MGX Accelerated Computing Rack and Trays Specification

Revision 1.1

Version
Product Specification Template v1.3
Effective August 29, 2024

Author: NVIDIA

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1. License

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☑ OPTION B: Open Web Foundation (OWF) CLA

1.1. OPTION B: Open Web Foundation (OWF) CLA

1.2 Acknowledgements

The Contributors of this Specification would like to acknowledge the following companies for their feedback:

Aivres	Envicool	Microsoft	SUNON
Amphenol	FIT	Molex	Supermicro
Asrock Rack	GIGABYTE	MotivAir	Taicheng
Astron	Google	Nidec	TE Connectivity
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Danfoss	Lotes	Samsung	
Dell	Luxshare	Schneider Electric	
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Eaton	Micron	Staubli	

2. Compliance with OCP Tenets

This contribution complies with the OCP Tenets of Openness, Efficiency, Impact, Scale, and Sustainability. The MGX Accelerated Computing Rack and Tray specification is built on top of existing OCP specifications to extend the utility of those specification for higher power and liquid cooled AI devices. This specification allows any third party to build racks and trays with common blind mate power and liquid cooling interfaces and mounting locations.

2.1. Openness

Third parties may build to this specification such that trays and racks are interoperable in power, cooling and latching interfaces. In addition, a volumetric and mounting locations are supported for tray to tray connectivity that may be implemented at the discretion of the implementer. Tray to tray connectivity electrical and mechanical specifics are not detailed in this specification given the myriad of options in the industry and silicon specific requirements of such interconnects. Implementers of this specification may deviate or build upon this specification as needed to meet product requirements.

2.2. Efficiency

This specification builds upon existing OCP contributions. These include:

- Open Rack V3 Base Specification
- Open Rack Busbar Specification
- Universal Quick Disconnect (UQD) Specification

In addition, this specification defines the first modular IO bay system for an OCP 1RU server which allows customization by end users with limited impact to existing infrastructure.
By leveraging and then building upon existing specifications, the MGX Accelerated Computing Rack and Tray Specification brings continuous improvement to the OCP community and allows leveraging of existing OpEx investments in datacenters and datacenter components.

2.3. Impact

Through establishing common infrastructure for an accelerated computing platform, this specification will streamline deployment of new hardware to enable new workloads. By leveraging this common infrastructure, users can reduce time-to-market and OpEx while increasing supply chain assurance and reducing technical risk. Known suppliers of relevant components are shared in this specification.

2.4. Scale

Accompanying and within this specification are the necessary documents (2D, 3D, design documentation) to kick off and scale production of the rack infrastructure specified. All designs shown are available from a variety of sources and may be procured by the implementor as desired.

2.5. Sustainability

By integrating liquid cooling into the rack and tray architecture, this specification maximizes heat capture and enables the implementor to reach a more sustainable datacenter PUE compared to air cooling. In addition, by leveraging existing specifications, this specification eliminates waste and encourages reuse.

3. Change Log

Date	Version #	Author	Description
10/10/24	1.0	NVIDIA	Initial draft
01/07/25	1.1	NVIDIA	Corrected drawings and CAD errors in KOZs. Updated EIA flange position in Rack and corresponding braces.

4. Scope

This document defines a Hardware Product Specification for the MGX Accelerated Computing Rack and Trays. The following details are defined within this specification.

- Rack overview design documentation (2D and 3D)
    - Rack alignment and reinforcement components for multi-node connectors and blind mate liquid
    - 1400A Bus Bar design based on ORV3 bus bar
    - Adaption to support 19” EIA hardware
    - Mounting locations, brackets and UQDB components for blind mate liquid cooling manifolds
    - Blind Mate Slide Rails for compute and switch trays
    - Rack level thermal requirements
- Compute and Switch tray mechanical form factors
    - Multi-node connector zones
    - UQD location and float mechanism design
    - Locking ejector design
    - MGX IO bay design
    - MGX Compute board form factor
    - MGX DC-SCM Form Factor

The following components are outside the scope of this specification:

- Power shelves
- TOR and MGMT Switches
- CDUs
- IO and Power cabling designs

5. Overview

This specification describes and documents a rack and tray infrastructure design that supports blind mate liquid cooling, intra-rack tray interconnectivity zones, higher bus bar power, rack reinforcements, modular compute trays and switch trays. The goal of the design is to build on top of existing OCP specifications and increase utility by adding the features above. The rack, trays, and internal components specified here were derived from the MGX architecture to build a modular and reusable infrastructure for AI on top of existing standards. The following figures show additions to the ORV3 base rack progressively for clarity, each building on the figure before.

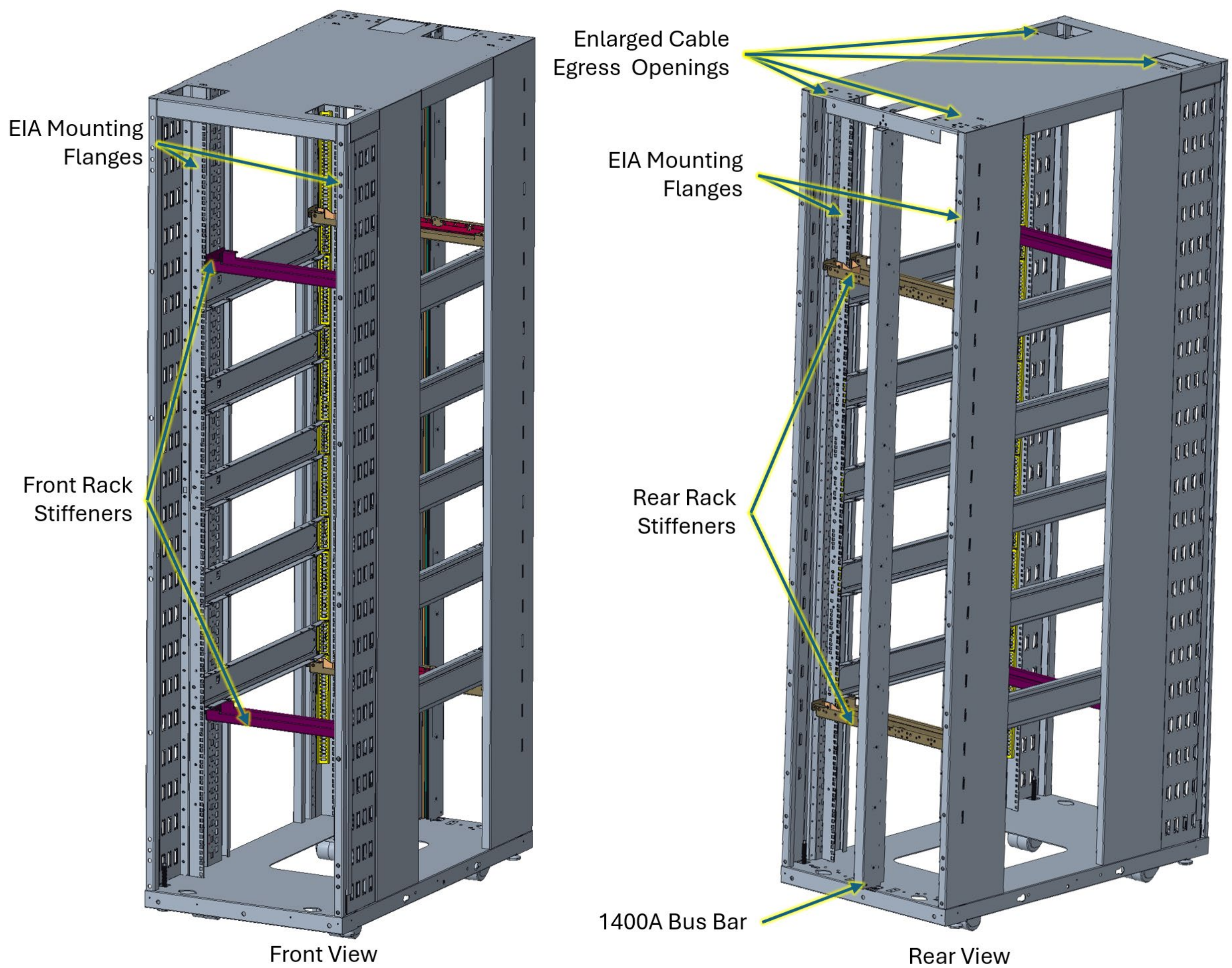


Figure 5-1. MGX Rack Overview 1 – Rack Extender, Blind Mate latching, and Manifold/Cartridge Supports

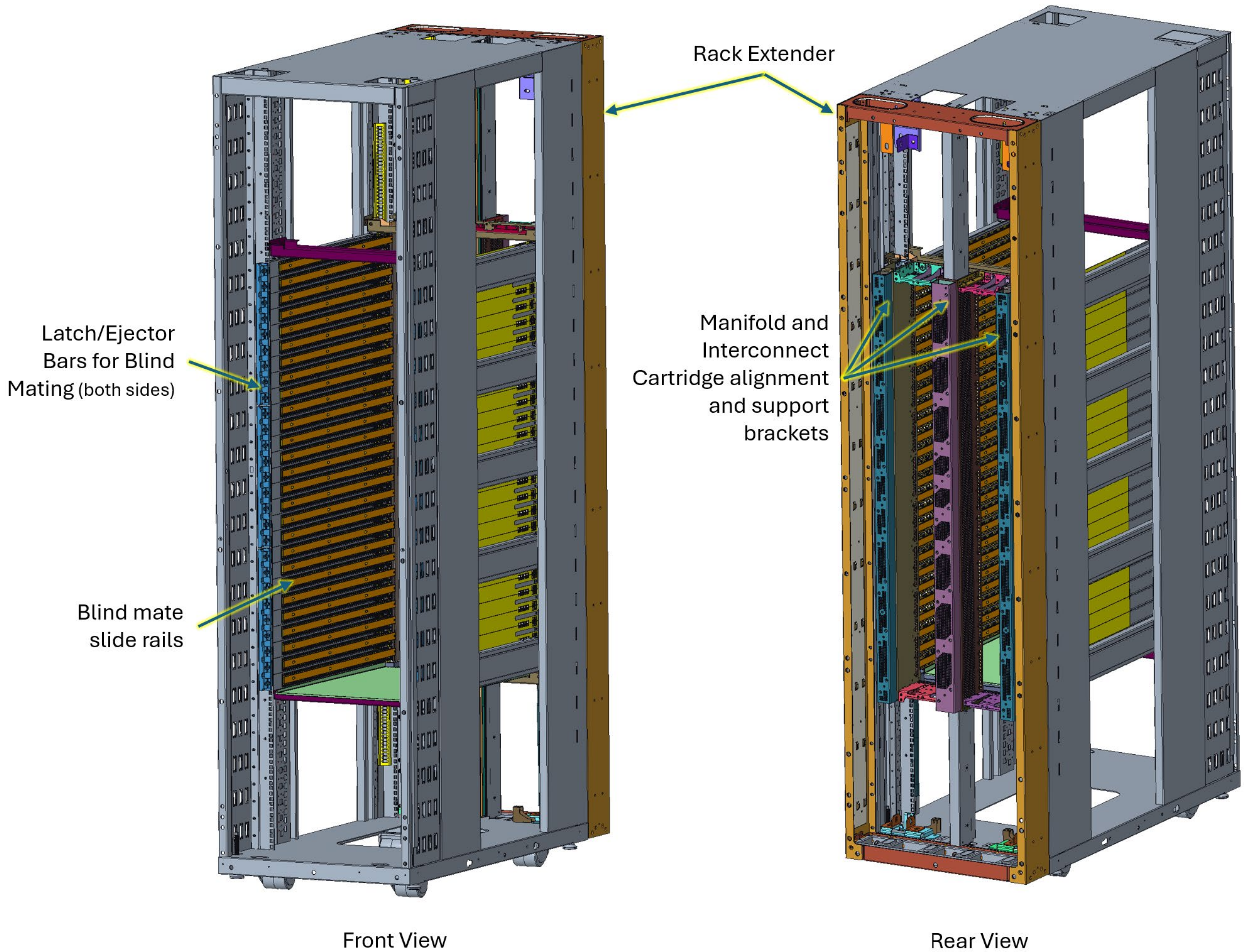


Figure 5-2. MGX Rack Overview 2 – Rack Extender, Blind Mate latching, and Manifold/Cartridge Supports

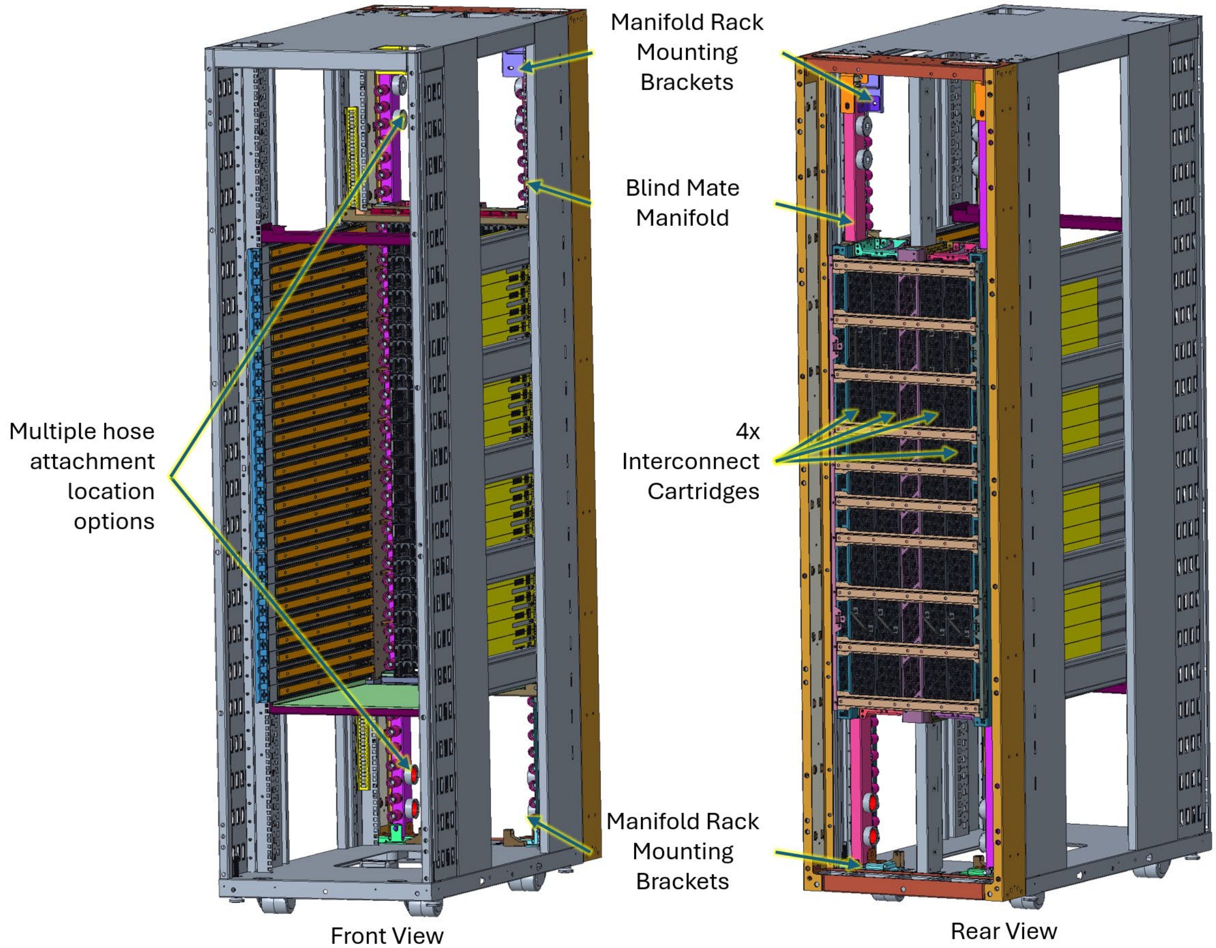


Figure 5-3. MGX Rack Overview 3 – Manifold and Cartridges

5.1 Accompanying Design Specifications

The following specifications are references throughout this document.

- Open Rack V3 Base Specification
- Open Rack Busbar Specification
- Universal Quick Disconnect (UQD) Specification
- OCP DC-SCM Module Specification

6. Environmental / Regulatory Requirements

The rack and tray infrastructure is designed to support "rack and roll" deployment with the option to be charged with liquid. The following environmental ratings and shock and vibration testing are used to validate the L11 implementation:

- Packaged L11 Shock and Vibration requirements
  - 2 hours ISTA 3B vibration. 1-200 Hz, 0.54 G_{rms}. No top load.
  - 2 hours of air vibration per ASTM D4169-23 e1.
- Rotational Drop Test – ISFTA 3B Palletized/Skidded, 6 inch drop, Front and left flat side, 2 opposing corners, 4 drops total
- Incline Impact Test – 4 sides, 4.0 ft/s
- Packaged L11 Handling Requirements
  - Tip Test – 22° in all directions (Front, Back, Left, Right)
  - Fork Lift Handling – Refer to ISTA 3B for details

7. Physical Specifications

This specification defines the rack design and tray form factors for Accelerated Computing systems and form factors for IO bays and boards. Datacenter layout, specific module and IO board designs are not included in this specification. Unless otherwise specified, tolerances in this document are shown below.

Table 7-1. Controlling Tolerances Unless Otherwise Specified

Dimension Type	Tolerance
Center of hole to center of hole	+/- 0.127 mm (+/- 0.005 inch)
Center of hole to edge	+/- 0.254 mm (+/- 0.010 inch)
Edge to edge	+/- 0.127 mm (+/- 0.005 inch)
Feature size	+/- 0.100 mm (+/- 0.004 inch)
PCB thickness	+/- 10% of nominal

7.1 Compute and Switch Tray Mechanical Form Factor

This section details the mechanical form factor of the compute tray and switch tray. In this specification, a compute tray refers to a 1RU server chassis that contains some element of CPU and/or GPU. A switch tray refers to a 1RU server chassis that contains the necessary ASICs and interconnects to create a multi-node network of compute trays. Both the compute tray and switch tray leverage the MGX 1RU reference chassis specified below. Refer to 3D models provided for design details not shown here.

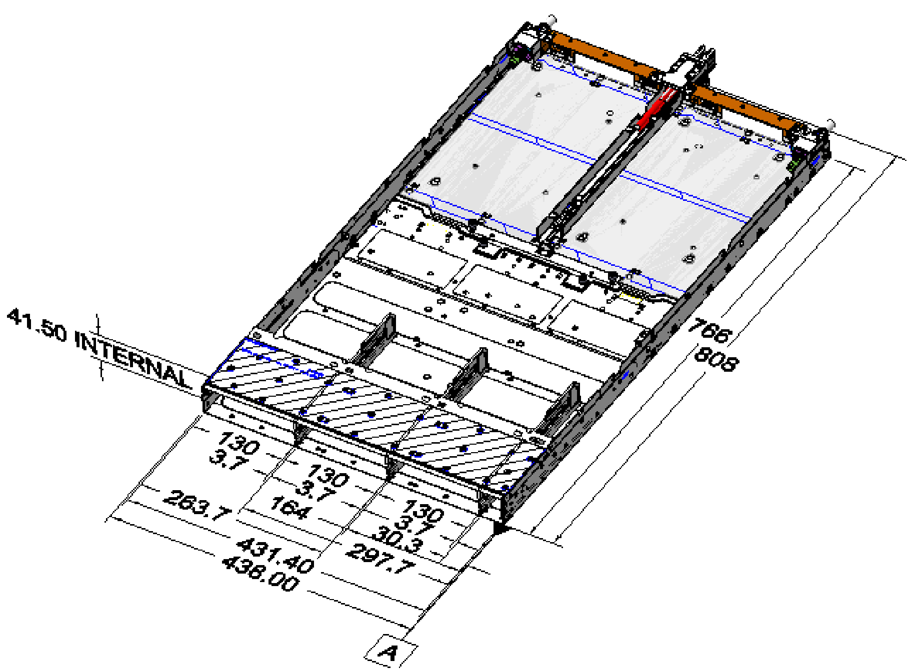


Figure 7-1. 1RU Common chassis dimensions

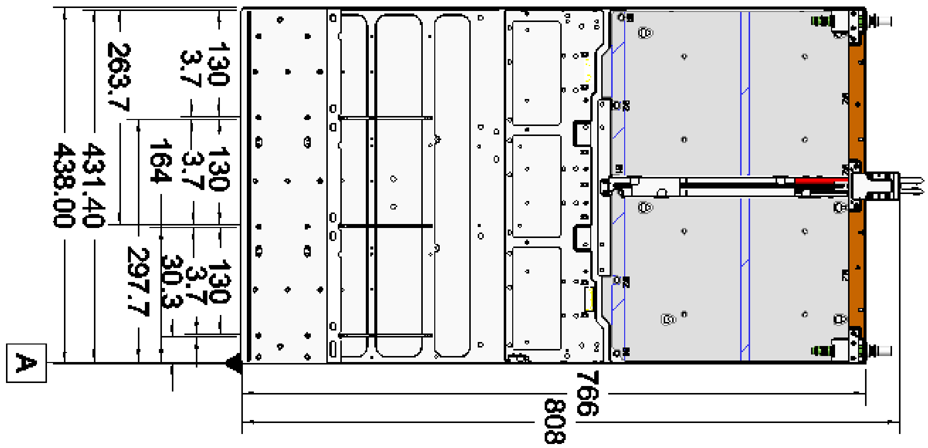


Figure 7-2. 1RU Common chassis dimensions – Top view

The figures below illustrate the compute tray design and key aspects of this specification.

