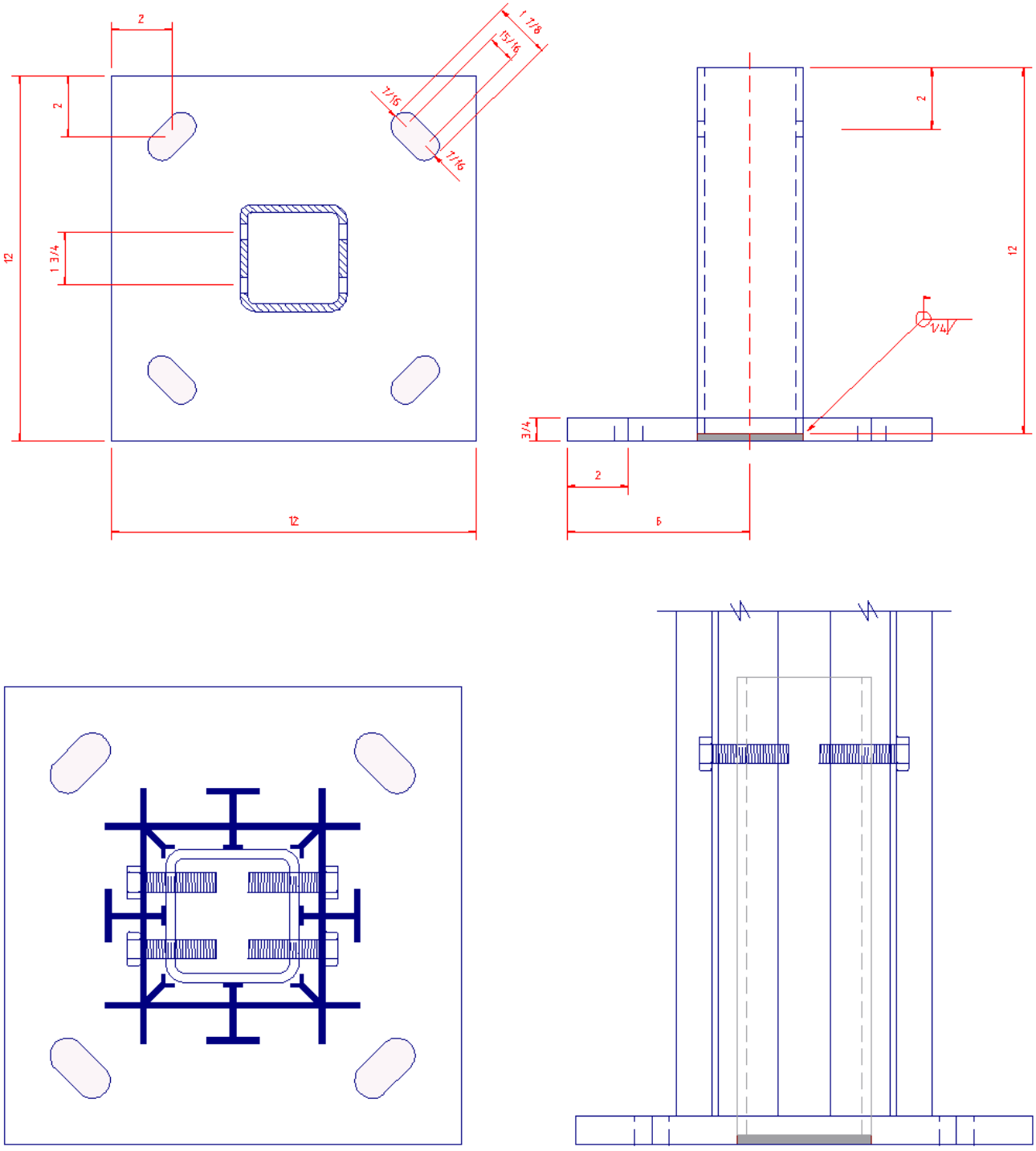

Figure 7 - MHS – Foundation Fixture

10.0 SUPPLEMENTAL CODES

10.1 2022 California Building Code:

The MHS Aluminum Structural Frame Assembly has been evaluated for use in accordance with the applicable provisions of the 2022 California Building Code (CBC). Complete structural plans and calculations bearing the signature of a licensed Civil or Structural Engineer, registered in the State of California, shall be submitted to the appropriate authority having jurisdiction for review and approval in accordance with Section 107.2.1 of the CBC. The system is limited to installation in buildings of Type V construction as defined by CBC Section 602.5. This evaluation does not address the fire-resistive rating of the MHS Aluminum Structural Frame Assemblies as building elements, which is outside the scope of this report. Structural loading capacities of the panels are outlined in this report and shall not be increased for wind or seismic design loads.

11.0 ELIGIBILITY OF REPORT

QAI's Code Evaluation Report complies with the 2021 / 2018 IBC Section 104.11 *Alternative materials, design and methods of construction and equipment* subsection 104.11.1 *Research Reports*. Supporting data has been evaluated by QAI for compliance of the noted materials and assemblies to the applicable code by QAI, and *approved* source as detailed below.

The attached report has been reviewed by a QAI Registered Professional Engineer approved by the specific state Board of Professional Engineers noted on the specific P.E. seal(s).

Per section 1703 of the IBC, QAI is an independent third-party testing, inspection and certification agency accredited by the International Accreditation Service, Inc. (IAS) for this specific scope (see IAS PCA-118). QAI can confirm that based on its IAS accreditation it meets IBC Section 1703.1 on Independence, Section 1703.1.2 on Equipment and Section 1703.1 on Personnel.

This Evaluation report has been designed to meet the performance requirements of IBC Section 1703.4 and contains the required information to show the product, material or assembly meets the applicable code requirements.

The product is labeled per section IBC 1703 and subject to follow-up inspection per IBC 1703.6 using QAI IAS accredited ISO/IEC 17020 inspection program (see IAS AA-723).

For more information regarding QAI Laboratories, please visit www.qai.org.

The above is an example of the QAI registered Listing mark. The Listing mark may only be used by the Report Holder per the QAI service agreement on products defined in this report. The 'us' indicator in the 4 o'clock position indicates the product complies with the properties evaluated with limitations outlined in this report for use in the US market. A 'c' indicator in the 8 o'clock position indicates the product has been evaluated for use in the Canadian market.

IAS ACCREDITED Product Certification Agency PCA-118

12.0 REFERENCED STANDARDS

ASTM A36 *Standard Specification for Carbon Structural Steel*
ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A354 *Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners*
ASTM B221 *Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes*
ASTM B308 *Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles*
ASTM F912 *Standard Specification for Alloy Steel Socket Set Screws*
ASME B18.3 *Socket Cap, Shoulder, Set Screws, and Hex Keys*
AA ADM-2020 *Aluminum Design Manual* – The Aluminum Association Inc.