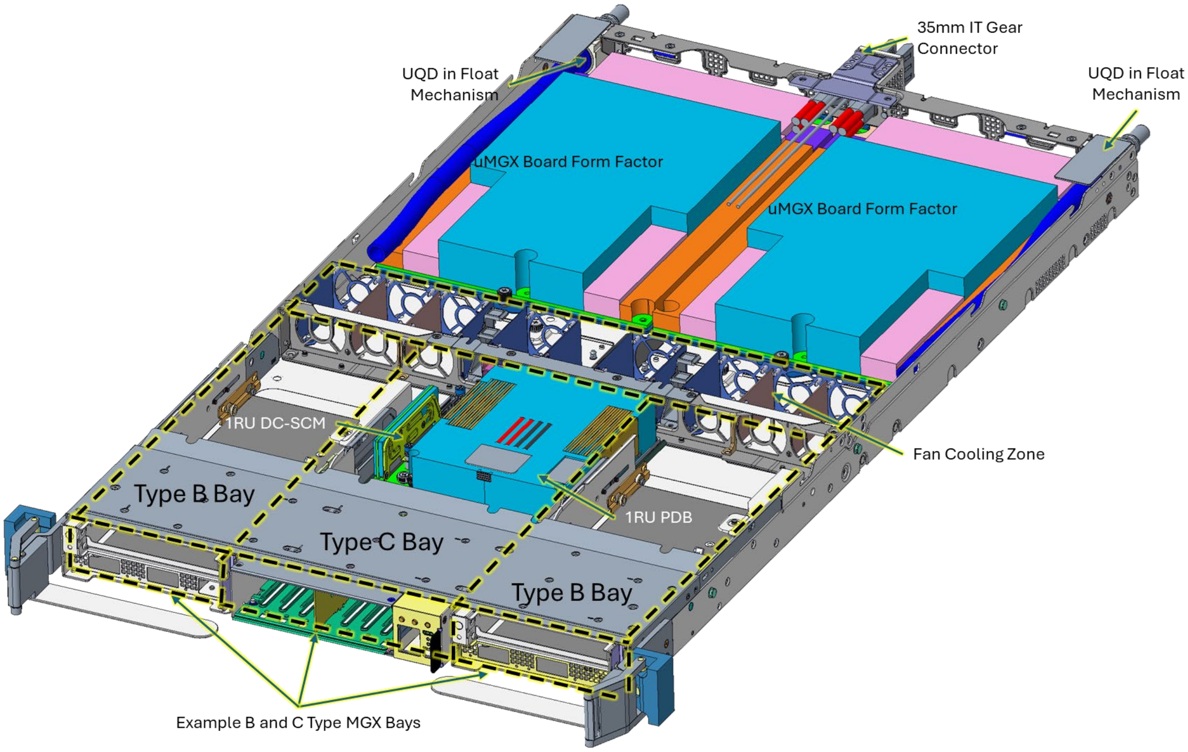


Figure 7-3. MGX 1RU System Overview – Front view

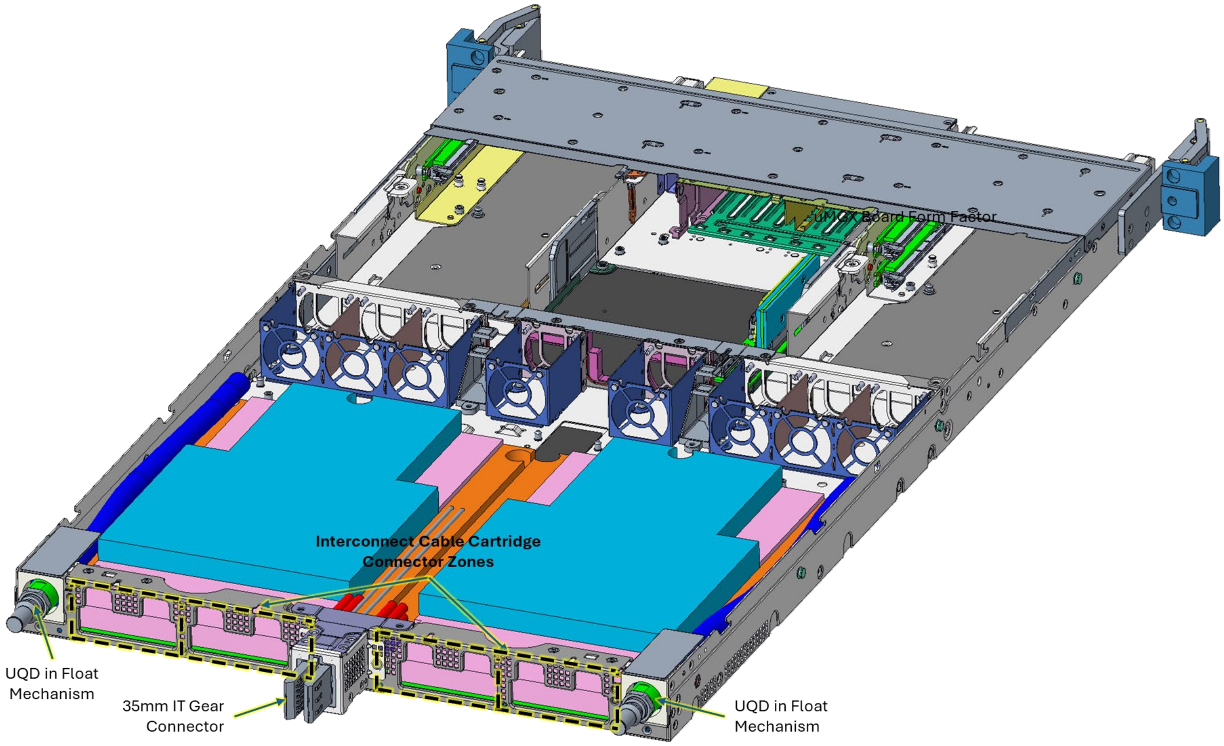


Figure 7-4. MGX 1RU System Overview – Rear view

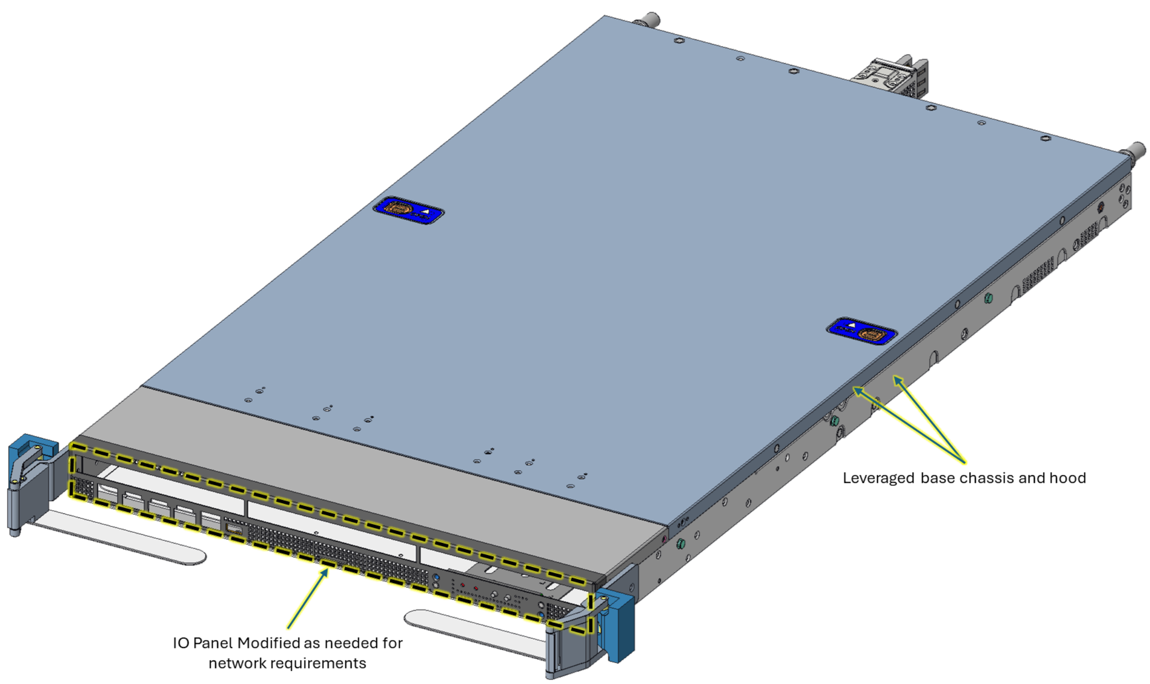


Figure 7-5. MGX 1RU Switch Overview – Front view

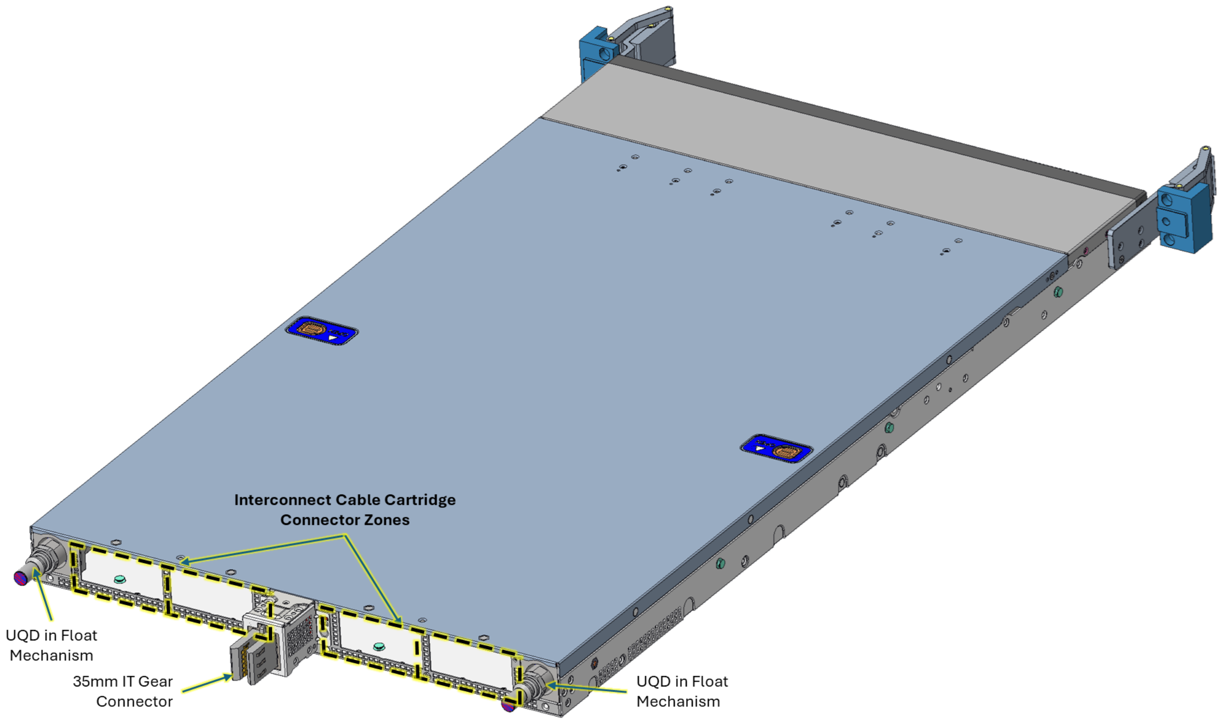


Figure 7-6. MGX 1RU Switch Overview – Rear view

7.2 Rack Form Factor

This section defines the MGX rack features built on top of the ORV3 rack specification. These include native 19" component support, rear extender to 1200mm, expanded IO cabling volume, full rack blind mate manifold, interconnect cartridge mounting, and additional rack structural support. Refer to 3D models provided for design details not shown here. Note that for rack supports, rear brackets and primary load bearing components SGC400 material or equivalent is recommended.

7.2.1 19" EIA IT Gear Support and Front Cabling

As previously mentioned, the MGX rack adapts the ORV3 rack to support 19" EIA gear and deploy on a 1RU pitch. For AI applications, this brings the benefits of additional front cabling volume for IO and management connectivity, space for latching and slide components, and additional structure to support blind mate liquid and interconnect forces. In addition, existing EIA native hardware such as switches, servers and CDUs may be supported.

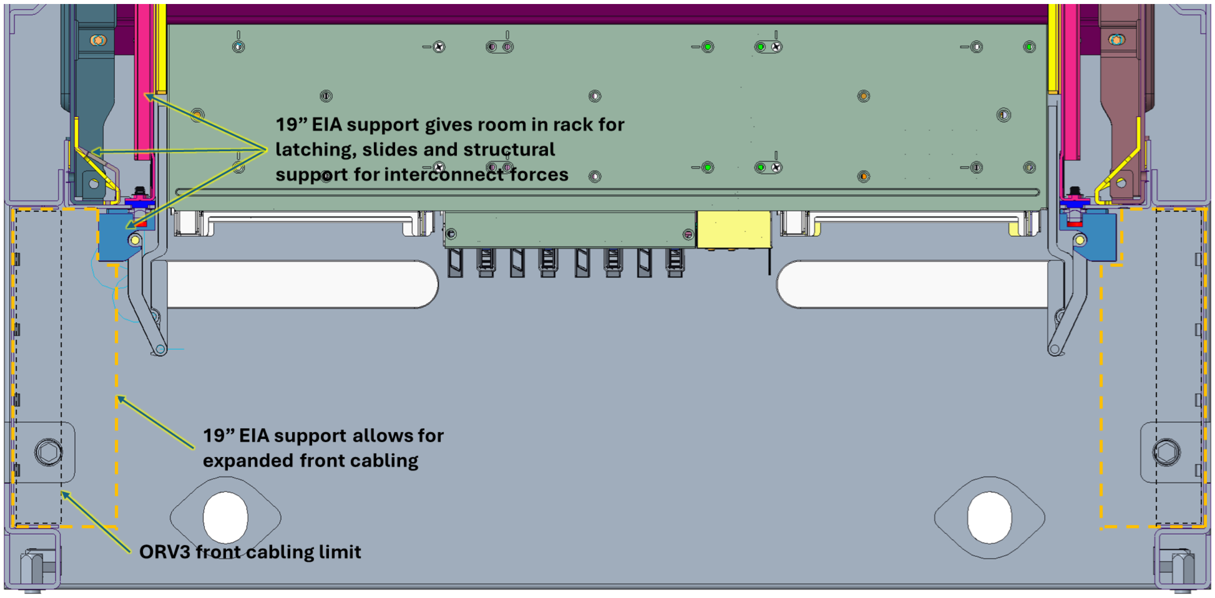


Figure 7-7. Front cabling volume expansion using 19" EIA rack mounting

7.2.2 Rear Rack Extender

Shown below is the rear rack extender which increase to the depth of the rack to 1200mm. This optional addition provides protection to rear rack components such as a the cable bracing and manifold fittings while maintain the existing OCP ORV3 rear hole pattern for seismic bracing and doors as needed. Refer to the 3D database for more details.

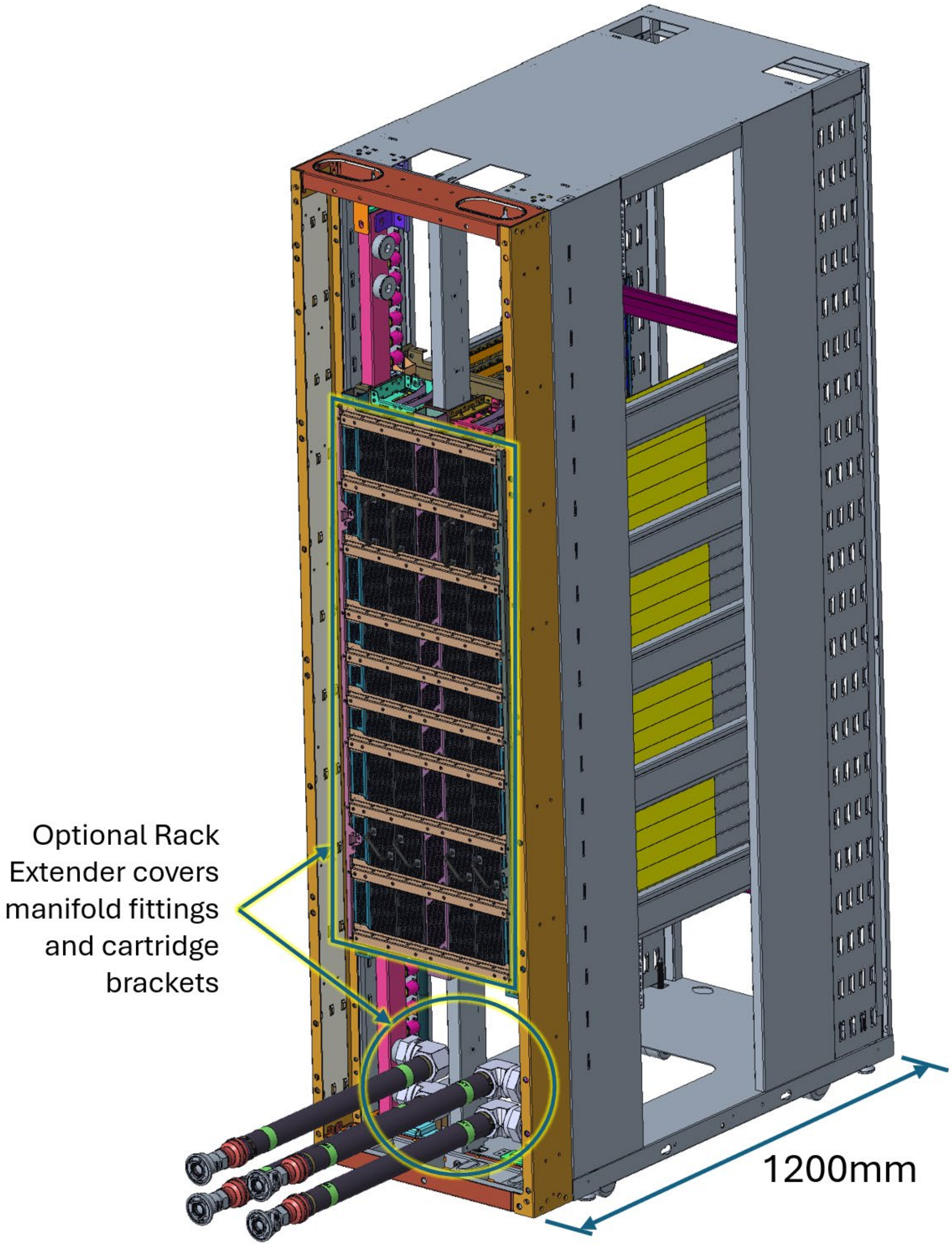


Figure 7-8. Rack Extender Overview

7.2.3 Rack Manifold Mounting

The following figures define the manifold detailed design, sub components, manufacturing requires, mounting brackets and mounting position within the MGX Rack and the ORV3 OCP Rack.

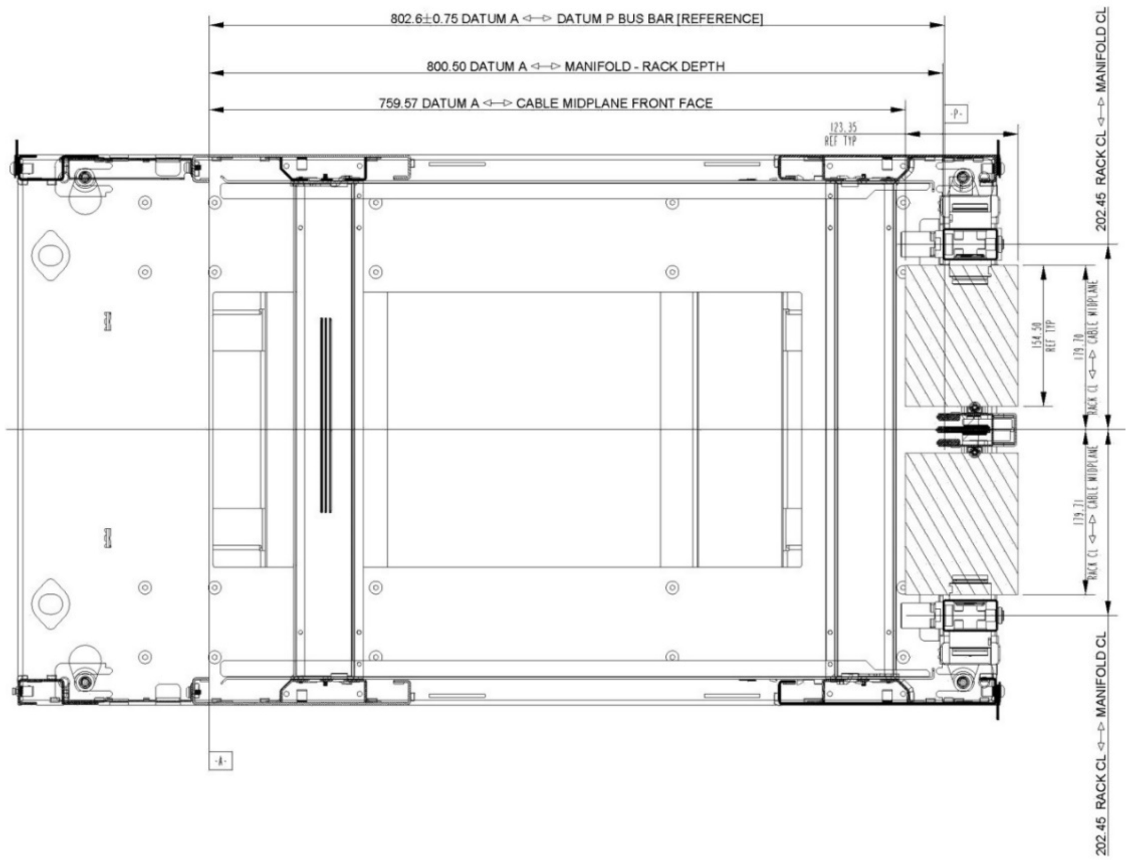
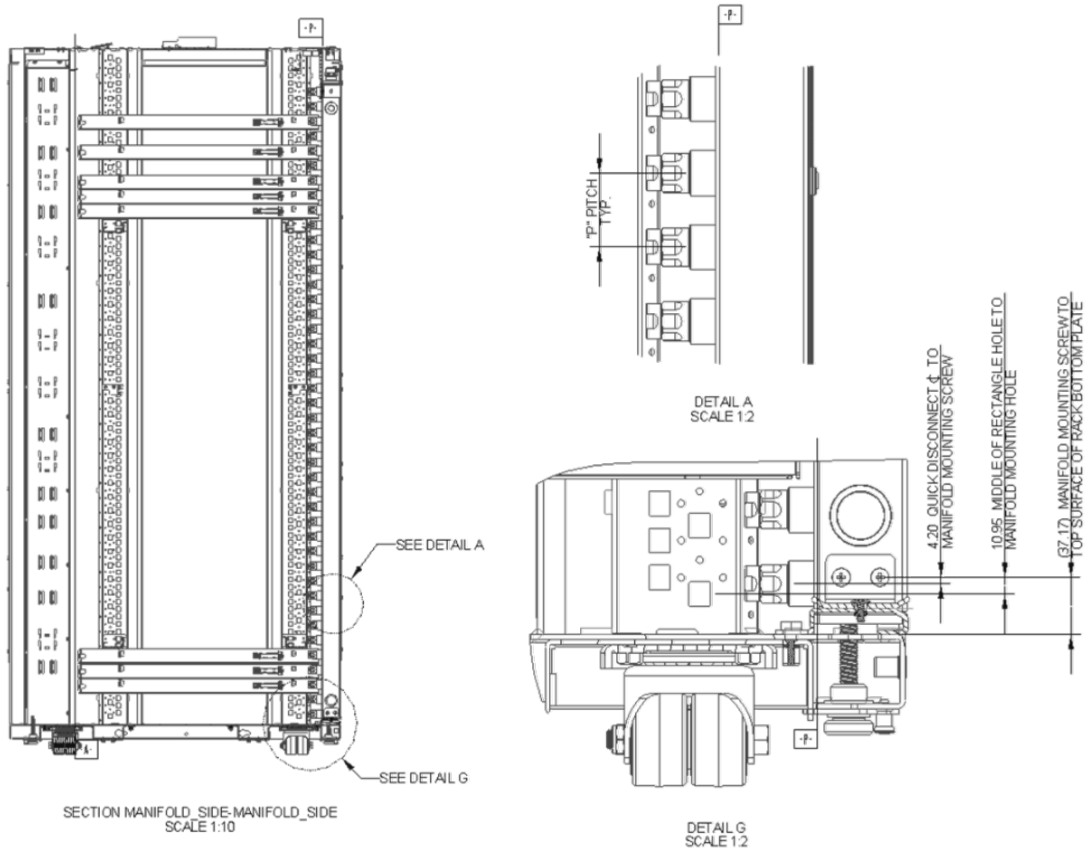


Figure 7-9. ORv3 Rack Manifold Location – Top View



DIMENSION "P" (MM)	DESCRIPTION
44.45	RACK UNIT (RU) PITCH
48.00	OPEN RACK UNIT (OU) PITCH

Figure 7-10. Orv3 Rack Manifold Locations Detail

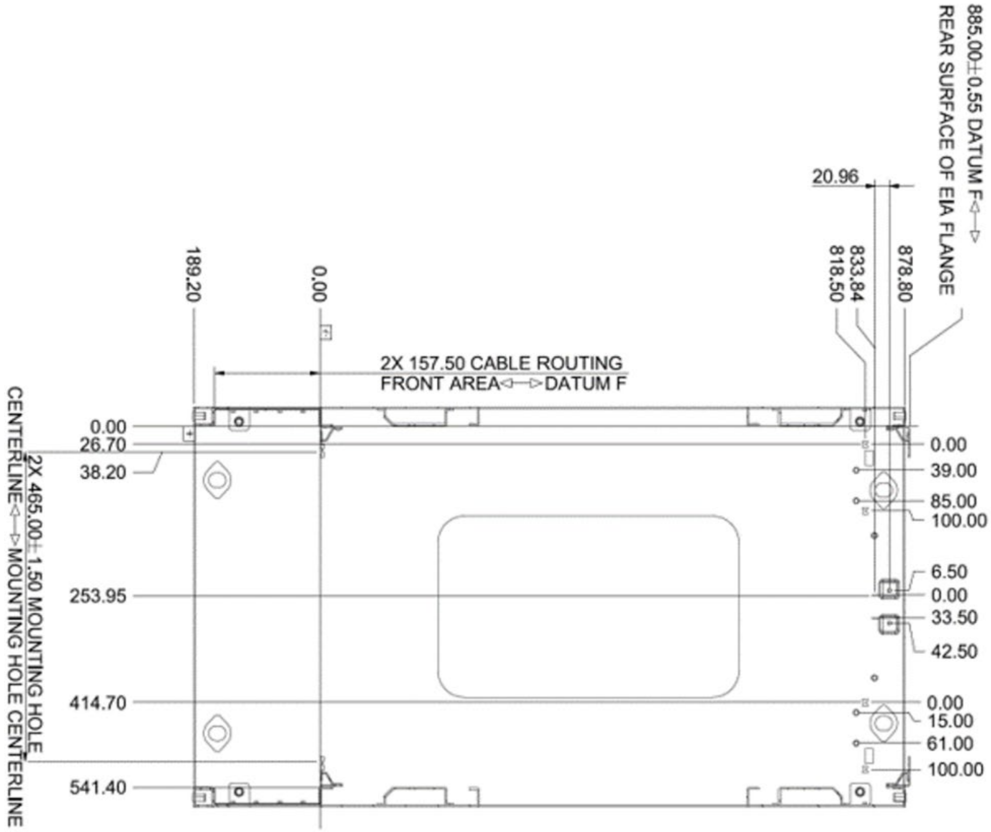


Figure 7-11. MGX Rack – Top View

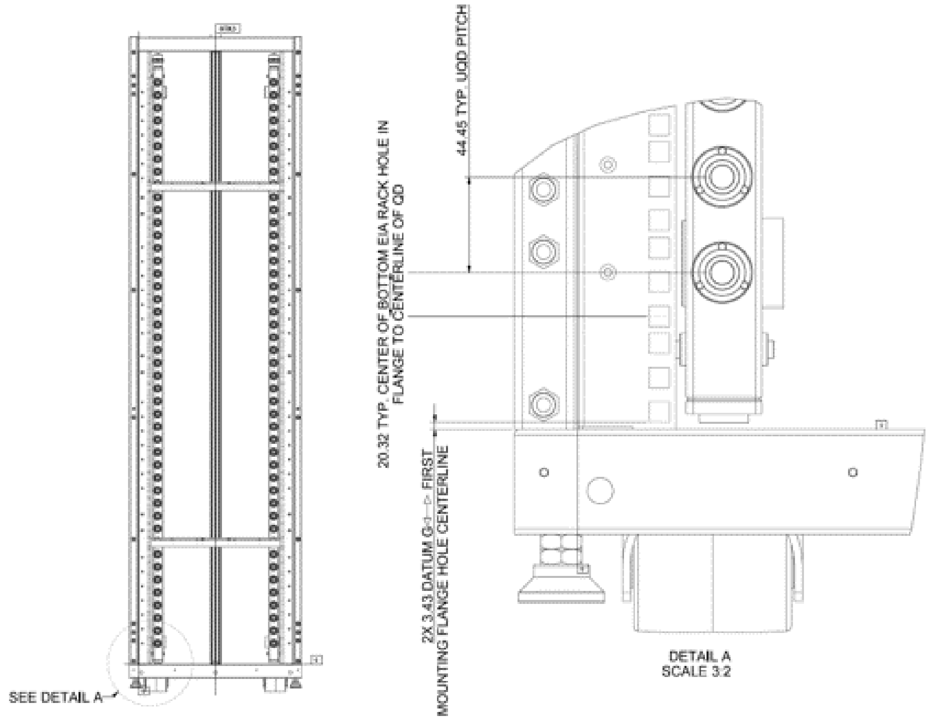


Figure 7-12. MGX Rack Manifold Locations Detail

Unless otherwise specified, the tolerances below apply to Figure 7-13 to Figure 7-22.

TOLERANCES:MILLIMETERS	
TOLERANCES UNLESS OTHERWISE SPECIFIED	
.X ±	0.25
.XX ±	0.1
X THRU X ±	X
X THRU X ±	X
X > ±	X
ANGLE ±	1°
BEND ANGLE ±	X
90° BEND ±	X

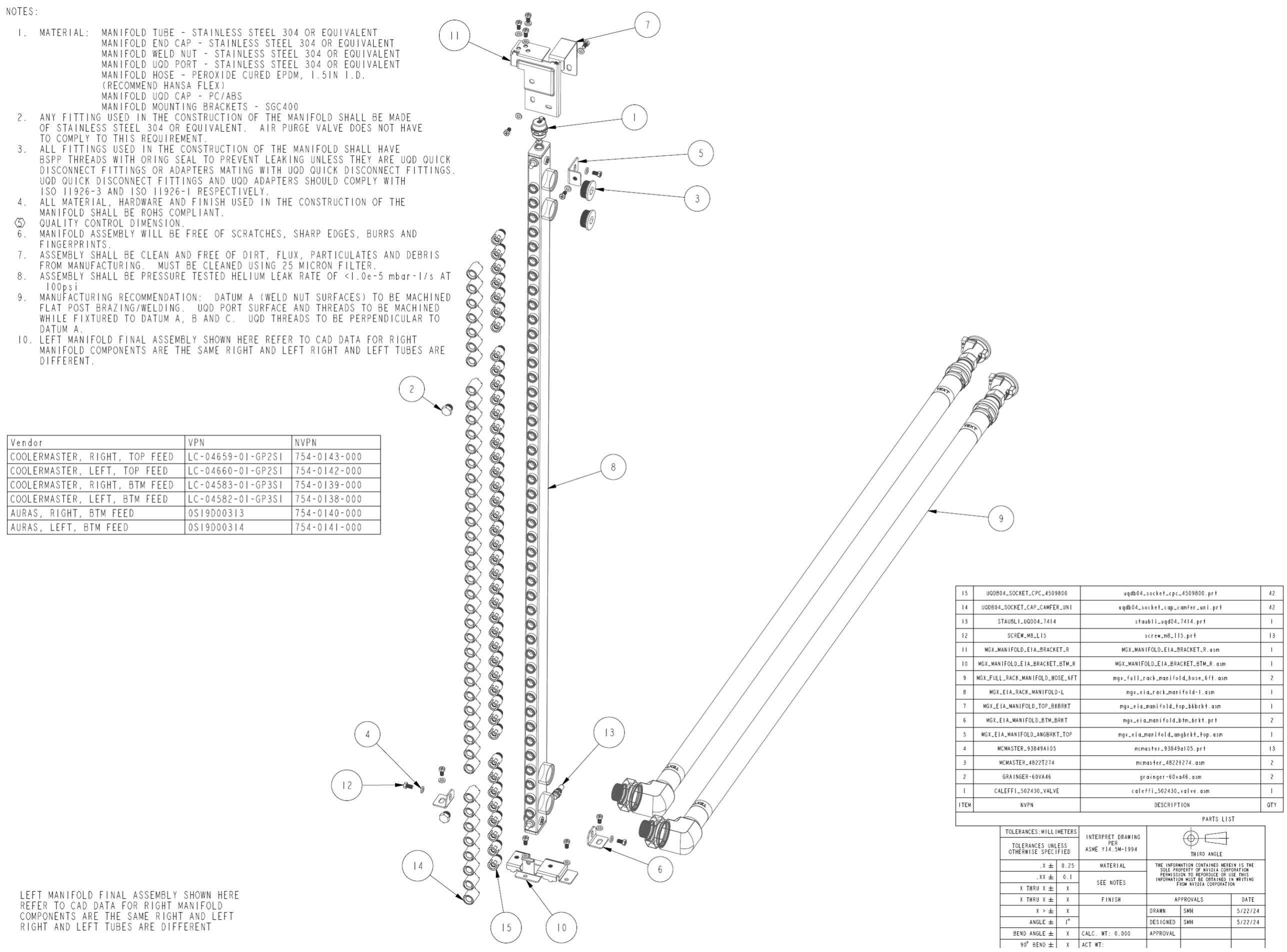


Figure 7-13. MGX Rack Assembly Drawing

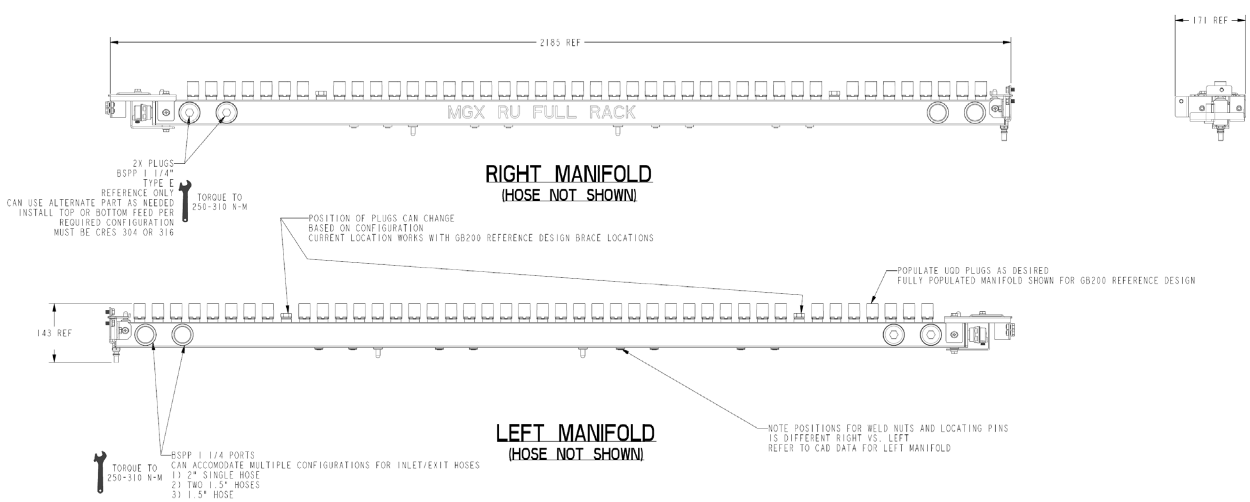


Figure 7-14. MGX Rack Manifold Assembly Requirements

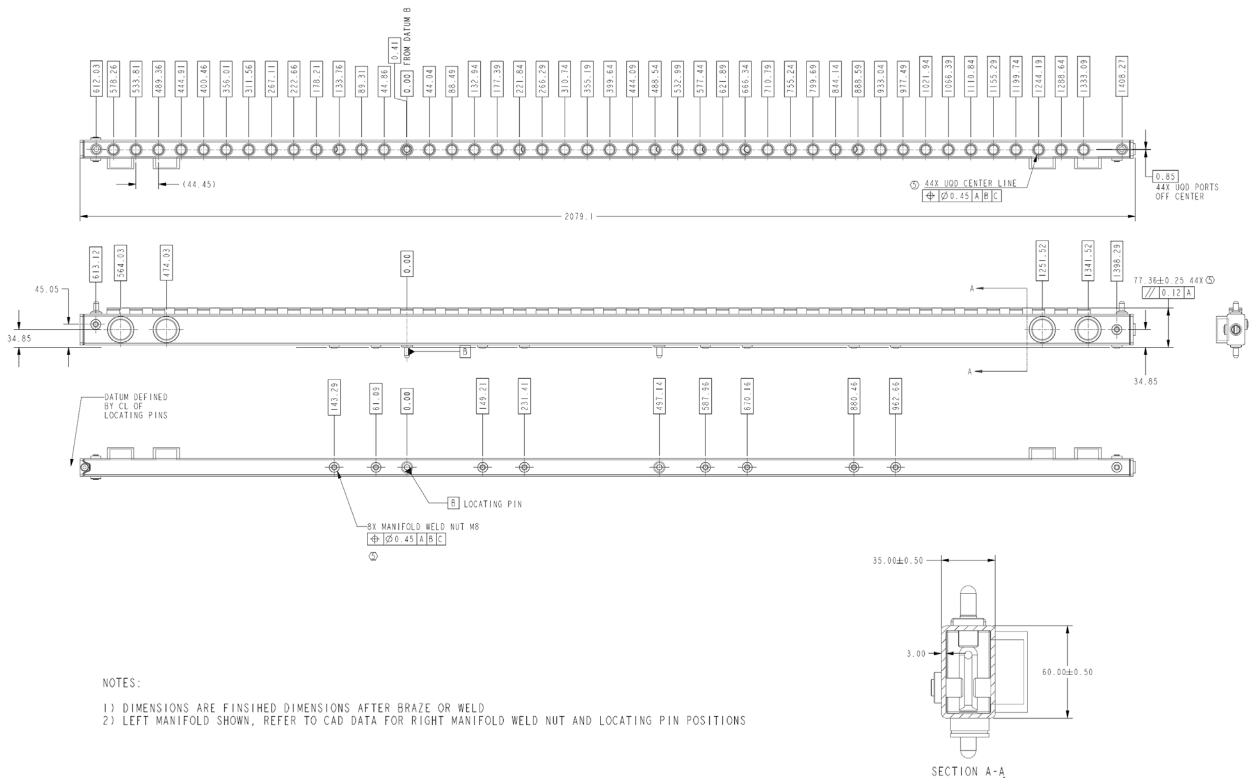


Figure 7-15. MGX Rack Manifold Drawing – Main Tube Assembly

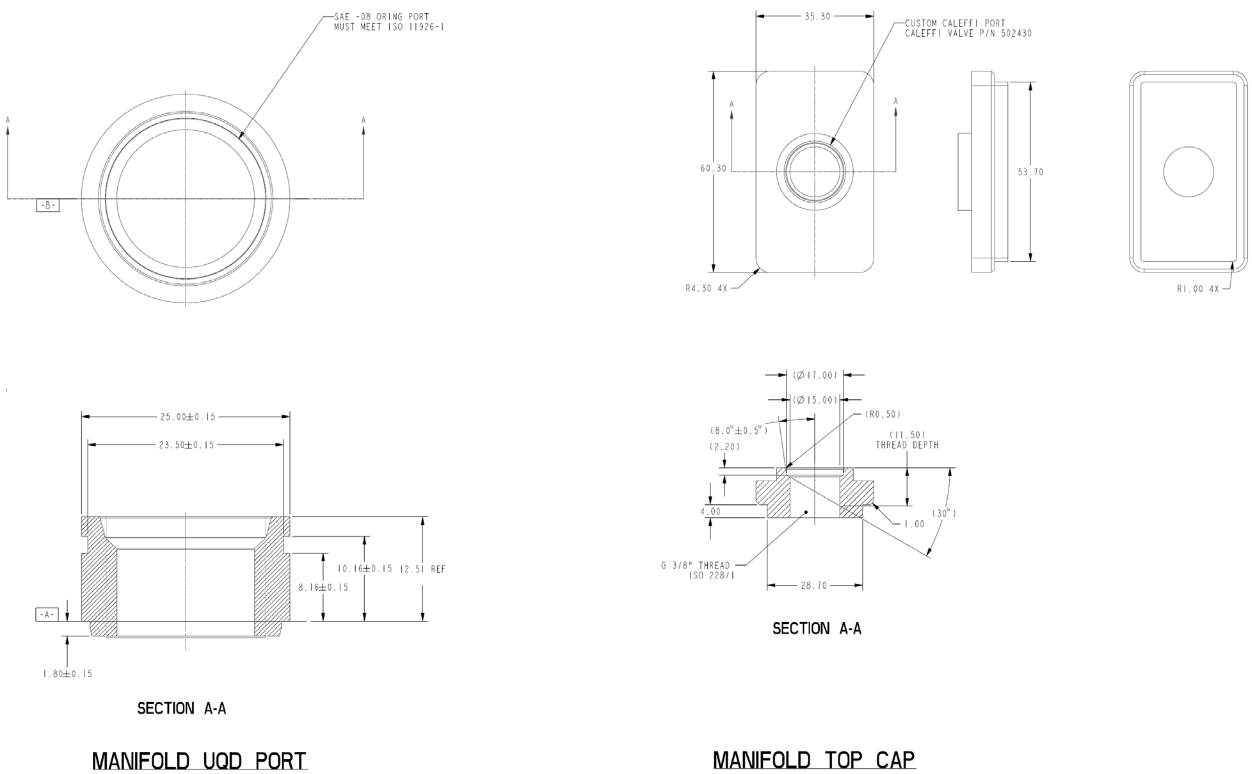


Figure 7-16. MGX Rack Manifold Drawing – Port and Cap

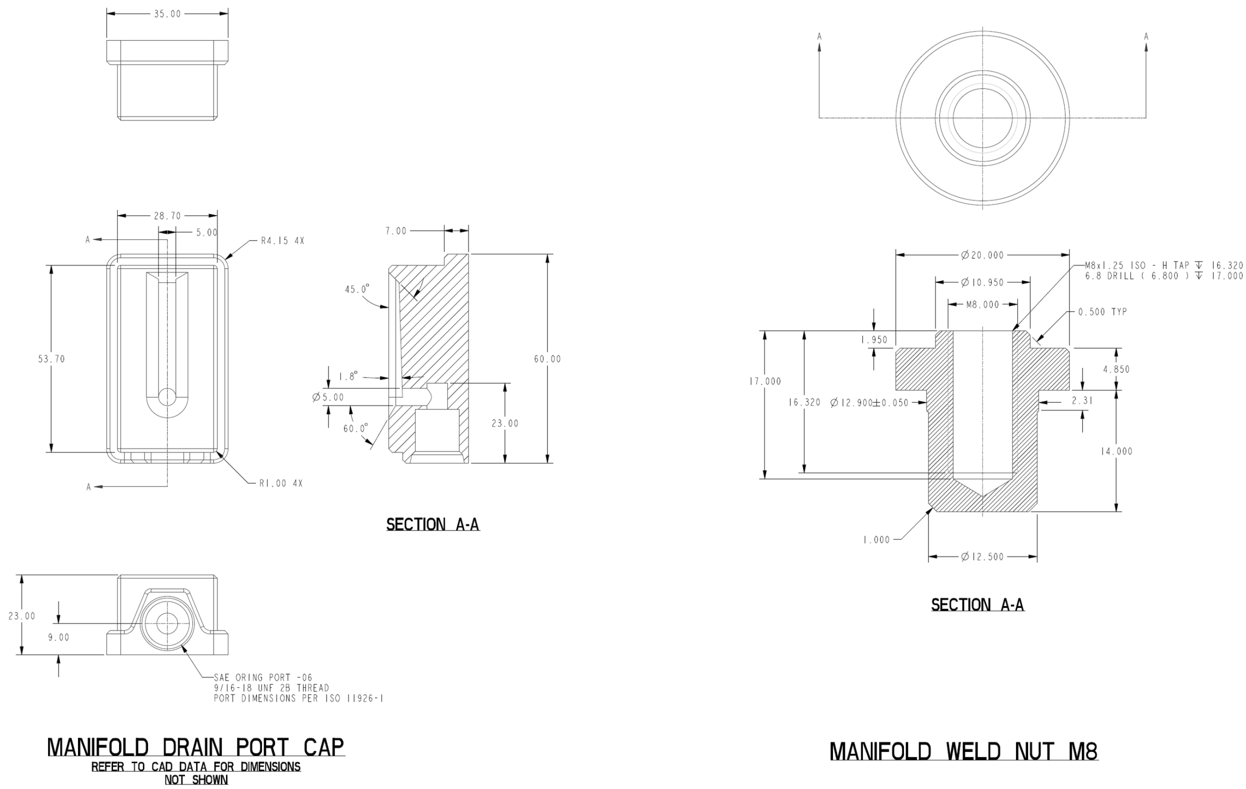


Figure 7-17. MGX Rack Manifold Drawing – Drain Port and Weld Nut

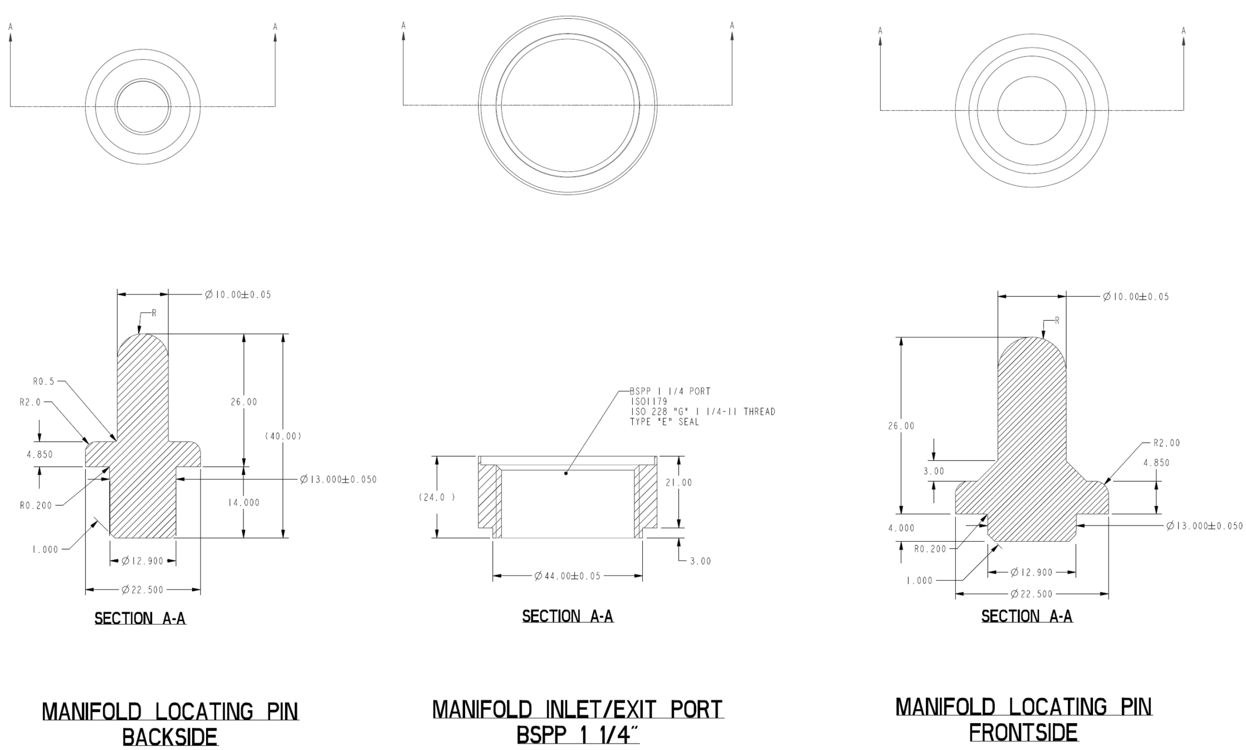


Figure 7-18. MGX Rack Manifold Drawing – Locating Pins, Inlet/Exit Port

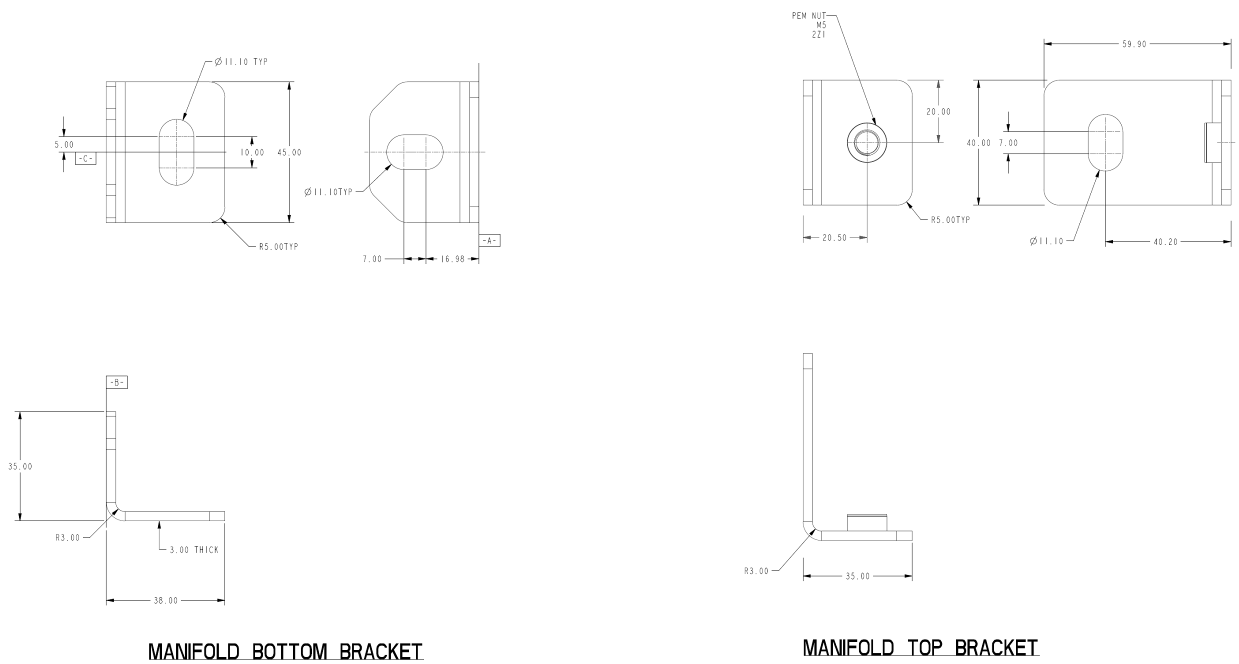


Figure 7-19. MGX Rack Manifold Drawing – Manifold Top and Bottom Mounting Brackets

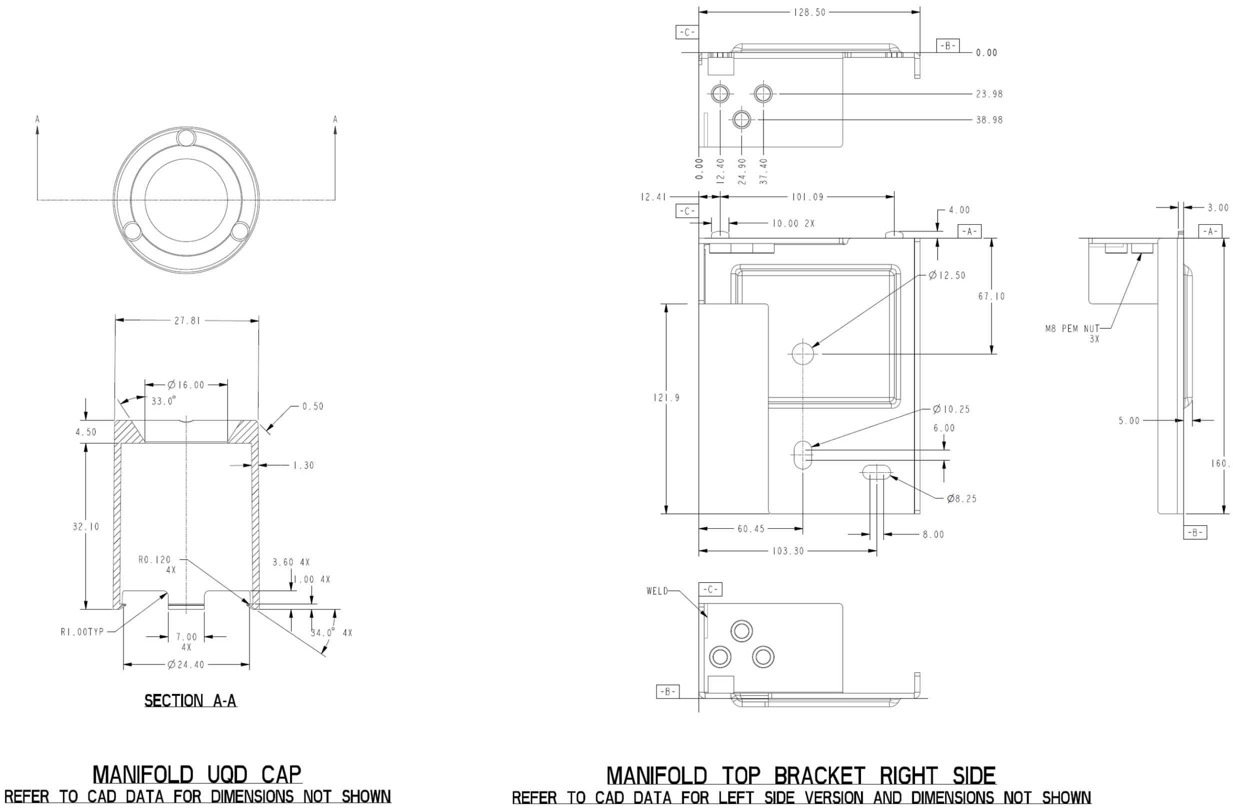


Figure 7-20. MGX Rack Manifold Drawing – Top Right Bracket and UQD Cap

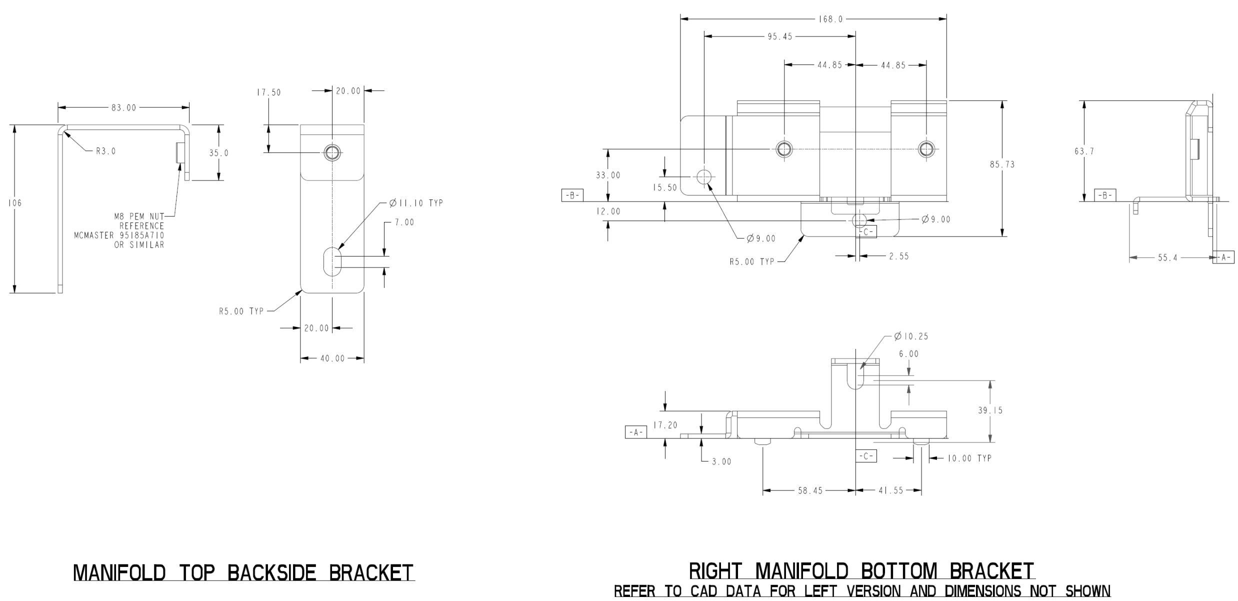


Figure 7-21. MGX Rack Manifold Drawing – Top rear and right bottom bracket

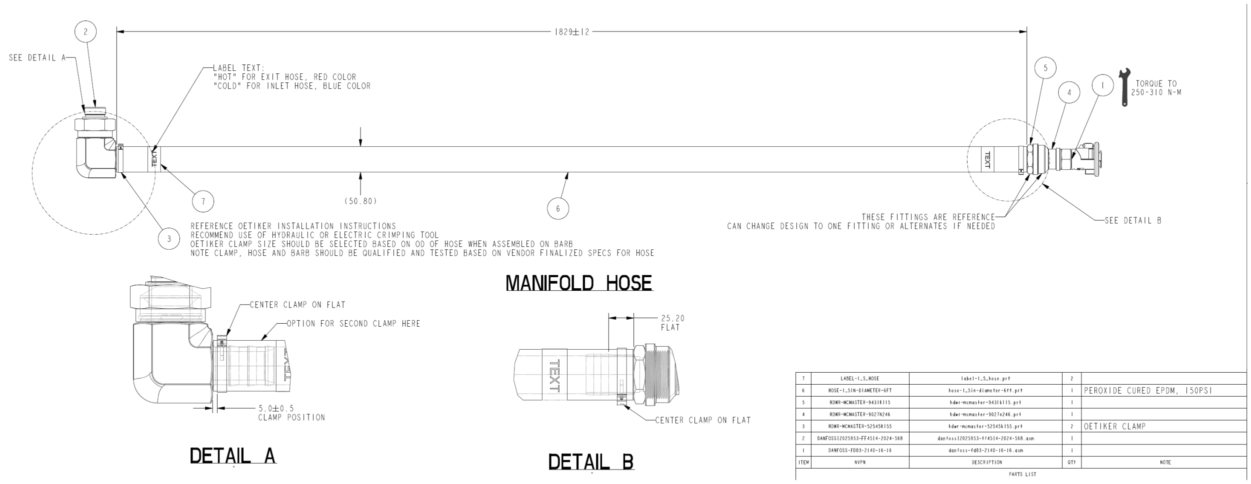


Figure 7-22. MGX Rack Manifold Drawing – Hose Assembly

The hose assembly specified above is one of many possible options that the infrastructure supports. The number of hoses per feed, the sizes of those hoses and the type and size of the connection to the datacenter may be customized as needed by end users to suit their datacenter liquid cooling requirements.

7.3 Slide Rail Interface

To ensure interoperability of rack slides pre-defined t-pin locations on the chassis side wall to enable a common slide rail interface. The specified t-pin locations and t-pin design are used across the MGX ecosystem as discussed in the following sections and allow for use of a standard slide rail design.

7.3.1 Standard Chassis Rail Interface

Figure 7-23 shows the preferred location of the t-pins referenced from chassis Datum A on a 1RU system. Using these pre-defined locations is strongly preferred for the MGX ecosystem as any variance from the following figure will require unique slide rail designs.

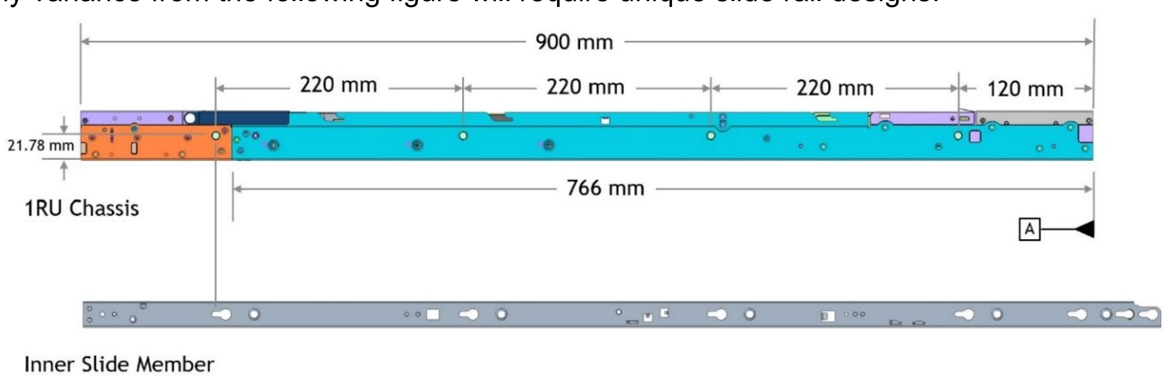


Figure 7-23. Slide Rail T-Pin Locations

7.3.2 Blind Mate Slide Rail

The following figures illustrate positioning and mounting enablement features included in the slide rail design. These features are used to properly support and align the tray to the interconnect and rack level manifolds. In addition, a latching surface is specified to enable latch designs for the blind mate liquid implementations and interoperability between slide and chassis.

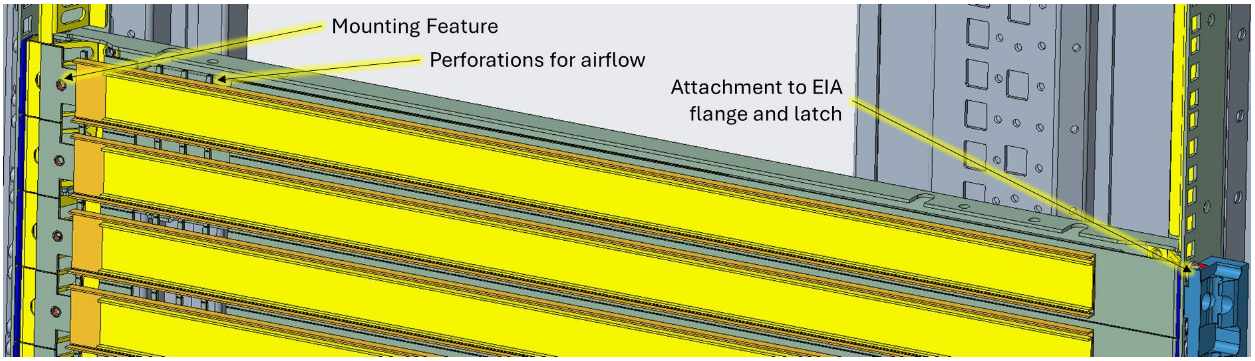


Figure 7-24. Blind Mate System Slide Rail Features

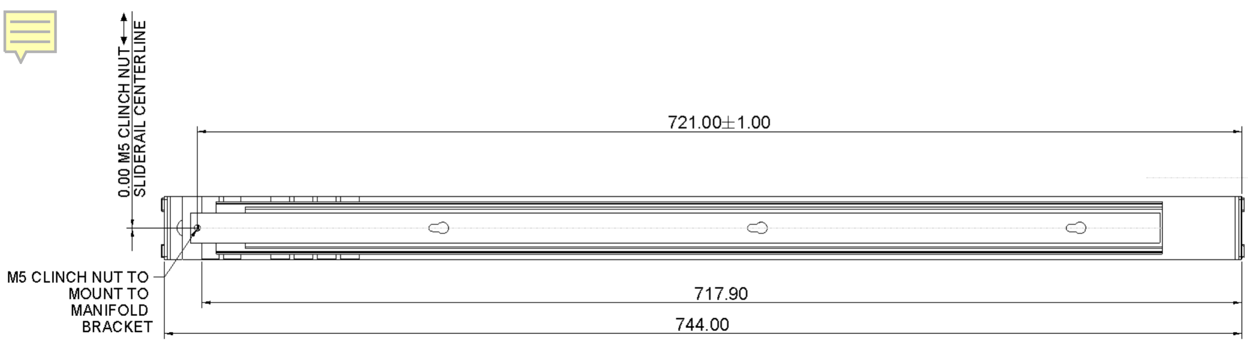


Figure 7-25. Blind Mate System Slide Rail Detail

7.4 MGX DC-SCM Module

This section defines the PCB outline and pinout of the MGX DC-SCM module. The module is designed to enable vertical installation within a 1RU server using the same SFF-TA-1002 based interface as existing DC-SCM form factors. The figures below show the module mated to a board connector and support bracket. Refer to 3D models for details not specified here.

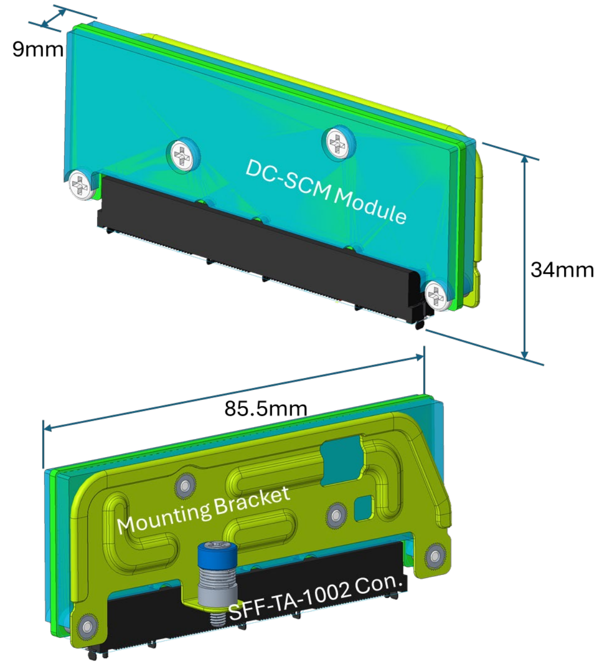


Figure 7-26. Compact 1RU DCSCM Module Overview

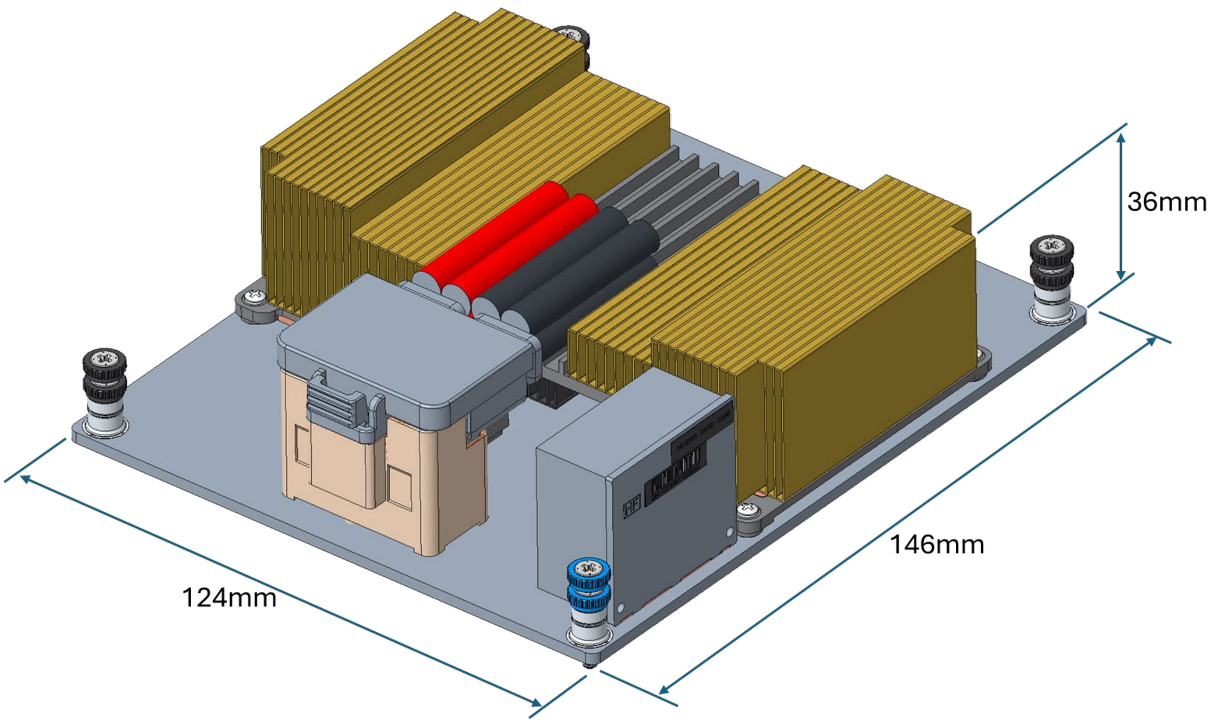
The module implements a subset of the DC-SCI pinout as shown in the table below.

Table 7-2. 1RU DC-SCM Module Pinout

DC-SCI PIN#	NV BMC DC-SCI PIN name	DC-SCI PIN#	NV BMC DC-SCI PIN name	DC-SCI PIN#	NV BMC DC-SCI PIN name
OA02	NC(USB3_SCMHOST2_SCM_HPM_	B03	ESPI_HPMCNTRL_RESET_N/GPIO	A49	I2C_3V3_6_SCL/GPIO
OA03	NC(USB3_SCMHOST2_SCM_HPM_	B04	ESPI_HPMCNTRL_IO_0/GPIO	A50	I2C_3V3_6_SDA/GPIO
OB02	NC(USB3_SCMHOST2_HPM_SCM_	B05	ESPI_HPMCNTRL_IO_1/GPIO	A58	I2C_I3C_1V8_12_SCL/GPIO
OB03	NC(USB3_SCMHOST2_HPM_SCM_	B06	ESPI_HPMCNTRL_IO_2/GPIO	A59	I2C_I3C_1V8_12_SDA/GPIO
OB05	DISPLAYPORT_AUX_DN/(VGA_B)	B07	ESPI_HPMCNTRL_IO_3/GPIO	A61	I2C_I3C_1V8_13_SCL/GPIO
OB06	DISPLAYPORT_AUX_DP/(DDC_SCL	B08	ESPI_HPMCNTRL_ALERT0_N/GPIO	A62	I2C_I3C_1V8_13_SDA/GPIO
OA05	DISPLAYPORT_LANE0_DN/(VGA_R)	A63	UART0_HPM_SCM_DATA / GPIO /	B39	I2C_I3C_1V8_14_SCL/GPIO
OA06	DISPLAYPORT_LANE0_DP/(VSYNC)	B51	UART0_SCM_HPM_DATA / PCIE_SCM_HPM_PERST_N / NCSI2_SCM_HPM_TX_EN	B40	I2C_I3C_1V8_14_SDA/GPIO
OA11	DISPLAYPORT_LANE1_DN/(VGA_G	B56	UART1_SCM_HPM_DATA /	B41	I2C_I3C_1V8_15_SCL/GPIO
OA12	DISPLAYPORT_LANE1_DP/(DDC_S	B57	UART1_HPM_SCM_DATA /	B42	I2C_I3C_1V8_15_SDA/GPIO
OB11	USB2_SCMHOST3_DN	A08	JTAG_TCK_CPU_BMC	A51	I2C_1V8_16_SCL/GPIO
OB12	USB2_SCMHOST3_DP	A09	JTAG_TDI_CPU_BMC	A52	I2C_1V8_16_SDA/GPIO
OA08	SGMII_SCM_HPM_DN	A10	JTAG_TDO_CPU_BMC	B09	I2C_1V8_17_SCL / ESPI0_HPMCNTRL_CS1_N/GPIO
OA09	SGMII_SCM_HPM_DP	A11	JTAG_TMS_CPU_BMC	B10	I2C_1V8_17_SDA / ESPI0_HPMCNTRL_ALERT1_N/GPI
OB08	SGMII_HPM_SCM_DN	A12	JTAG_TRST_CPU_BMC_L	B52	I2C_3V3_7_SCL / SGPIO_CLK /NCSI2_HPM_SCM_CLK/ GPIO
OB09	SGMII_HPM_SCM_DP	A20	NC(LTPI_SCM_HPM_DATA_DN)	B53	I2C_3V3_7_SDA / SGPIO_LD /NCSI2_HPM_SCM_CRS_DV / GPIO
A28	PCIE_HPM_SCM_PERST_N	A21	NC(LTPI_SCM_HPM_DATA_DP)	B54	I2C_3V3_8_SCL / SGPIO_DATAOUT /NCSI2_SCM_HPM_D0 / GPIO
A30	PCIE_HPMROOT_SCM_HPM_DN	A23	NC(LTPI_SCM_HPM_CLK_DN)	B55	I2C_3V3_8_SDA / SGPIO_DATAIN /NCSI2_SCM_HPM_D1 / GPIO
A31	PCIE_HPMROOT_SCM_HPM_DP	A24	NC(LTPI_SCM_HPM_CLK_DP)	A01	P12V_AUX
B30	PCIE_HPMROOT_HPM_SCM_DN	B20	NC(LTPI_HPM_SCM_DATA_DN)	A02	P12V_AUX
B31	PCIE_HPMROOT_HPM_SCM_DP	B21	NC(LTPI_HPM_SCM_DATA_DP)	A03	P12V_AUX
A36	PCIE_HPM_SCM_CLK_100M_0_DN	B23	NC(LTPI_HPM_SCM_CLK_DN)	A04	P12V_AUX
A37	PCIE_HPM_SCM_CLK_100M_0_DP	B24	NC(LTPI_HPM_SCM_CLK_DP)	OA01	GND
A65	NC(USB3_SCMHOST1_SCM_HPM_	B43	NCSI_HPM_SCM_CLK / GPIO	OA04	GND
A66	NC(USB3_SCMHOST1_SCM_HPM_	B44	NCSI_HPM_SCM_CRS_DV / GPIO	OA07	GND
B65	NC(USB3_SCMHOST1_HPM_SCM_	B45	NCSI_SCM_HPM_TX_EN / GPIO	OA10	GND
B66	NC(USB3_SCMHOST1_HPM_SCM_	B46	NCSI_SCM_HPM_D0 / GPIO	OA13	GND
A33	PCIE_SCMROOT_SCM_HPM_DN	B47	NCSI_SCM_HPM_D1 / GPIO	A05	GND
A34	PCIE_SCMROOT_SCM_HPM_DP	B48	NCSI_HPM_SCM_D0 / GPIO	A06	GND
B33	PCIE_SCMROOT_HPM_SCM_DN	B49	NCSI_HPM_SCM_D1 / GPIO	A19	GND
B34	PCIE_SCMROOT_HPM_SCM_DP	A07	PRSNT1_HPM_SCM_N	A22	GND
A68	PCIE_HPM_SCM_CLK_100M_1_DN	B58	PRSNT0_SCM_HPM_N	A25	GND
A69	PCIE_HPM_SCM_CLK_100M_1_DP	A13	SCM_HPM_STBY_RST_N	A29	GND
B36	USB2_SCMHOST1_DN /	A14	SCM_HPM_STBY_EN	A32	GND
B37	USB2_SCMHOST1_DP /	B26	HPM_SCM_STBY_RDY	A35	GND
B68	NC(USB2_SCMHOST2_DN / USB2_HPMHOST2_DN)	B27	HPM_SCM_INTRUSION_N	A38	GND
B69	NC(USB2_SCMHOST2_DP / USB2_HPMHOST2_DP)	B28	P3V0_HPM_SCM_BAT	A53	GND
B60	SPI_SCMCNTRL_CLK	B50	VCC_SCM_HPM_FRU	A64	GND
B61	SPI_SCMCNTRL_MISO	OA14	PECI_HPM_SCM	A67	GND
B62	SPI_SCMCNTRL_MOSI	OB14	PECI_VREF_HPM_SCM	A70	GND
B63	SPI_SCMCNTRL_CS0_N	A39	I2C_I3C_1V0_18_SCL /	OB01	GND
A60	GPIO/SPI_SCMCNTRL_IRQ0_N	A40	I2C_I3C_1V0_18_SDA /	OB04	GND
B59	SPI_SCMCNTRL_CS1_N / GPIO	A41	I2C_I3C_1V0_19_SCL /	OB07	GND
B12	QSPI_HPMCNTRL_CLK/GPIO	A42	I2C_I3C_1V0_19_SDA /	OB10	GND
B13	QSPI_HPMCNTRL_CS0_N/GPIO	A15	I2C_3V3_0_SCL/GPIO	OB13	GND
B14	QSPI_HPMCNTRL_IO_0/GPIO	A16	I2C_3V3_0_SDA/GPIO	B11	GND
B15	QSPI_HPMCNTRL_IO_1/GPIO	A17	I2C_3V3_1_SCL/GPIO	B19	GND
B16	QSPI_HPMCNTRL_IO_2/GPIO	A18	I2C_3V3_1_SDA/GPIO	B22	GND
B17	QSPI_HPMCNTRL_IO_3/GPIO	A26	I2C_3V3_2_SCL/GPIO	B25	GND
B18	QSPI_HPMCNTRL_CS1_N/GPIO	A27	I2C_3V3_2_SDA/GPIO	B29	GND
A54	SPI_HPMCNTRL_TPM_CLK	A43	I2C_3V3_3_SCL/GPIO	B32	GND
A55	SPI_HPMCNTRL_TPM_CS_N	A44	I2C_3V3_3_SDA/GPIO	B35	GND
A56	SPI_HPMCNTRL_TPM_MOSI	A45	I2C_3V3_4_SCL/GPIO	B38	GND
A57	SPI_HPMCNTRL_TPM_MISO	A46	I2C_3V3_4_SDA/GPIO	B64	GND
B01	ESPI_HPMCNTRL_CLK/GPIO	A47	I2C_3V3_5_SCL/MDC/GPIO	B67	GND
B02	ESPI_HPMCNTRL_CS0_N/GPIO	A48	I2C_3V3_5_SDA/MDIO/GPIO	B70	GND

7.5 MGX Power Distribution Board

The power distribution board (PDB) is illustrated below. Mounting location, a reference air cooled heat design are shown along with example power connector that connects from the 35mm bus bar connector to the PDB. For details refer to the 3D CAD provided with this specification.



8. Bus Bar Requirements

The MGX Rack supports a 48VDC nominal, 40 – 59.5VDC, bus bar that supports up to 1400A. The bus bar assembly is the same width as the existing ORV3 bus bar but supports greater ampacity by growing deeper. The bus bar assembly may also be implemented in an existing ORV3 rack. The electrical and mechanical requirements for the bus bar are specified below.

8.1 Busbar Electrical Requirements

The busbar shall be capable of meeting 1400A at 45 C ambient, 3050 m elevation, static airflow (natural convection only), and meet all touch temperature safety requirements and stay within the specified IT busbar clip's temperature rating.

Typical power shelf output voltages are 48V, 51V, or 54V nominal (note some variance based off droop compensation etc... see specific power shelf spec for detailed voltage ranges).

Both power and ground busbar components within the assembly shall be continuous electrically for the entire height of the busbar to form a single power zone.

The busbar assembly is expected to have the following parasitic resistance, inductance, and capacitance per RU when measured at 25C.

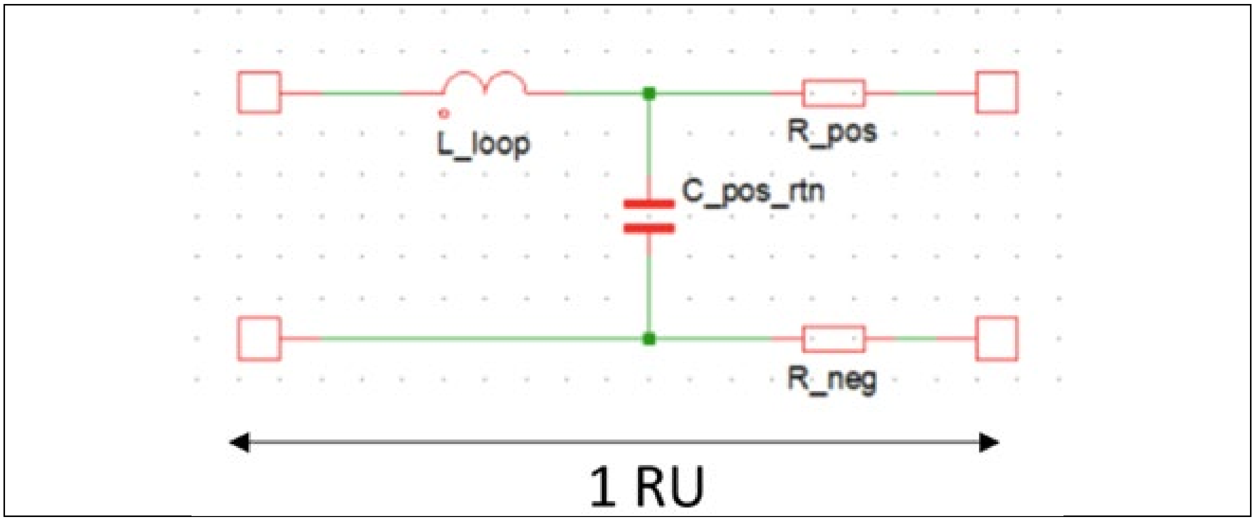


Figure 8-1. Electrical Parasitics Model

Table 8-3. 1400A Busbar Parasitics

	Min.	Typ.	Max.	Unit
Resistance per RU positive or return	-	1.5	1.6	μΩ / RU (44.45 mm)
Loop Inductance per RU positive and return	-	8.3	8.8	nH / RU (44.45 mm)
Capacitance positive to return per RU	-	49	52	pF / RU (44.45 mm)

Note: Presently these are calculated values and more conservative than Finite Element Analysis derived values. Tolerance is ±5% off typical.

See compliance section for HiPot requirements.

8.2 Busbar Grounding Requirements

The busbar shall have two orderable SKUs, one with isolated chassis and return and another with a hard ground tie between the chassis return. This opens the possibility of two different rack grounding schemes with minimal hardware changes.

- **8.2.1 Chassis to RTN connection**

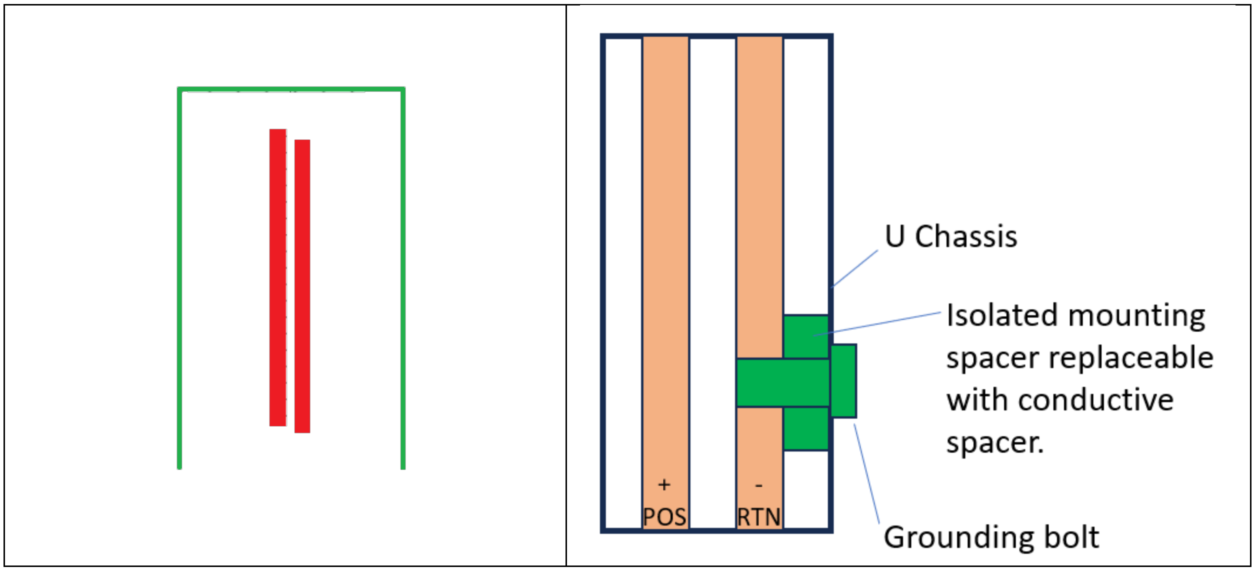


Figure 8-2. [Left] Top view cross section showing power busbars in Red (Positive and Return) and Chassis in Green [Right] Illustration of grounding bolt and/or conductive mounting spacer used to tie RTN to chassis.

8.2.2 Ground connection to rack

The busbar chassis / U-channel must connect to the rack electrically to maintain a common ground potential. This is done with a connection at the top and the bottom of the rack.

The connection at the top and bottom of the rack requires either masking or serrated washers to make an electrical connection between the rack and the busbar. The inside of the rack where the busbar surface contacts the rack shall be masked to minimize impedance.

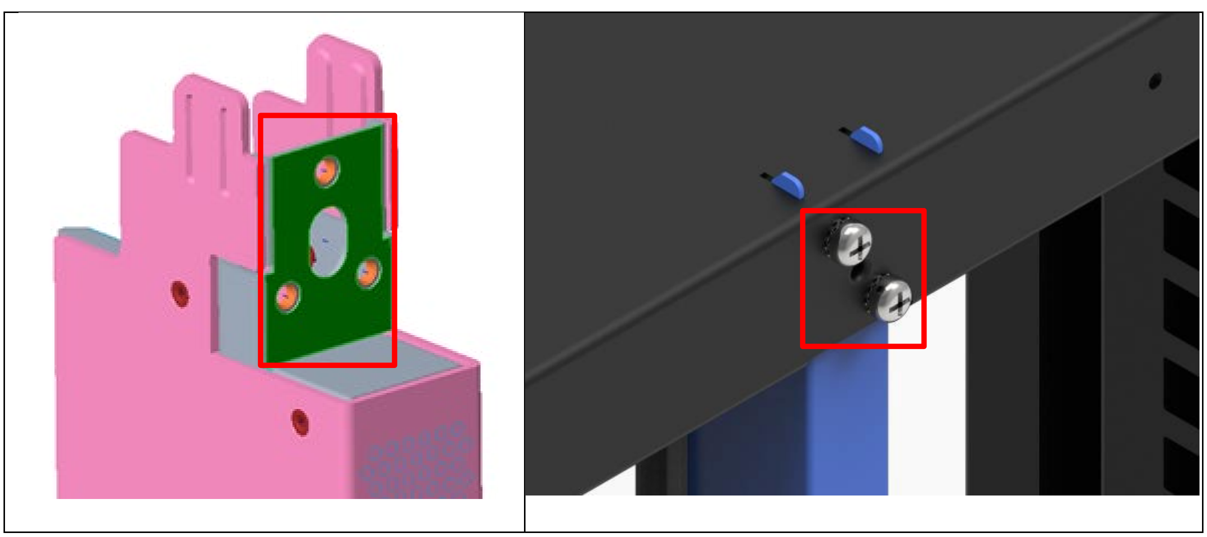


Figure 8-3. [Left] Busbar top mounting holes with masked section shown in green. [Right] Bolts with serrated washers mounting through the rack and to the masked section of busbar.

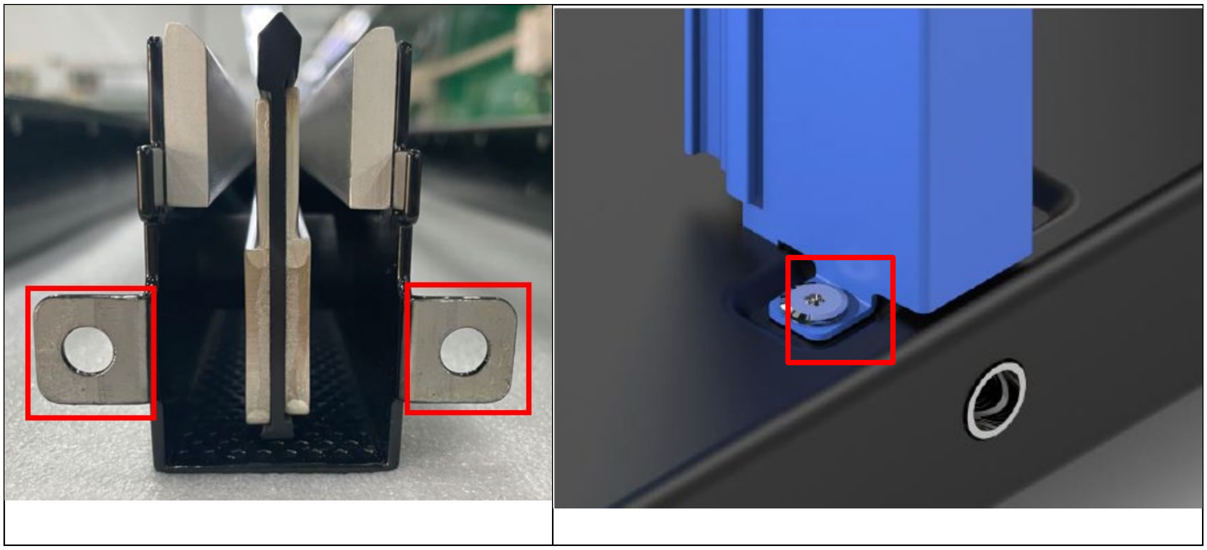


Figure 8-4. [Left] Bottom of the busbar and masked section. [Right] Busbar mounted onto the rack with bottoms of tabs connecting to the rack

8.3 Busbar Mechanical Requirements

The busbar is designed to be replaceable within the rack by a trained technician.

The busbar and its position within the rack has the following dimensions:

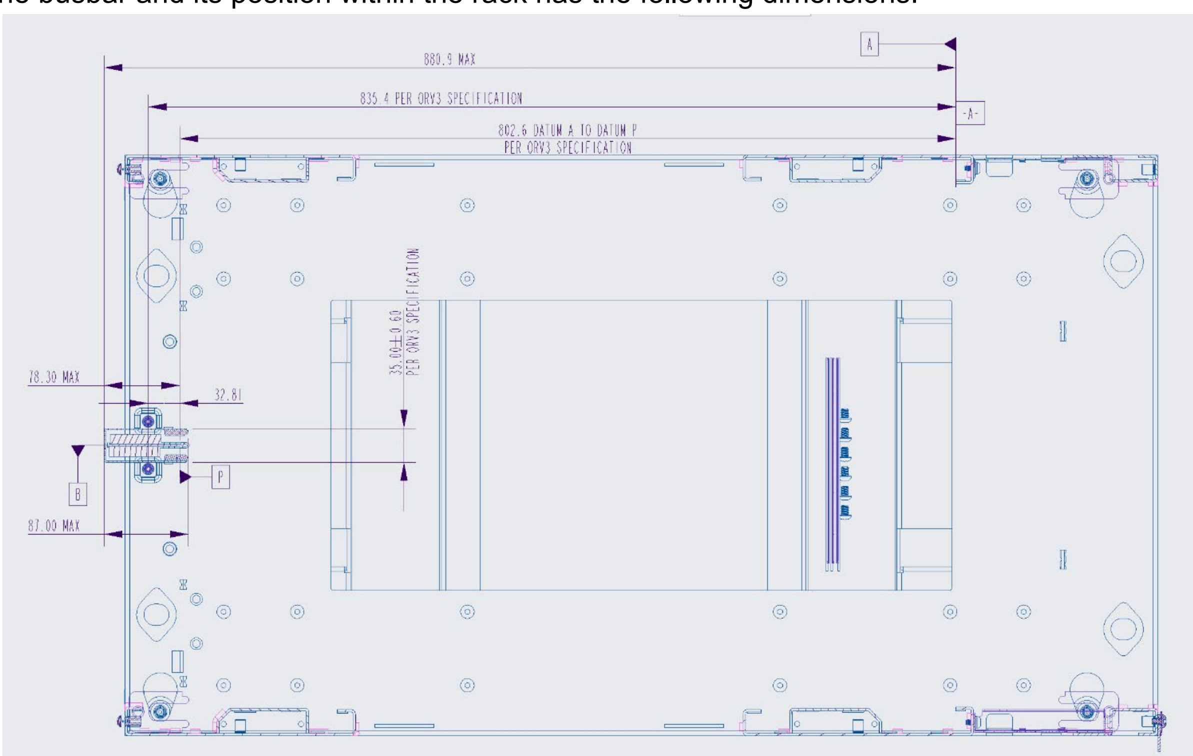


Figure 8-5. Busbar Maximum Depth and Position within MGX Rack.

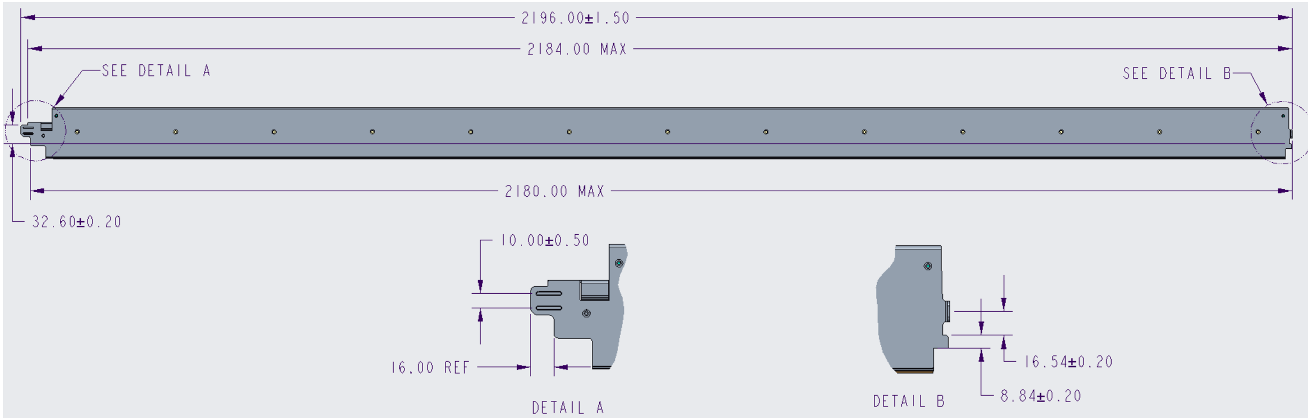


Figure 8-6. Key busbar dimensions to ensure interoperability across ORV3 and MGX racks.

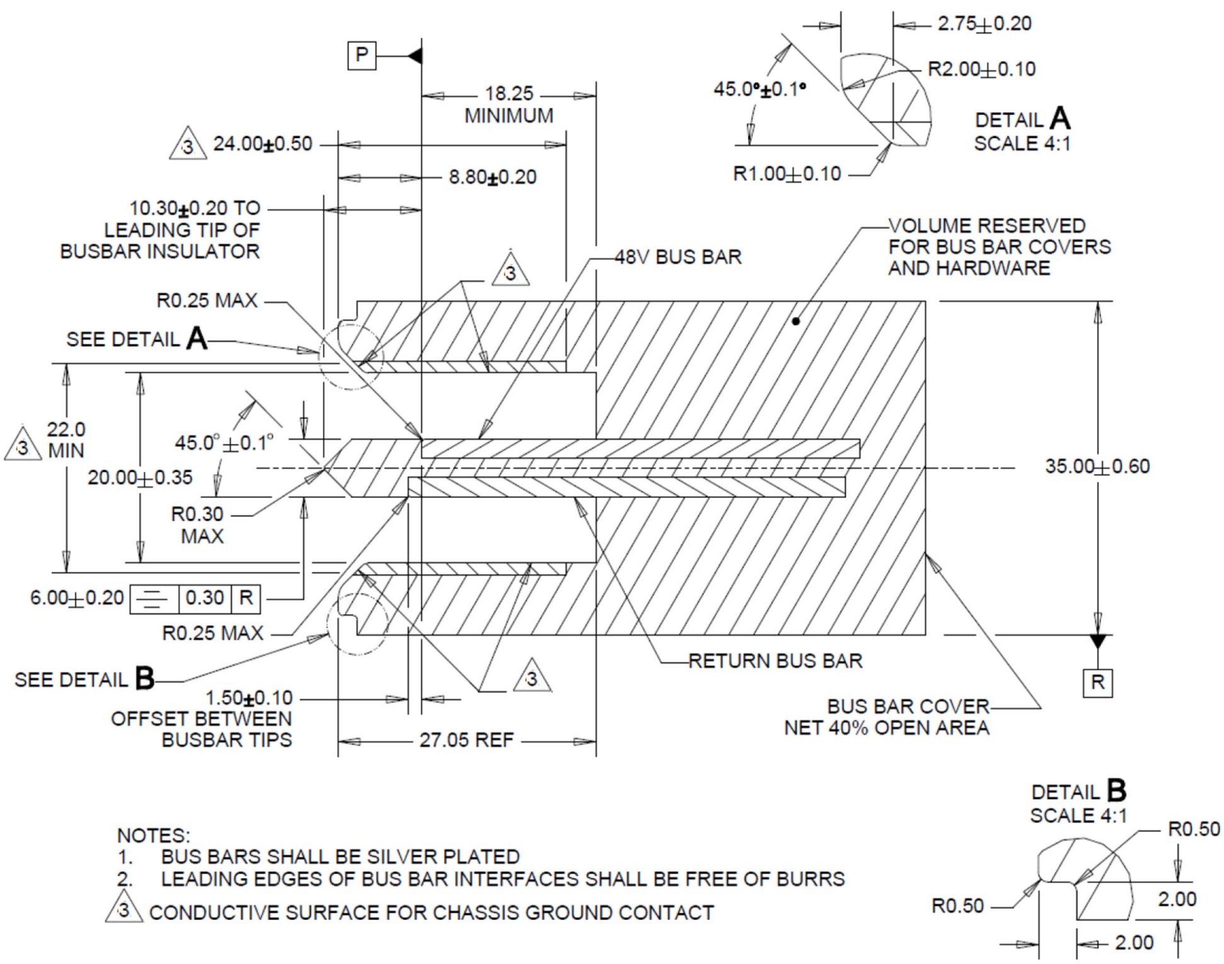


Figure 8-7. Busbar Cross Section Dimensions

The busbar shall be positioned in the center of the rack per the Open Rack Base Frame V3 Specification. Refer to that specification for all other dimensioning and tolerancing of the bus bar.

The busbar shall have 48 RU total rack positions for IT equipment.

The busbar shall have venting on both side and rear surfaces to maximize airflow across the busbar without compromising structural rigidity as needed. Perforations shall conform to UL 62368-1.

The power and return busbars shall be constructed of C11000, H02 temper copper or equivalent.

The chassis ground busbars shall be constructed of Aluminum 4047.

The busbar should have a typical weight of 31 kg.

8.4 Busbar Environmental Requirements

The busbar shall meet the below required operating conditions.

Table 8-2. Busbar operating conditions

	Min.	Typ.	Max.	Units
Operating Temperature	10	35	45	C
Storage Temperature	-40	25	70	C
Operating and Storage Humidity	10%	50%	90%	
Elevation			3050	m

8.4 Busbar Reliability Requirements

The busbar shall withstand 50 cycles of mating and un-mating with the specified IT connector in the Mechanical section of this document without wearing out the plating.

8.5 Busbar Labeling Requirements

100% of units shall be labeled with the following markings

1. Part Number / Revision
2. Date Code
3. Hi-pot Stamp

8.6 Busbar Compliance Requirements

The busbar shall be designed to comply with the latest edition, revision, and amendments of safety standards required to ship globally. Priority should be given to North America certifications as soon as possible with global certifications to follow.

The busbar shall conform to the following standards at a minimum:

- UL/IEC62368-1
- UL/IEC60950-1 – for legacy sites and jurisdictions

HiPot Requirements:

The assembly must comply with the following HiPot requirements on 100% of Busbar assemblies.

Measured from power busbar to return busbar:
Minimum of 1.2 kV, 10 second ramp, 30 second hold with a maximum leakage of 10 μA.

Measured from power busbar to chassis ground and return busbar to chassis ground (Not applicable to the hard grounded versions):
Minimum of 1.2 kV, 10 second ramp, 30 second hold with a maximum leakage of 10 μA.

9. Compute Tray Board and IO Bay Form Factors

The following sections specifies the Board and IO bays for the compute tray. These form factors are derived from the MGX architecture to enable modularity and re-usability. The board form factors employed in this specification are termed the "MGX board" (a full tray width form factor) and the "micro MGX" board (a half width form factor that allows two assemblies to be place side by side in a 19" EIA standard tray). This form factor shares common elements with OCP DC-MHS form factors as described below.

9.1. Board Form Factors

The micro MGX board is compliant with the outline and mounting holes defined in the DC-MHS DNO Type 2 specification. The following figure shows the approximate locations of major parts of the micro MGX motherboard.

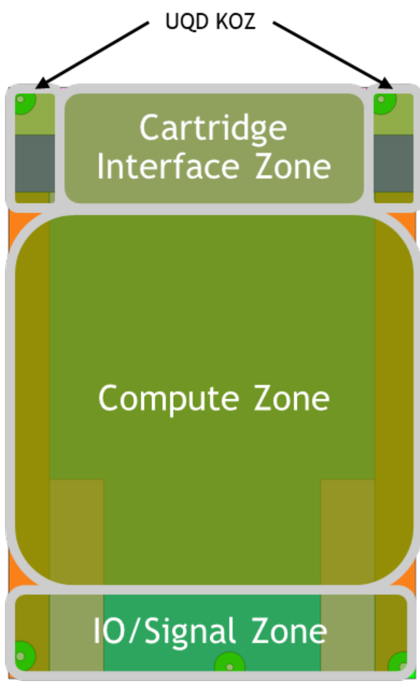


Figure 9-1. Micro MGX Board Overview

9.2 Micro MGX Outline

The micro MGX board outline is shown in below. The units are in millimeters. Refer to 3D models provided for design details not shown here.

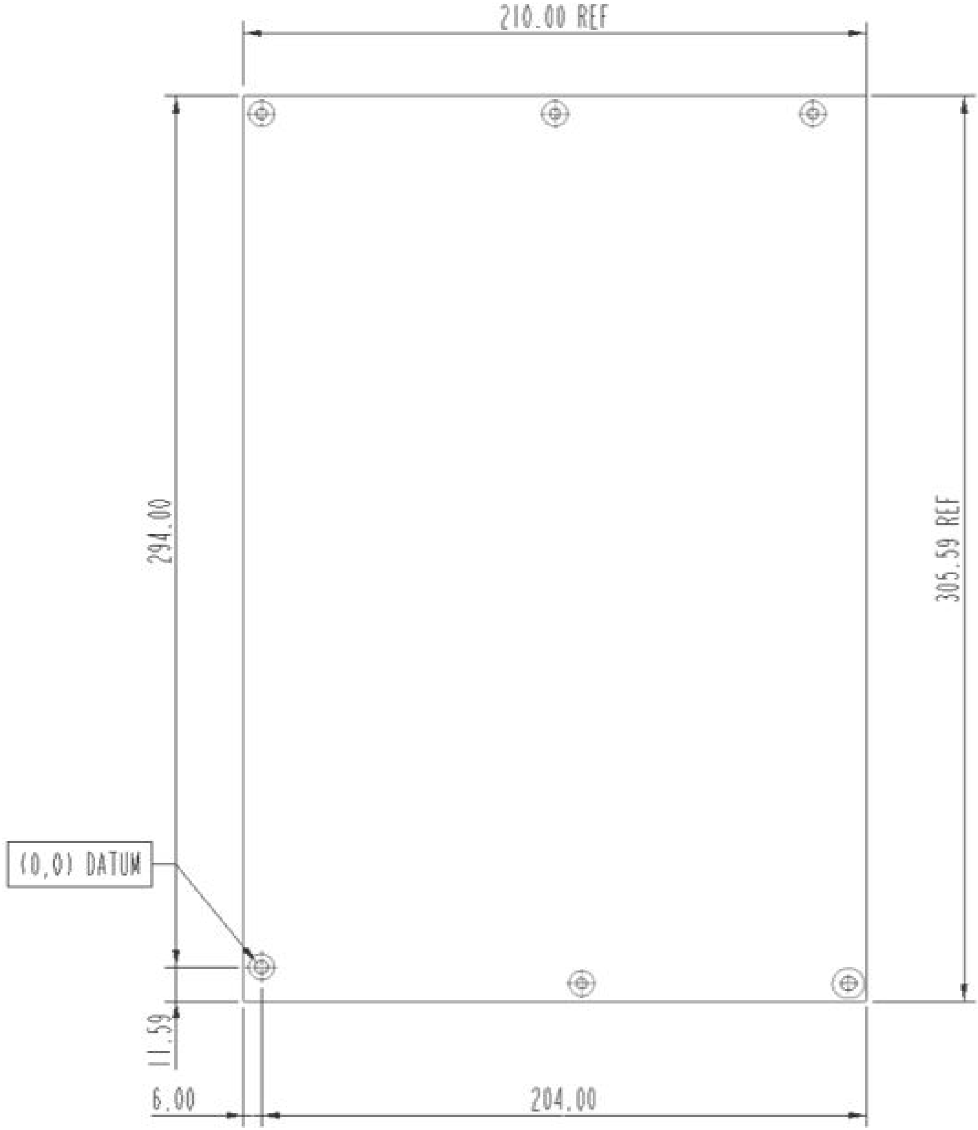


Figure 9-2. Micro MGX Board Outline

9.2.1 Micro MGX Mounting Holes

The following figure defines the required mounting hole locations and sizes. Additional mounting holes may be necessary for mechanical stability based on technological and design needs. The implementer of this specification may introduce additional mounting holes as needed. All fasteners or mounting methodologies contacting the motherboard must stay within the ground pad diameter as shown in the following figure.

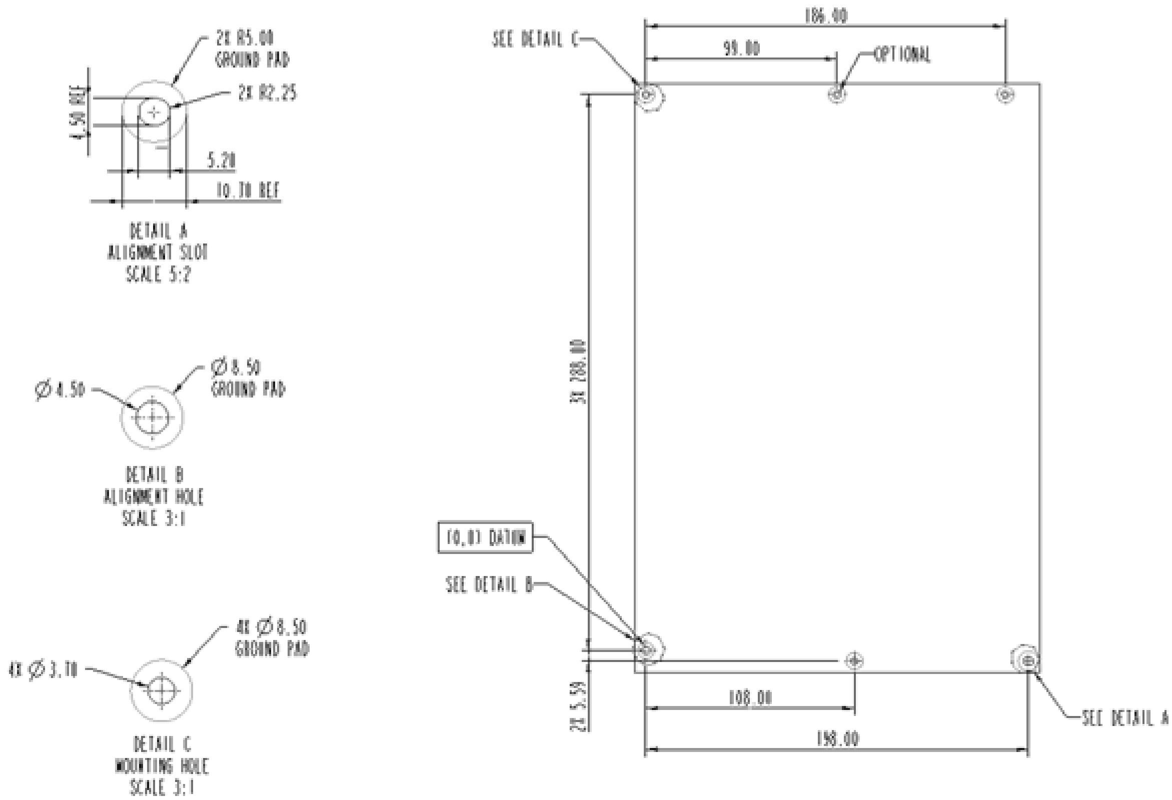


Figure 0-3. Micro MGX Board Mounting Holes

9.2.2 Micro MGX Keepout Zones

Maximum component height restrictions define an absolute maximum height of components terminated to the PCB post processing for both the primary and the secondary sides of the board. Implementers must use best practices for supporting other components within the system added after the board process. Examples of these types of components include, but are not limited to, heat sinks, air baffles, cable management hardware, and so on.

There are two options available for the primary side keepout zone. The first, a more generic option, considers DIMM based HPMs and provides a large region suitable for placing DIMMs. The second option is more detailed and intended to be used for non-DIMM layouts. The CAD contributed with this specification includes the micro MGX non-DIMM layout. Other options specified here are for the purpose to show other possible implementations

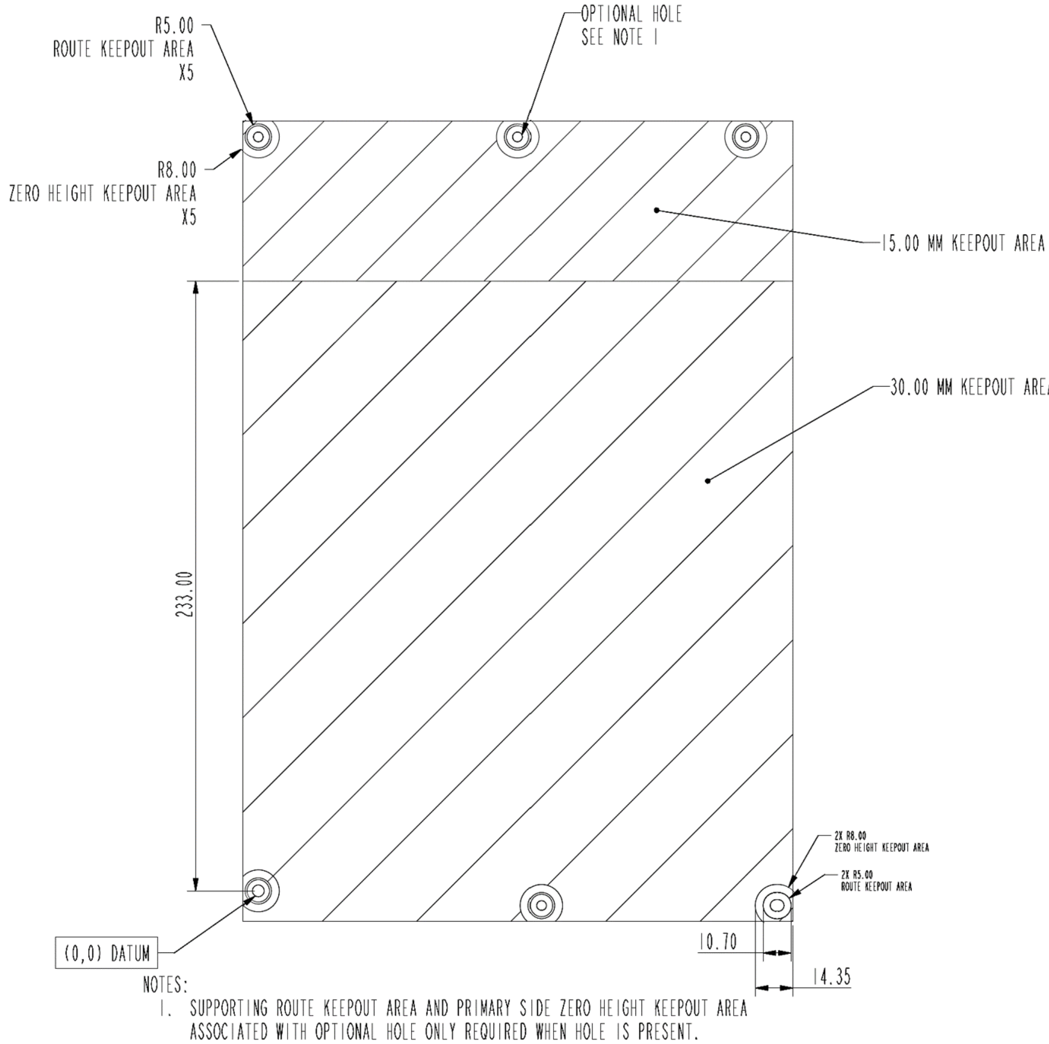


Figure 9-4. Micro MGX Primary Side Maximum Component Height Keepouts DIMM Based HPM Option

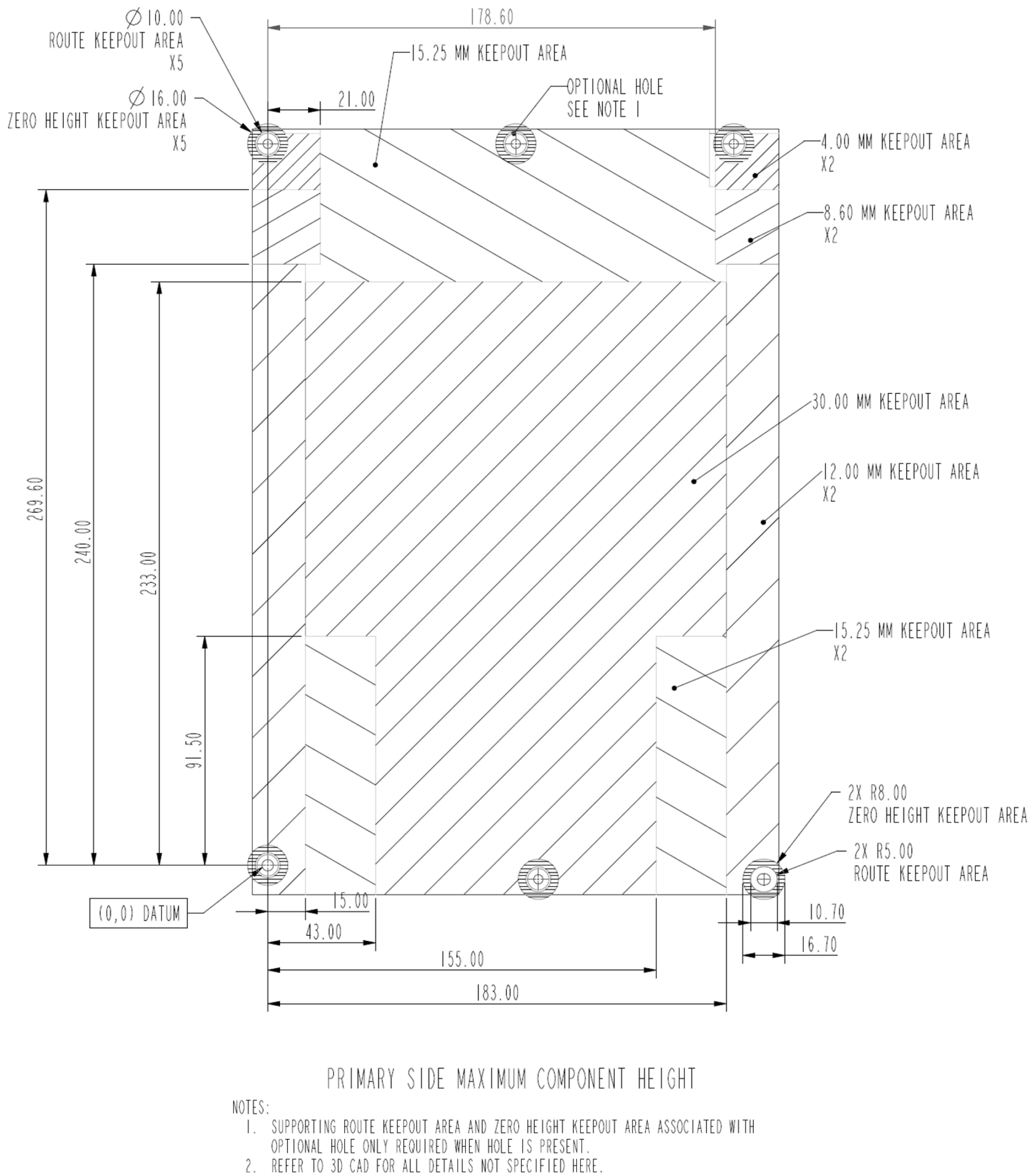
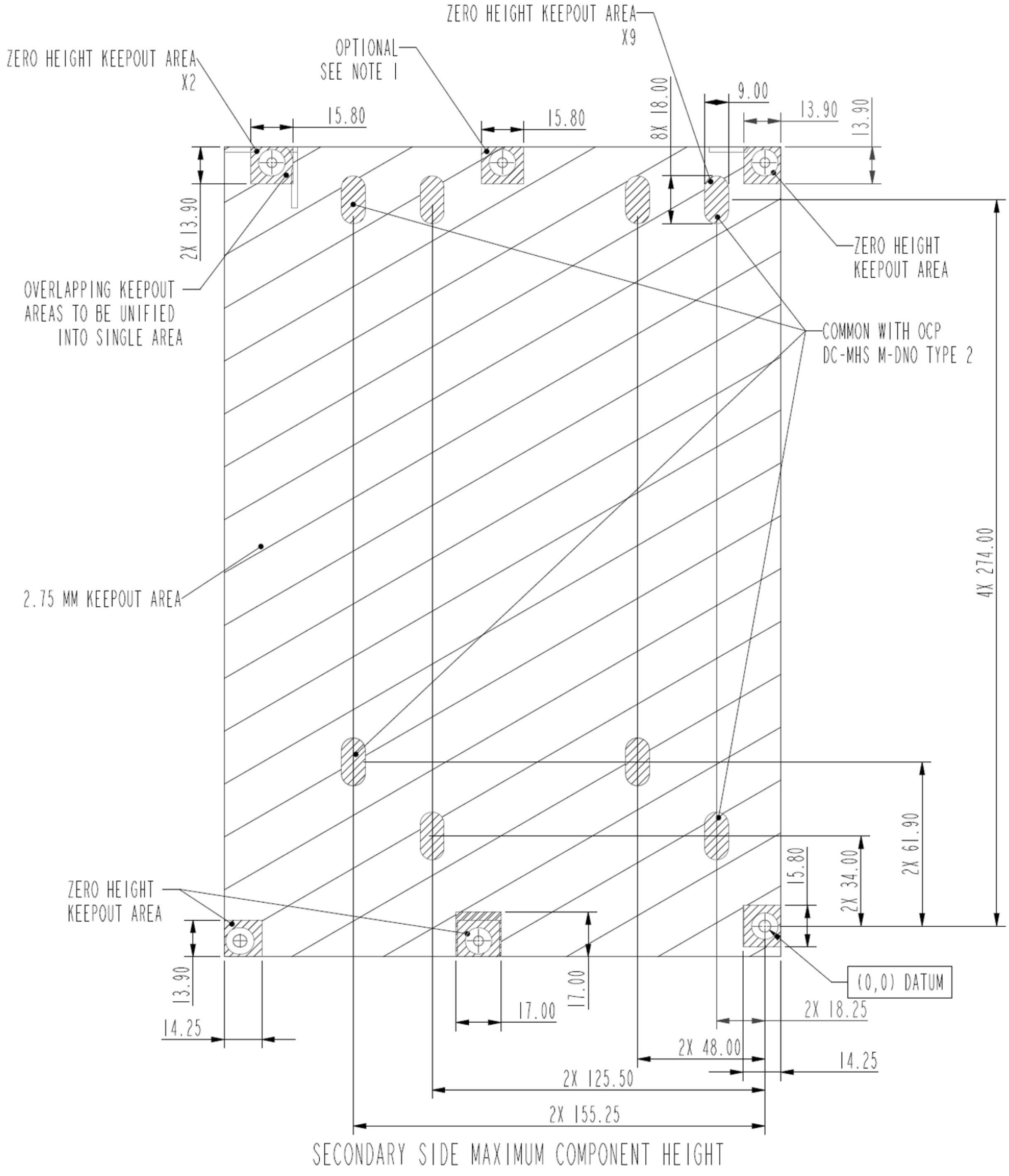


Figure 9-5. Micro MGX Primary Side Maximum Component Height Keepouts Non-DIMM Based Option

Component height restrictions on the secondary side of the PCB do not include supporting mechanical structures that may be necessary for the motherboard (such as, sub-pans, stiffening plates, or other mechanical parts). If this additional hardware is required in the design, necessary keep-in or keepout zones should be added as required. However, there are predefined areas where zero height is required to be compatible with other systems based on an OCP DC-MHS architecture for M-DNO.



NOTES:
1. SUPPORTING ROUTE KEEPOUT AREA AND ZERO HEIGHT KEEPOUT AREA ASSOCIATED WIT OPTIONAL HOLE ONLY REQUIRED WHEN HOLE IS PRESENT.
2. REFER TO 3D CAD FOR ALL DETAILS NOT SPECIFIED HERE.

Figure 9-6. Micro MGX Board Secondary Side Maximum Component Height Definition

9.2.3 Micro MGX Board Pan

The micro MGX board allows use of a supporting board pan. The micro MGX board secondary side component height constraints assume using this pan as a part of an overall assembly accounting for compatibility to a common chassis. The board pan design may vary based on implementation. An example use of this pan is illustrated in **Error! Reference source not found.**.

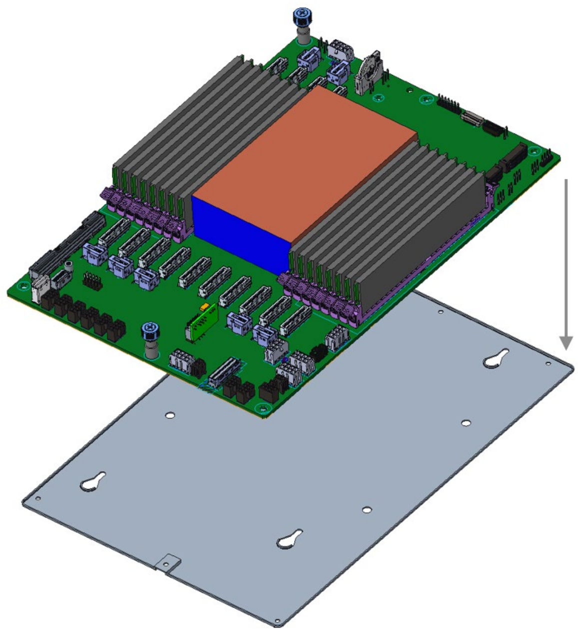


Figure 9-7.   Micro MGX Board Pan Example

9.3 MGX Board Outline

The MGX board defined in this specification takes advantage of the allowable motherboard zone in the chassis to maximize available board space. The following figure shows the approximate locations of major parts of the MGX motherboard. Refer to 3D models provided for design details not shown here.

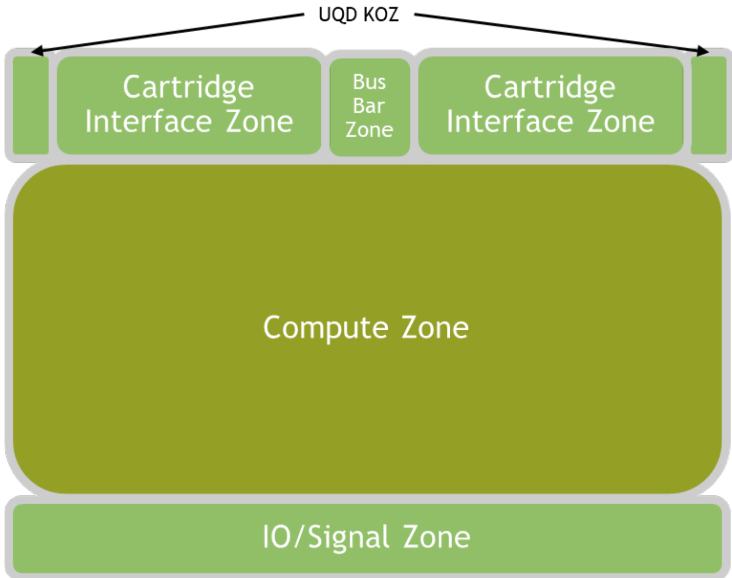


Figure 9-8. MGX Board Overview

9.3.1 MGX Board Outline

The MGX board outline is defined in **Error! Reference source not found.**. The units shown are in millimeters.

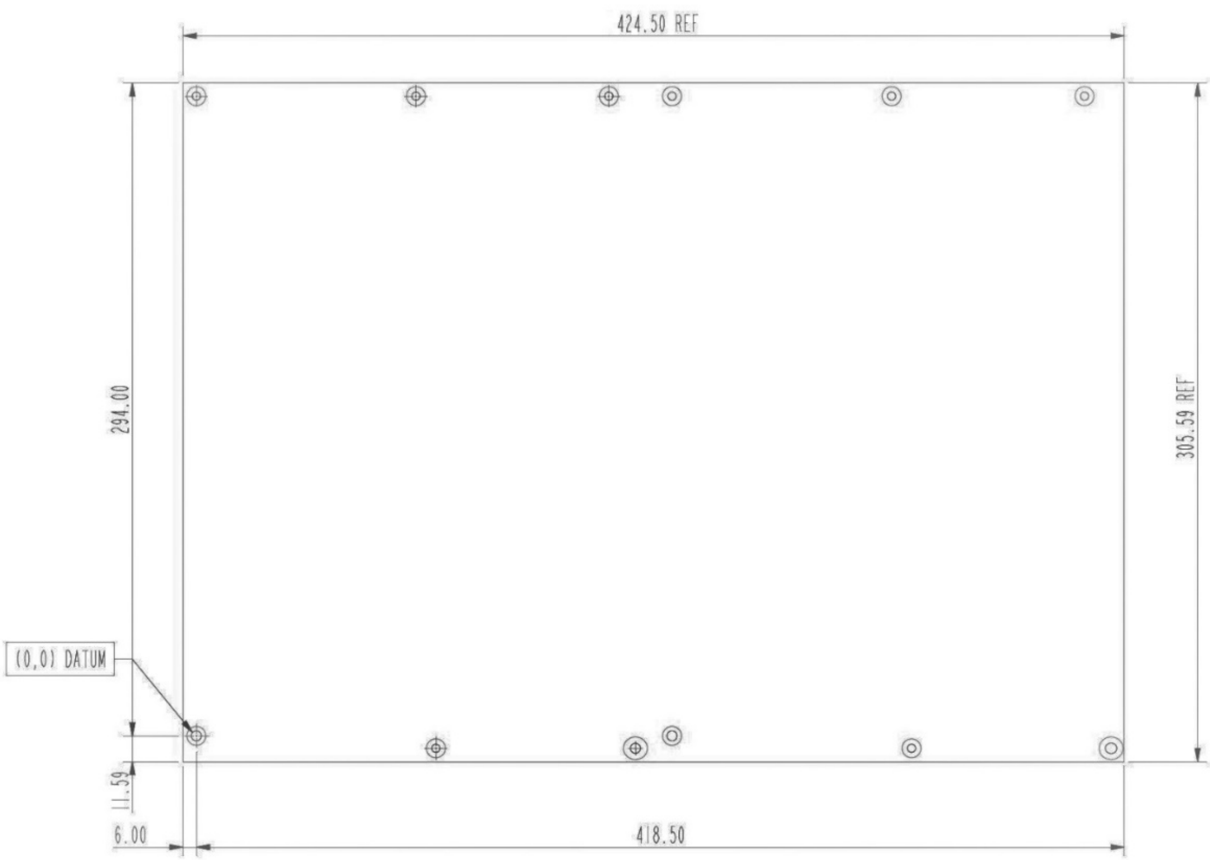


Figure 9-9. MGX Board Outline

9.3.1 MGX Board Mounting Holes

The following figure defines the required mounting hole locations and their sizing. Additional mounting holes may be necessary for mechanical security based on technological and design needs. The designer may introduce additional mounting holes as needed. All fasteners or mounting methodologies contacting the motherboard must stay within the ground pad diameter as shown in the following figure.

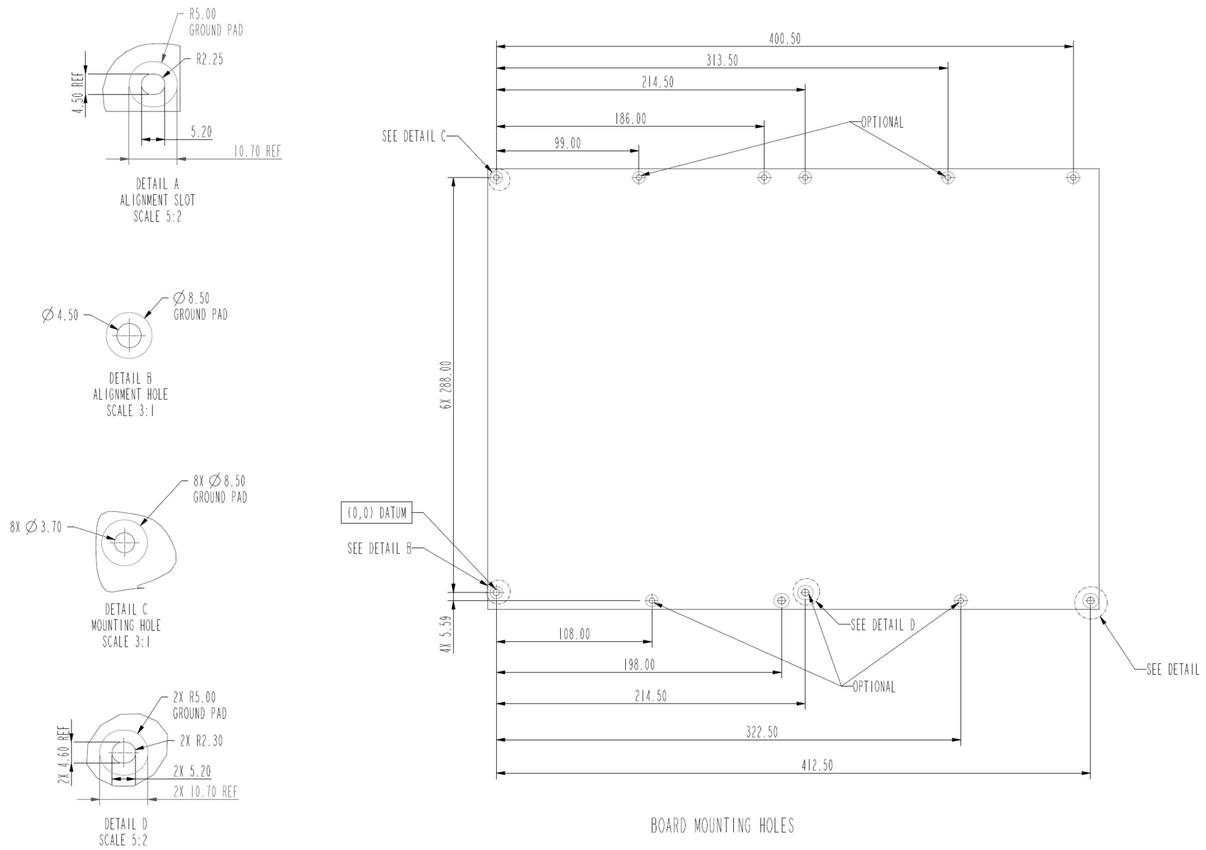


Figure 9-10. MGX Board Mounting Holes

9.3.2 MGX Board Keepout Zones

Maximum component height restrictions define an absolute maximum height of the components terminated to the PCB following the processing for both the primary and secondary sides of the board. The designer must use best practices for supporting other components within the system added in the post board process. Examples for these types of components include, but are not limited to, heat sinks, air baffles, cable management hardware, and so on.

Again, there are two options available for the primary side keepout zone. The first, a more generic option, considers DIMM based HPMs and provides a large region suitable for placing DIMMs. This board form factor is defined here to show additional implementation options of the compute tray HPM.

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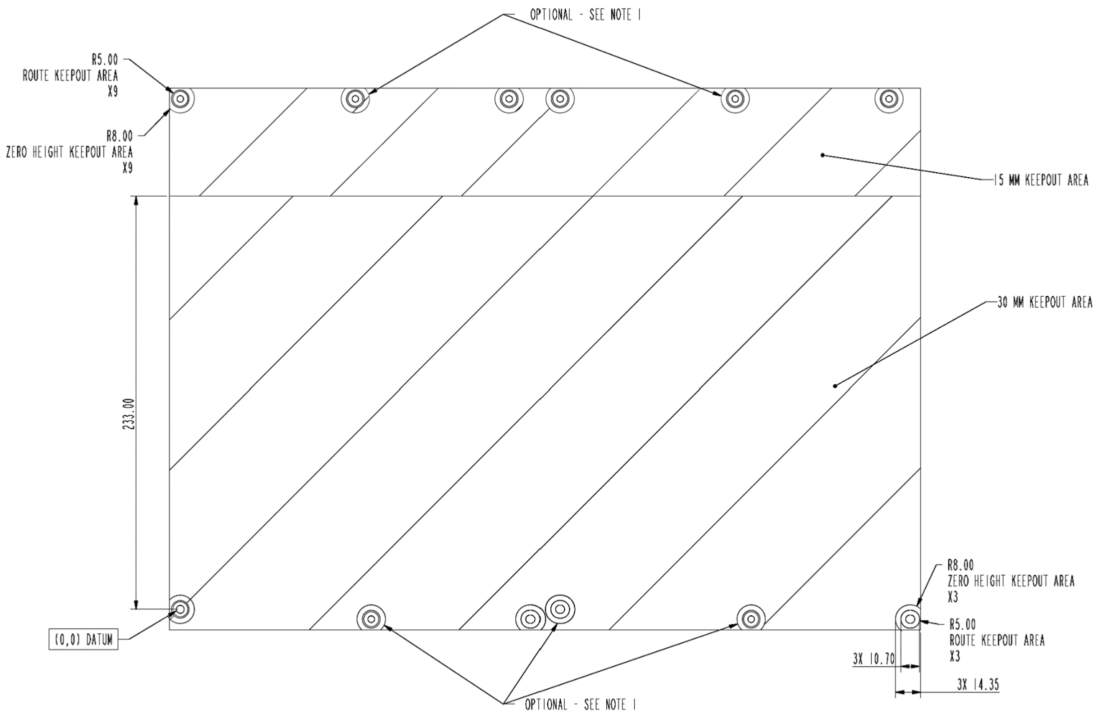


NOTES:
1. SUPPORTING ROUTE KEEPOUT AREA AND PRIMARY SIDE ZERO HEIGHT KEEPOUT AREA ASSOCIATED WITH OPTIONAL HOLE ONLY REQUIRED WHEN HOLE IS PRESENT.

Figure 9-11. MGX Board Primary Side Maximum Height Component Height Keepouts DIMM Based HPM Option

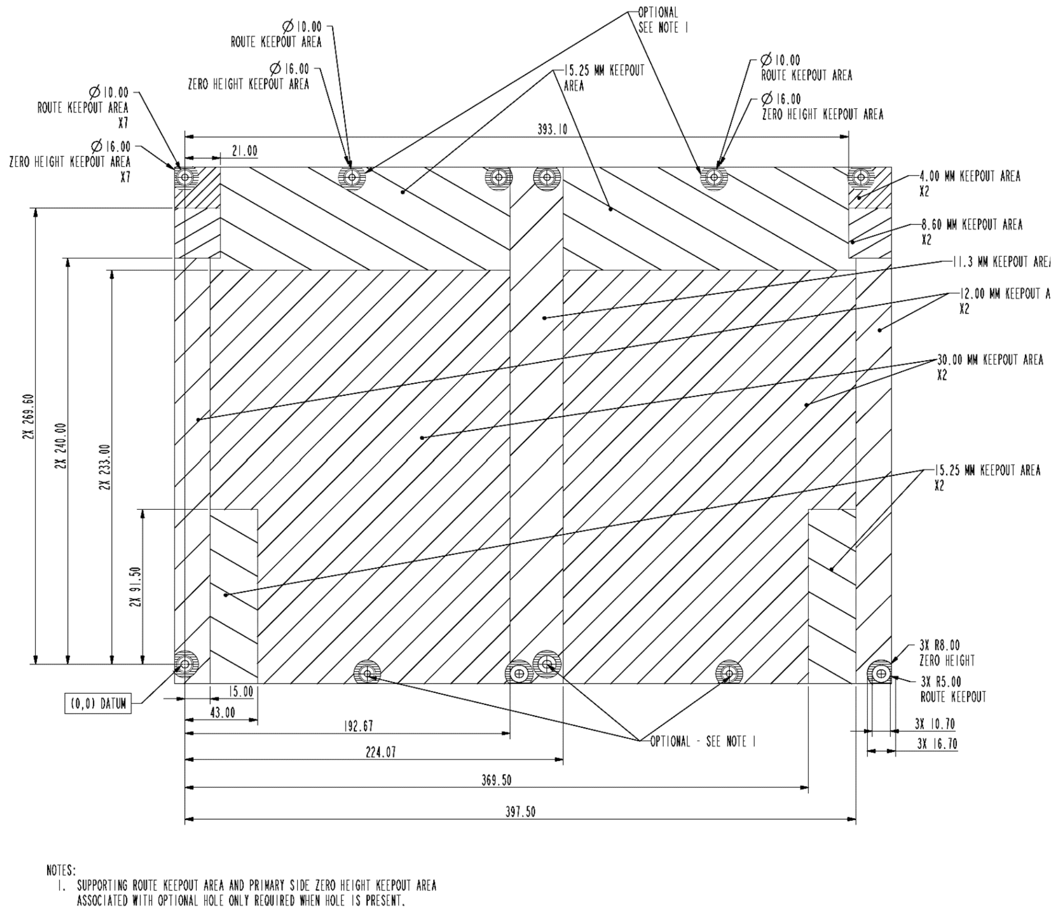


Figure 9-12. MGX Board Primary Side Maximum Component Height Keepouts Non-DIMM Based Option

Component height restrictions on the secondary side of the PCB do not include supporting mechanical structures that may be necessary for the motherboard (such as subpans, stiffening plates, or other mechanical parts). If this additional hardware is required, necessary keep-in or keepout zones should be added as required. However, there are predefined areas where zero height is required to be compatible with other systems based on an OCP DC-MHS architecture for M-FLW.

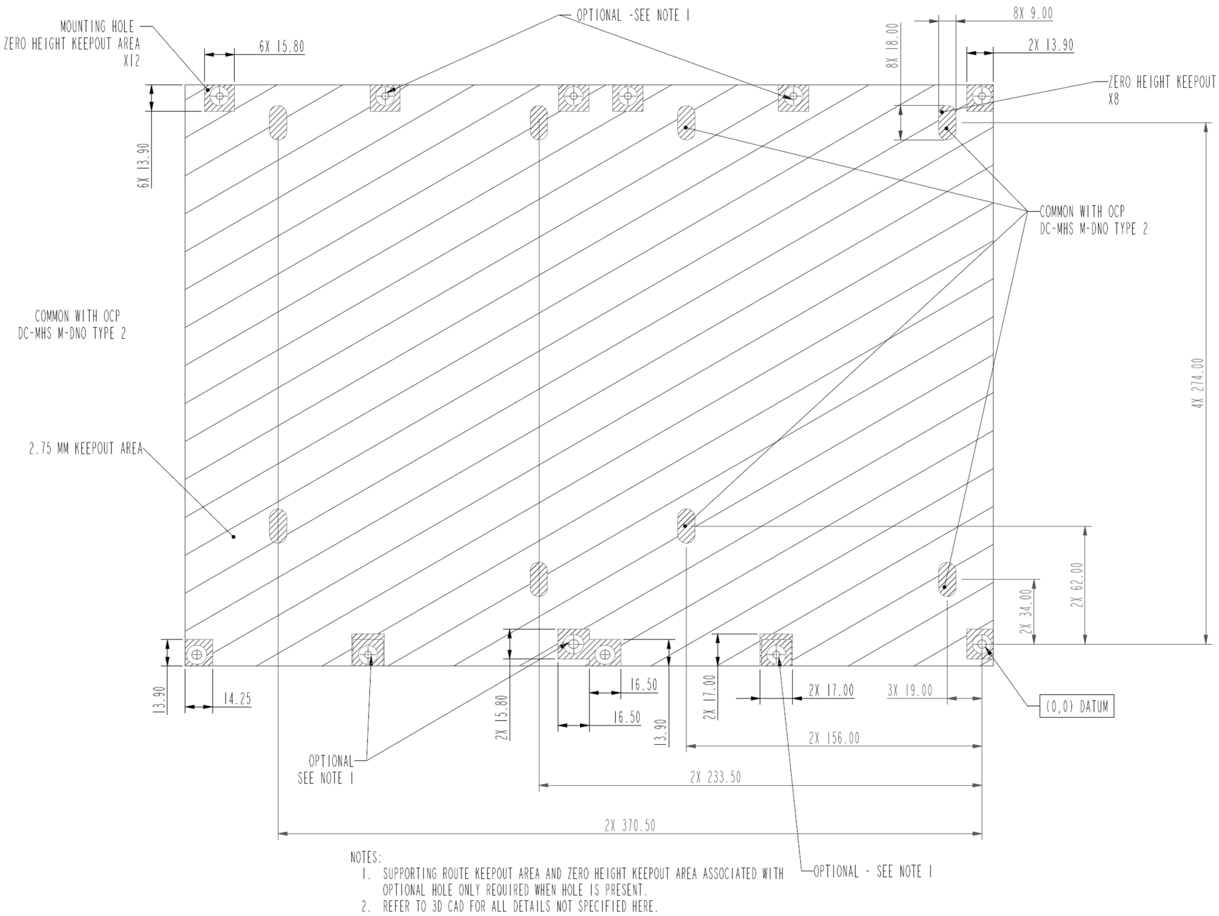


Figure 9-13. MGX Board Secondary Side Maximum Component Height Definition

9.2.6 MGX Board Pan

Like the micro MGX board, the MGX board form factor allows for a supporting board pan. Its secondary side component height constraints assume that the pan is part of an overall assembly accounting for compatibility to a common chassis. An example use of this pan is illustrated in **Error! Reference source not found.**.

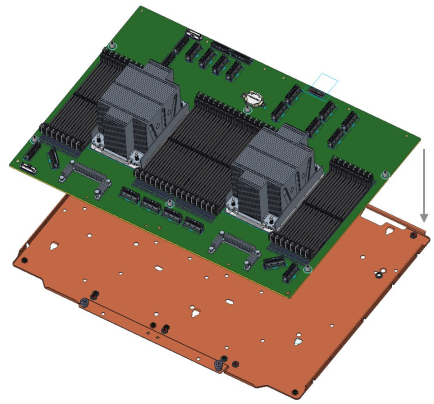


Figure 9-14. MGX Board Pan Example

9.3. IO Bay Form Factors

The MGX architecture from which the Compute Trays are derived contains several sizes of bay modules that are suitable for many chassis lengths, chassis heights, and desired system technology layout configurations. The configuration shown below is the example implementation in the CAD of this contribution. This configuration supports 4 air cooled OSFP transceivers, 2 PCIe card slots, 8 E1.S SSDs, Power buttons, status LEDs, a MGMT port and serial pull tab. Refer to 3D models provided for design details not shown here.

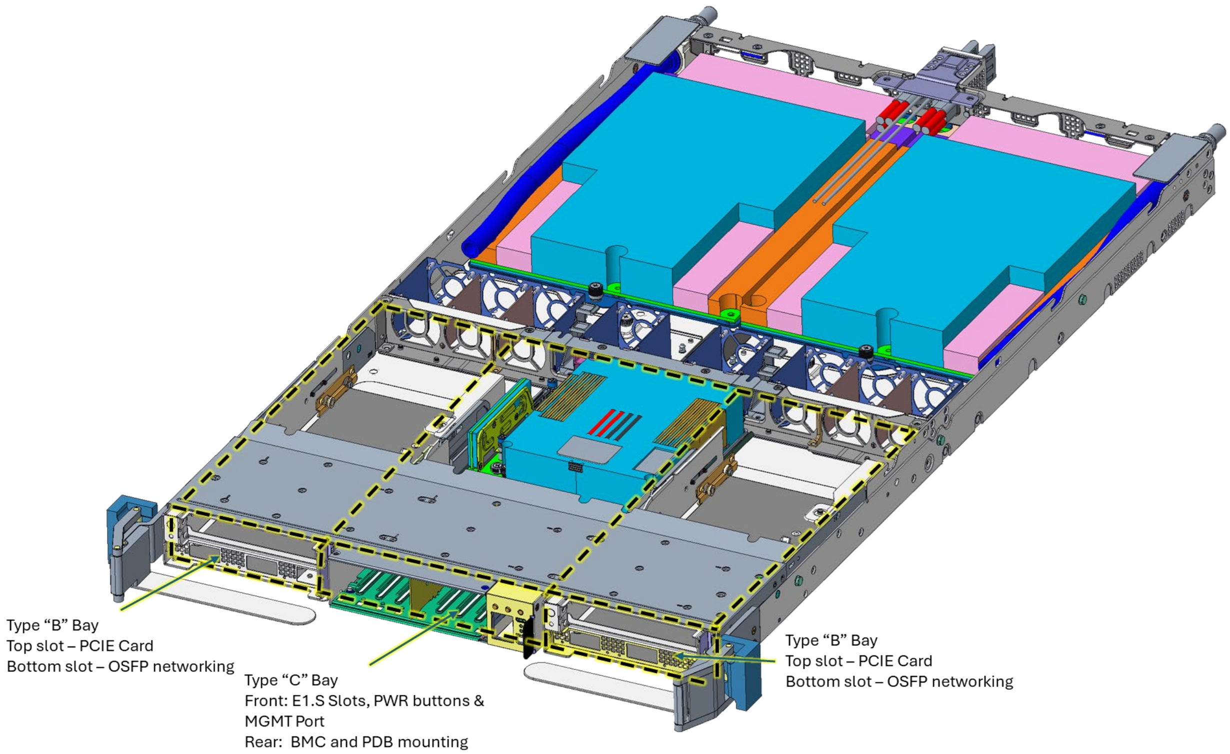


Figure 9-15. Compute Tray IO Bay Examples

However, many options are available so that implementers may customize the front configuration to meet their specific IO needs. The following section details the options for IO configurations and defines the architecture around them.

Across the various modular bay types are common interfaces within the system to permit compatibility of a short bay module within the same space required for a long bay module, the use of two 1RU bay modules within the space of a single 2RU bay module, or the use of wider bays in place of narrower options. An overview of each bay module is described in this section for reference and to show all available options when implementing a compute tray to this specification.

Table 9-1. Bay Module Attribute Description

Bay Module Attribute	Background
Type A	Description of bay module width. Width inspired to support E1.s EDSFF storage or power input connectors.
Type B	Description of bay module width. Width inspired to support full-height PCIe AIC with standard faceplate.
Type C	Description of bay module width. Width inspired to span the width of a Type A, Type B, and the divider. It will also support two CRPS units side by side with room for pass-through power cable.

Bay Module Attribute	Background
Type D	Description of bay module width. Width inspired to span the width of two Type B bays and the divider. It can support designs requiring more space than standard PCIe AIC widths.
Type E	Description of bay module width. Width inspired to span the width of a Type B and Type C bay and the divider. It is able to support designs requiring more space than a standard double width Type B bay.
Short	Description of bay depth. Short depth bays can be used in bays designated as short or long and may support storage devices such as NVMe E1.S, E3.S, U.2
Long	Description of bay depth. Long bays can only be used in bays designated as long and cannot be used in short bay locations. Depth inspired to support a long PCIe AIC length.

9.3.1 Bay Design and Location

As described in Table table above, five different bay types are possible. Each bay type has a required width dimension but can support different heights and depths. The bay depth is classified as either short or long depending upon the max depth dimension of the bay and the height can vary in increments of an RU (for example, 1RU, 2RU, 4RU, and so on).
The bays can be placed in a system in many configurations, but the location is restricted by its type and depth. These restrictions, along with the chassis design, will dictate the bay quantities and locations allowed in a system and are interfaced with a bay naming methodology. The bay naming assumes that every system has four bay locations across the width in both the front and back labeled 1 through 4. The height of the chassis is designated by rows with every row number indicating 1RU of height. The bay name then communicates depth, chassis location, and type as follows:

Bay Location = Row Location + Depth (Short/Long) + Location (1,2,3,4) + Type (A,B,C,D,E)

When using one of the wide bays, types C, D, or E bays, the 1 through 4 chassis location numbering system is still maintained by listing all the chassis locations the bay uses. For example, a Type D long bay located on the leftmost chassis location in the bottom RU would be assigned the name ‘Row 1 - Long 1.2.D.’ The name communicates that the Type D Bay uses locations 1 and 2 in the chassis and is located on the bottom RU of height. In a similar fashion, if using a bay taller than 1RU, the bay name would list all the rows the bay uses. For example, if the bay just discussed was 2RU in height, the assigned name would be ‘Row1.2 – Long 1.2.D.’ Other bay numbering examples and an illustration of row locations in a 2RU system are provided in the following figures.

Figure 9-16. Example Bay Location Names

9.3.2 Type A Bay Module

The Type A Bay module is sized to support the width necessary for existing standard form factors such as an E1.S EDSFF device or an input power connection enabling pass through PDU to PSU connectivity. However, the use of this bay module is not limited to these form factors.

The Type A Bay can be constructed into any RU height with the 1RU form factor being the main use case. It can also come in either a short or long depth with the short bay having a max dimension of 132.8 mm and long bay 318 mm. However, the width of the bay of 29.8 mm is a requirement. The module envelope dimensions shown here are nominal outside envelope dimensions.

Figure 9-17. Bay Type A Detail

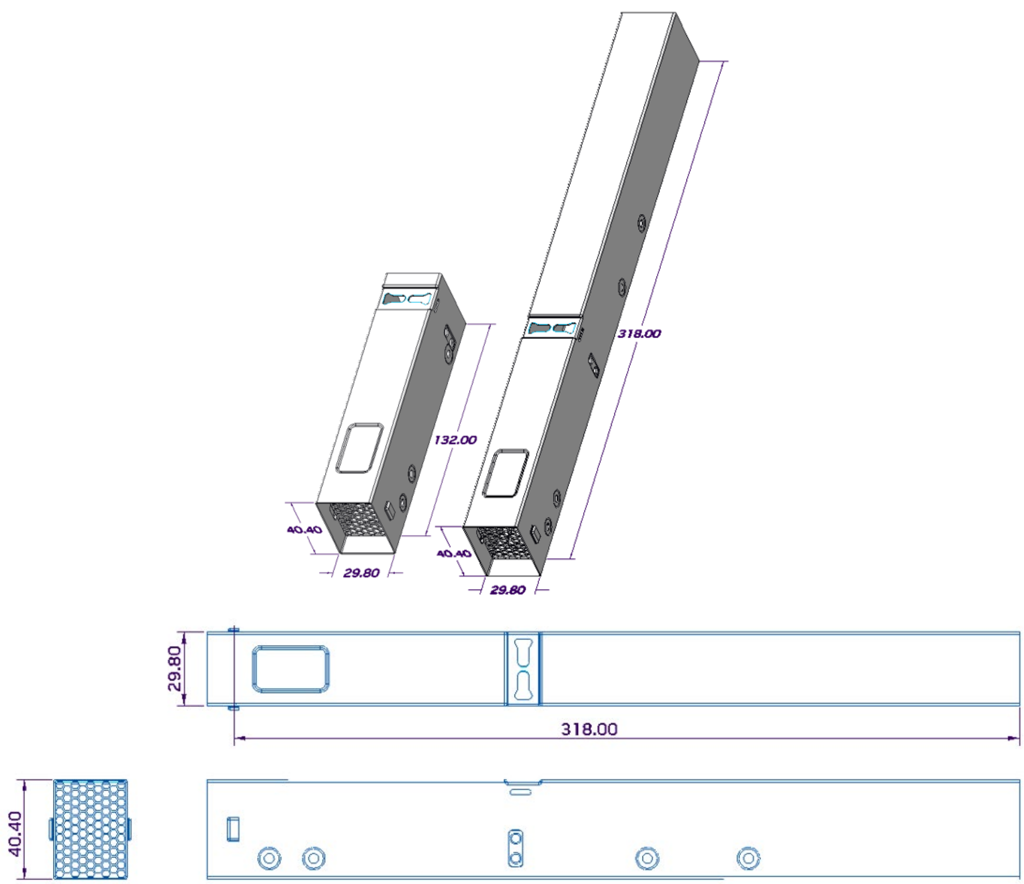


Figure 9-18. Bay Type A Dimensional Envelope

9.3.3 Type B Bay Module

The Type B Bay module is sized to support the depth necessary for a full-length PCIe AIC form factor. However, the use of this bay module is not limited to a PCIe AIC form factor. Other form factors available within the industry may be supported. In addition, should there be a need for a unique I/O board, or other technology, the developer is able to support this implementation within the envelope of the bay module form factor.

Like the Type A Bay, a Type B Bay can be constructed into any RU height with the 1RU form factor being the main use case. It can also come in either a short or long depth with the short bay having a max dimension of 132.8 mm and long bay 318 mm. The required width of the Type B Bay is 129.5 mm.

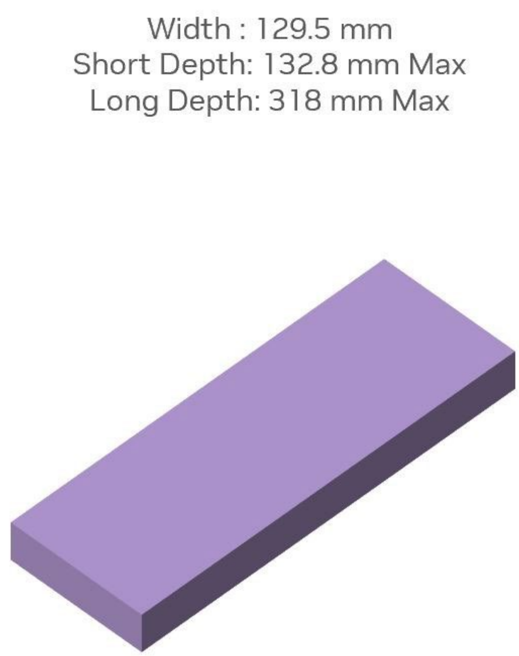


Figure 9-19. Bay Type B Dimensional Envelope

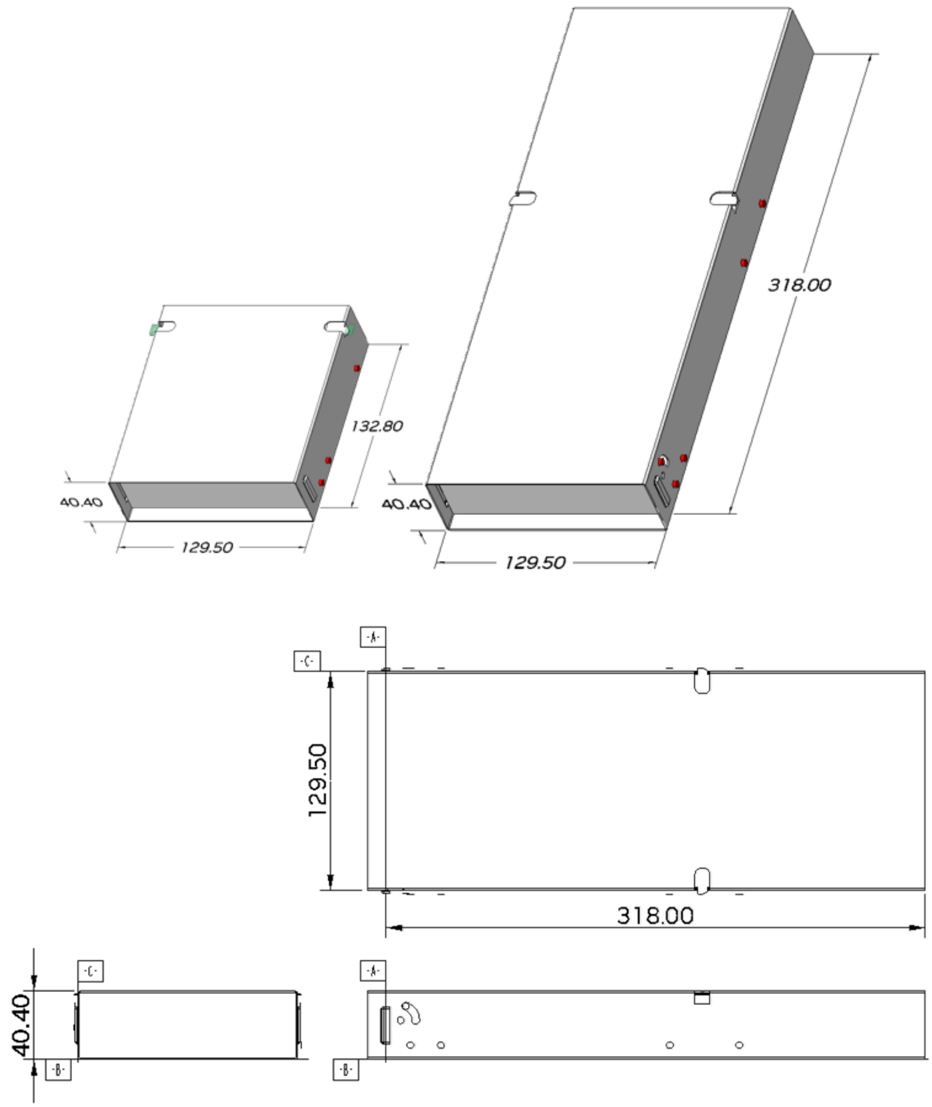


Figure 9-20. Bay Type B Detail

Some form factors (such as PCIe AICs) may include geometry that must extend beyond the datum surface. Any protrusion beyond the datum surface is the responsibility of the system designer.

9.3.4 Type C Bay Module

The Type C Bay module is sized to support the depth necessary for a full-length PCIe AIC form factor but with a greater allowable width than the Type B Bay. It is sized to accommodate two CRPS units side by side. The Type C Bay module consumes the same width as a Type A and a Type B Bay module together.

The Type C Bay can also be constructed into any RU height and can be made in either short, CRPS optimized short or long depth. The max dimension for the short bay is the same as the other short bays. However, the Type C Bay has a CRPS optimized option which allows for a longer depth due to it being used for standard CRPS power supplies. The optimized short bay max dimension is 185 mm. The width of the bay is 163.5 mm.

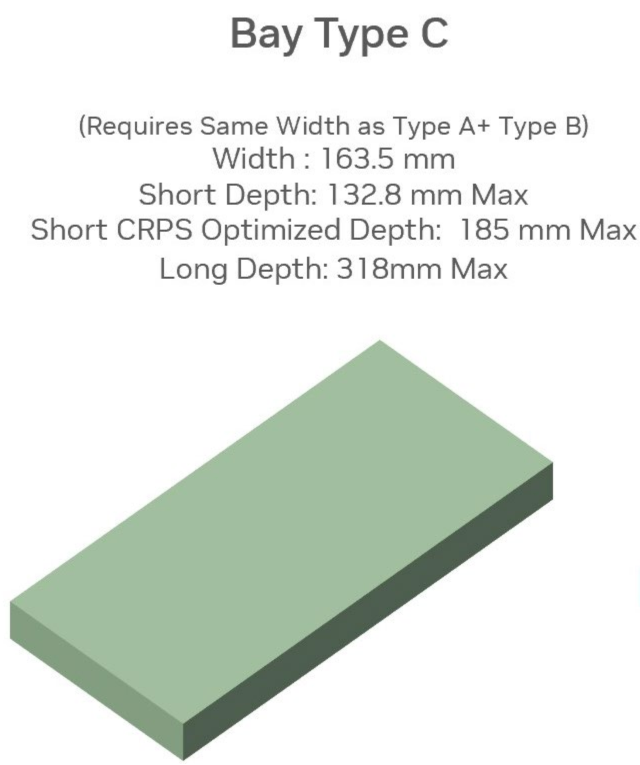
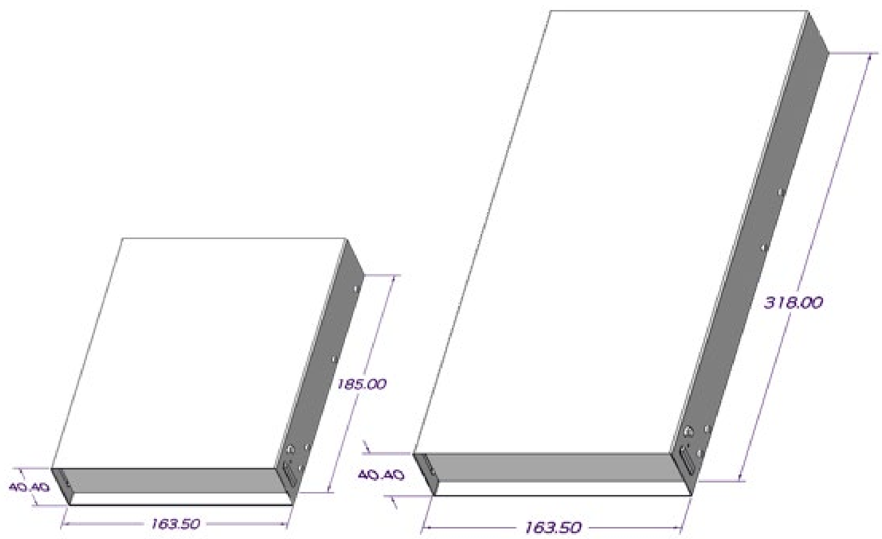


Figure 9-21. Bay Type C Dimensional Envelope



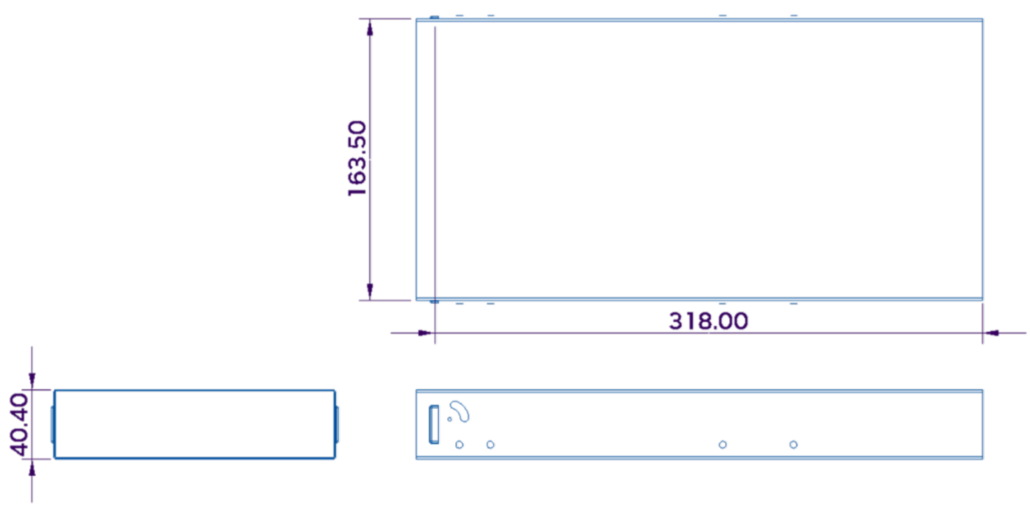


Figure 9-22. Bay Type C Detail

Some form factors (such as PCIe AICs) may include geometry that must extend beyond the datum surface. Any protrusion beyond the datum surface is the responsibility of the system designer.

9.3.5 Type D Bay Module

The Type D Bay module is sized to be the equivalent width of two Type B bays plus the divider. It is sized to accommodate two PCIe full-height cards side by side or for a micro-MGX motherboard. However, the use of this bay can be used for other content if the overall dimensional requirements are satisfied.

The Type D Bay can also be constructed into any RU height. It can be made in either a short or long depth with the short bay having a max dimension of 132.8 mm and long bay 318 mm. The required width of the Type D Bay is 263.2 mm.

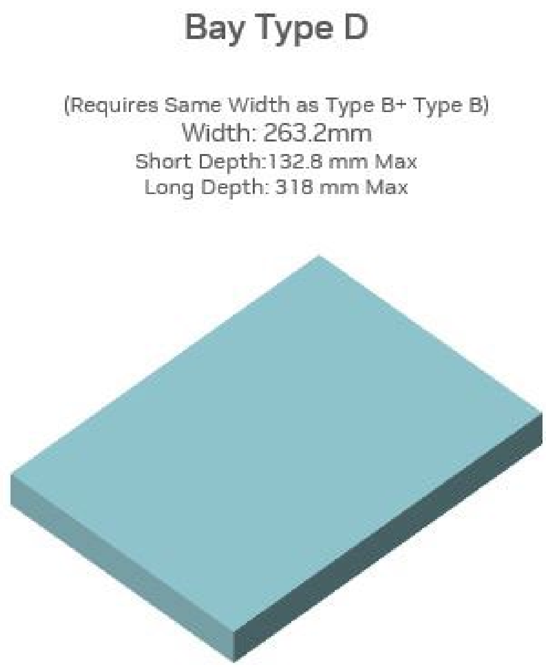


Figure 9-23. 1RU Type D Bay Dimensional Envelope

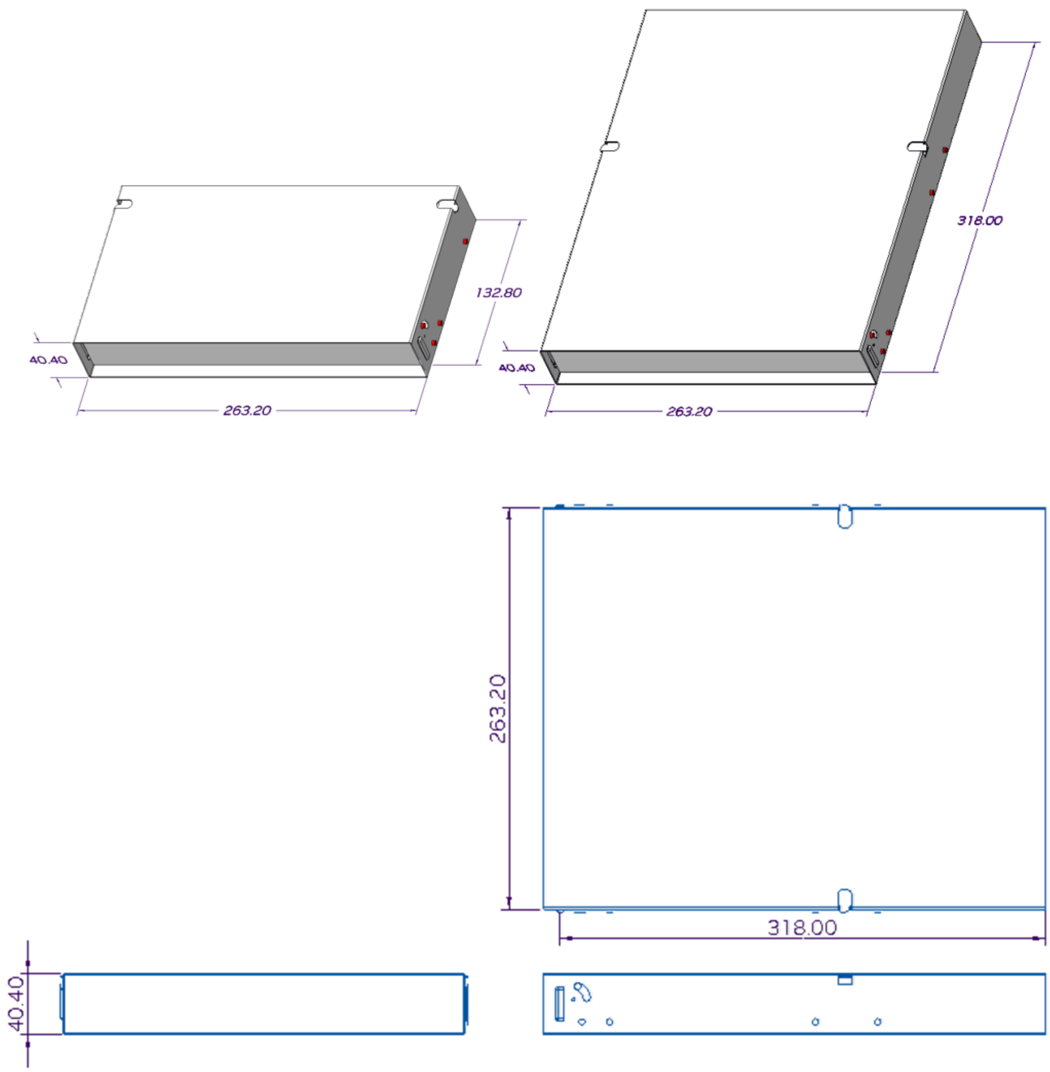


Figure 9-24. Bay Type D Detail

9.3.6 Type E Bay Module

The Type E Bay module is sized to be the equivalent width of a Type B plus a Type C Bay with the divider. It can be constructed into any RU height and can be made in either a short or long depth with the short bay having a max dimension of 132.8 mm and long bay 318 mm. The required width of the Type E Bay is 297.2 mm.

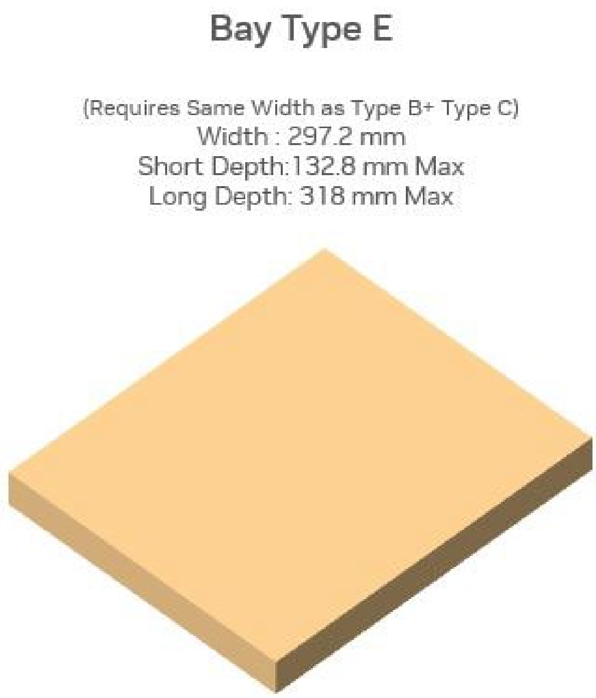
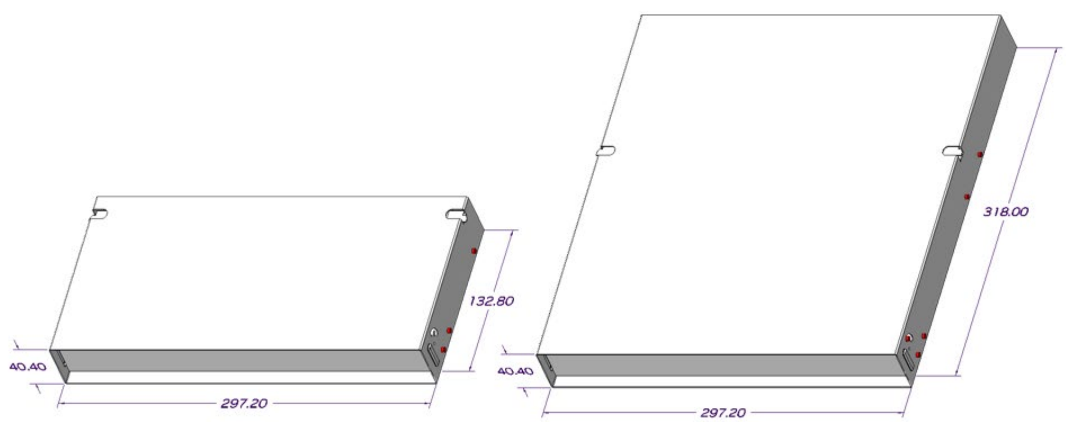


Figure 9-25. Type E Bay Dimensional Envelope



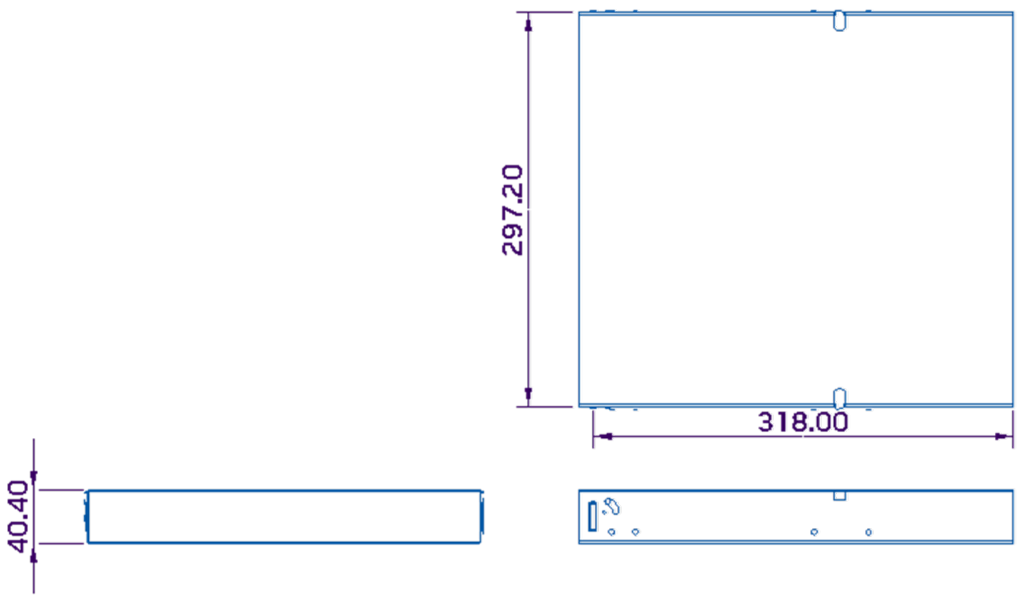


Figure 9-26. Bay Type E Detail

9.3.7 IO Bay Chassis Interface

Each bay module is secured to the chassis during configuration assembly using one of two methodologies. A single spring latch and catch, internal to the system, or a camming latch handle (external to the system), retains the bay in place. Each bay in the chassis may be designed to support a short bay, long bay, or both by allowing for spring or camming latch positions as shown in the following figures. Refer to 3D models provided for design details not shown here.

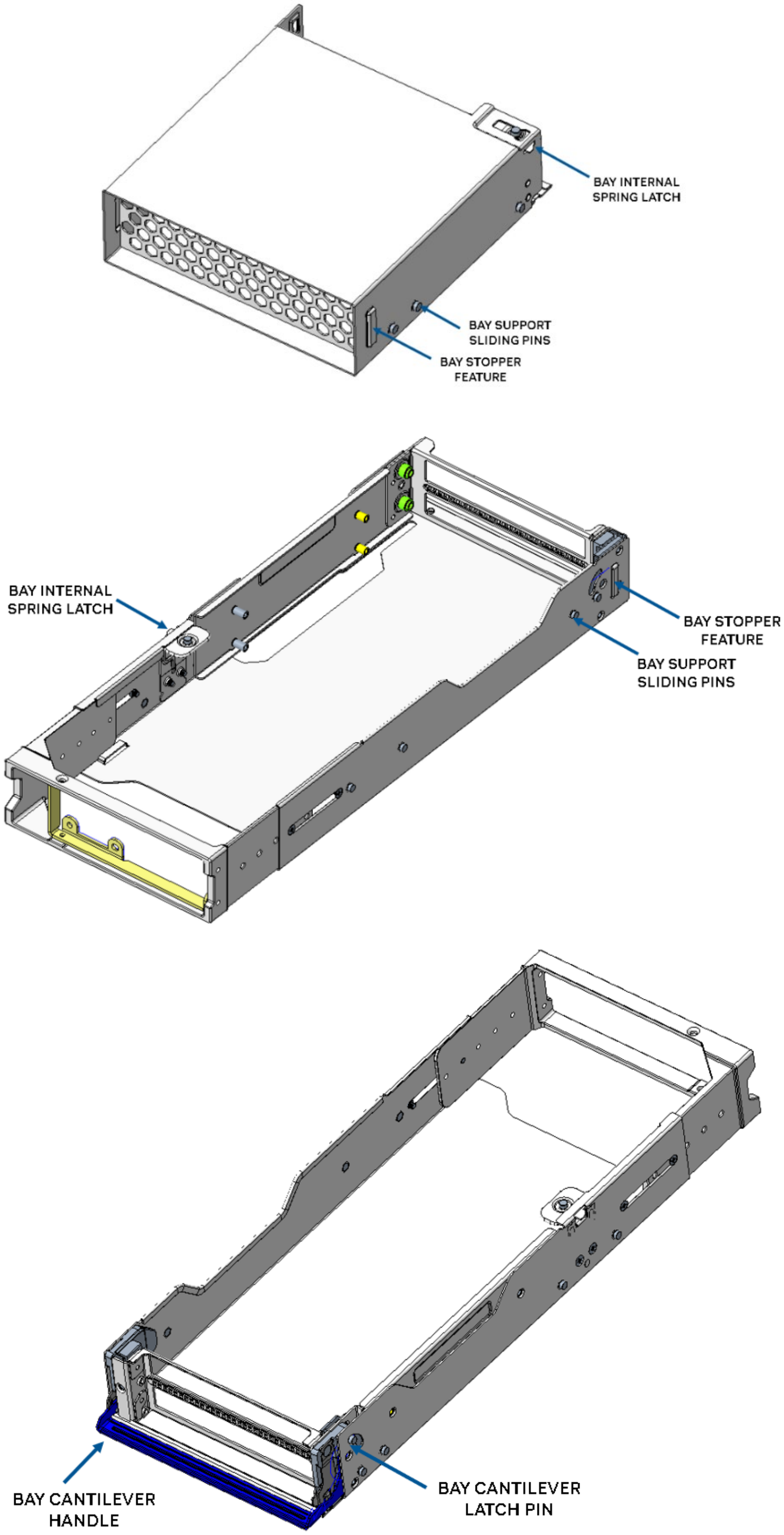


Figure 9-27. Bay Module Retention to Chassis Detail

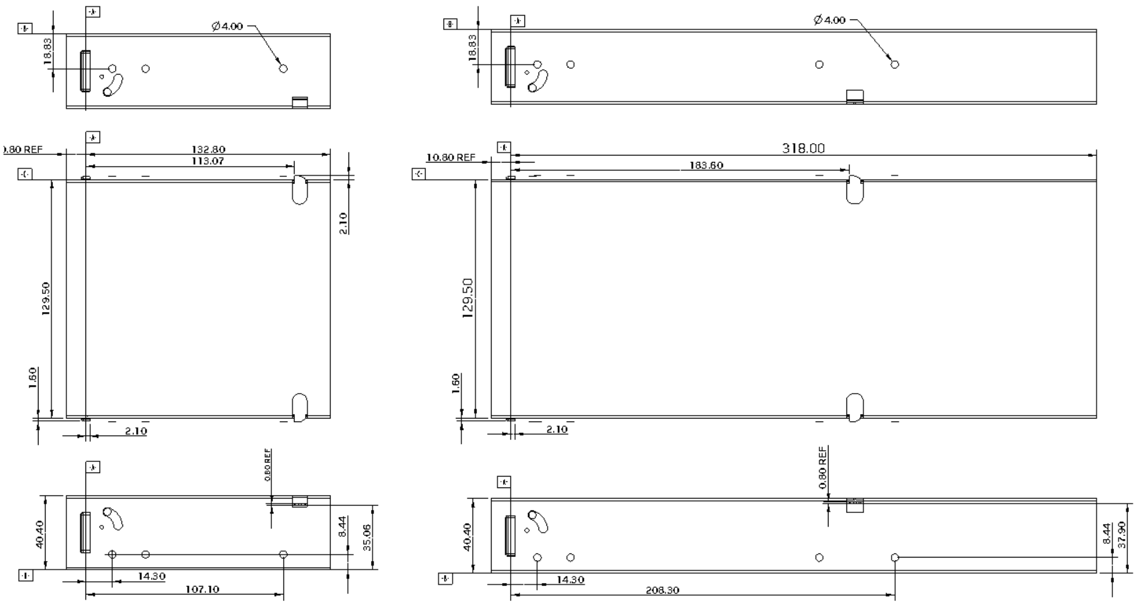


Figure 9-28. Spring Latch Location from Bay Datum

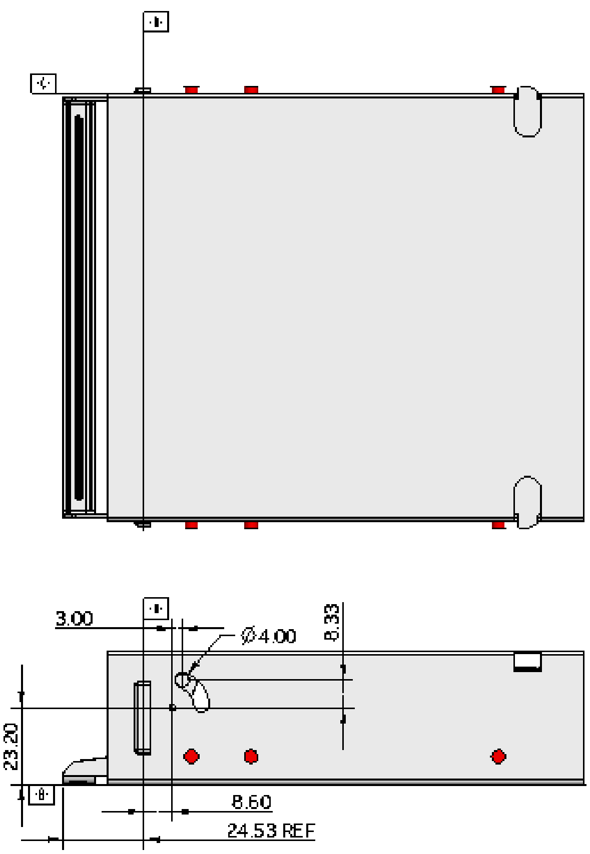


Figure 9-29. Cantilever Latch Location from Bay Datum

10. Interconnect and Liquid Cooling Interfaces

The following section specifies the interfaces for the interconnect cartridge and blind mate liquid cooling in the tray and rack.

10.1 Universal Quick Disconnect Interface

The following section specifies the blind mate interface designed around the OCP UQD and UQDB specifications.

10.1.1 Blind Mate Float Mechanism Overview

The figure below illustrates the key components and dimensions of the blind mate float mechanism. The mechanism employs the UQD-04 insert on the tray side and captures it on a hose adaptor between two washers with a pre-loaded spring. This allows simultaneous rotational and radial motion. On the rack manifold side, a UQDB-04 socket is mounted to a thread adaptor that contains a slot on which a lead-in cap is mounted to increase gatherability of the socket. The hose adaptor is customized for each specific supplier to maintain a consistent mating dimension of 53.19mm as shown. The thread adaptor on the socket is also customized for each supplier to maintain a mating depth of 45.51mm as shown.

- Blind Mate Float Mechanism Primary components
  - UQD-04 Insert – Off the shelf UQD from supply base
  - UQDB-04 Socket – Off the shelf UQD from supply base with lead-in.
  - Hose and Thread Adaptor – Enables multi-vendor support, addresses supplier to supplier dimensional variability
  - Coil Spring and Washers – Ensures full mate, allows for angular and linear misalignment
  - Chassis Mount – Mechanical support and connection to chassis
  - Lead-in Cap – Increases socket gatherability

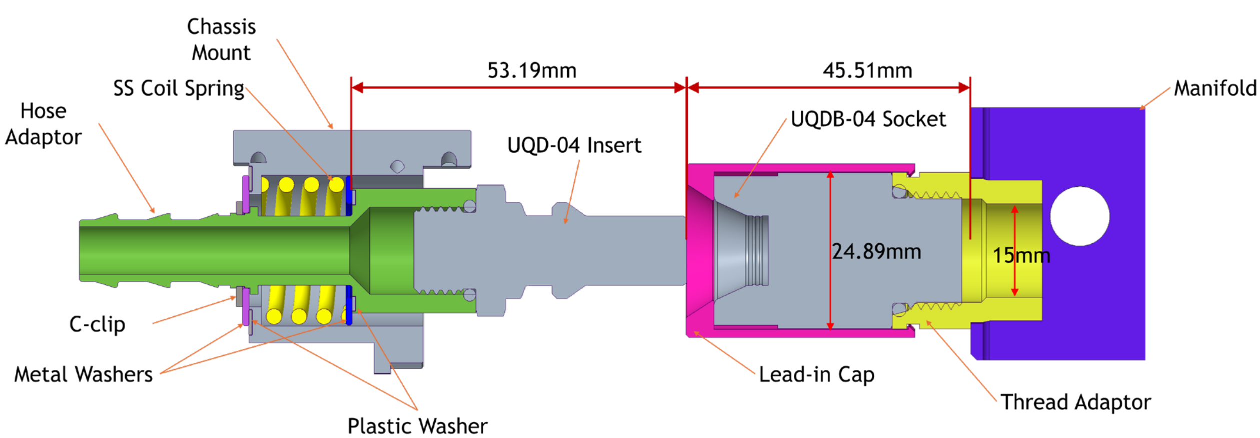
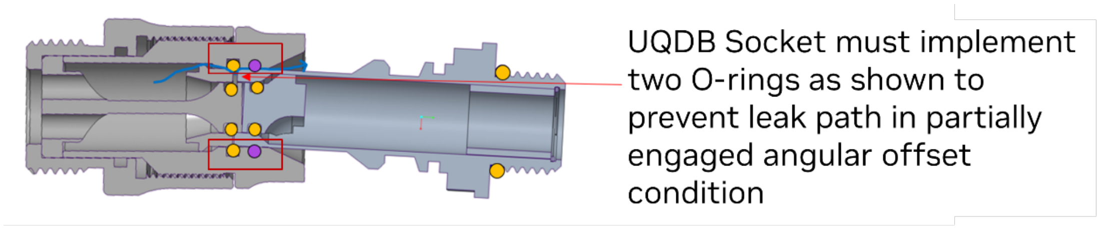


Figure 10-1. UQD Float Mechanism Overview

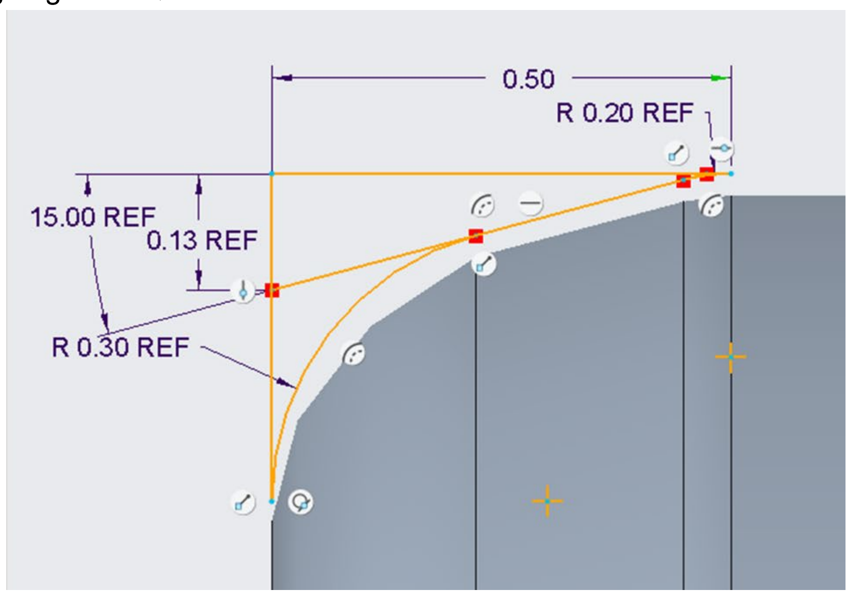
10.1.2 UQD Component Design Requirements

This specification establishes additional requirements beyond those in the UQD/B specs to ensure interoperability between different suppliers and improve blindmatability in this application.

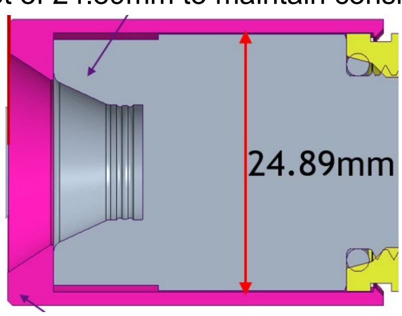
- Dual O-ring Seal on UQDB Socket



- Radii and chamfer on leading edge of UQD Insert



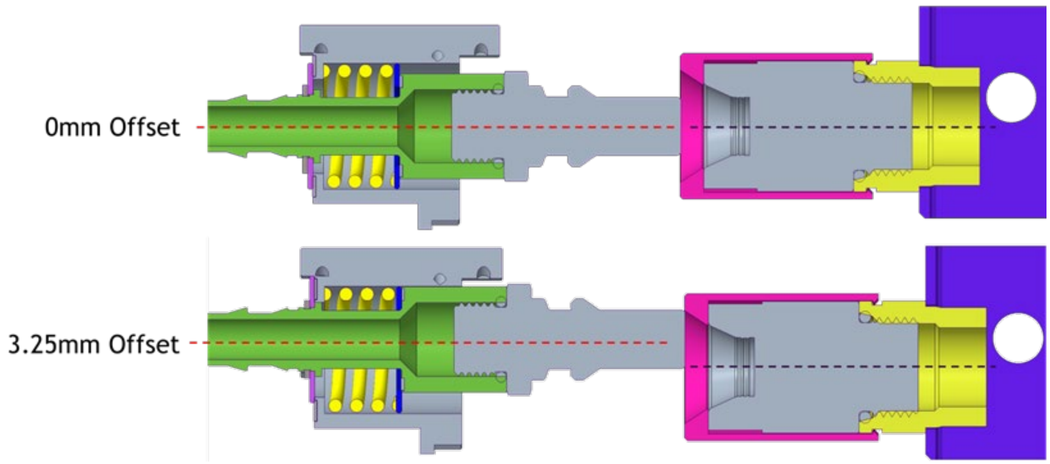
- Nominal OD of UQDB Socket of 24.89mm to maintain consistent piloting on Lead-in Cap



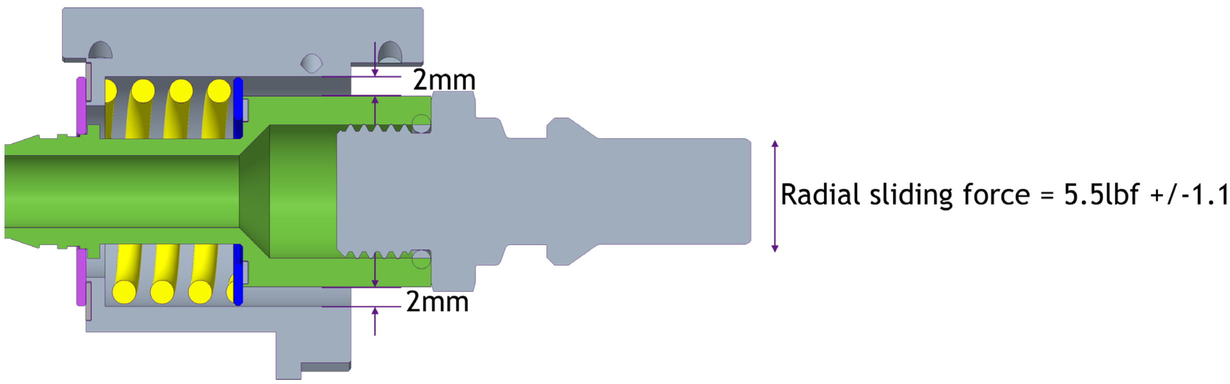
10.1.3 Blind Mate Mechanism Mechanical Features

This section describes the features of the blind mate float mechanism.

- Linear Gatherability - Up to 3.25mm linear offset between chassis and manifold

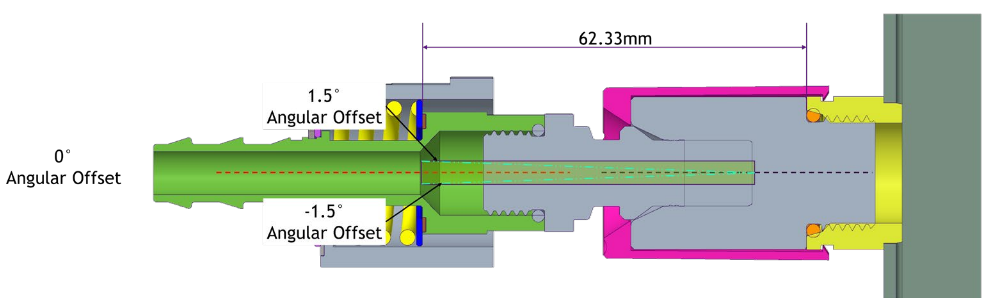


- Radial Float – +/-2mm, 4mm total travel



- Analysis of allowable radial offset vs rigid angular offset. As noted in OCP BMQC Specification there is an inverse relationship between fixed angular offset and radial offset. The values below were calculated using the same method as BMQC. Note: The mounting feature to the chassis may be toolless, in which case addition radial float of approximately 0.2mm could be observed.

Fixed Angular Offest (Deg)	-1.5	-1.3	-1.2	-1	-0.75	-0.5	0	0.5	0.75	1	1.2	1.3	1.5
Radial Offset (mm)	0.37	0.59	0.69	0.91	1.18	1.46	2.00	1.46	1.18	0.91	0.69	0.59	0.37



- Z-Float, Pre-load and Nominal Engagement Position

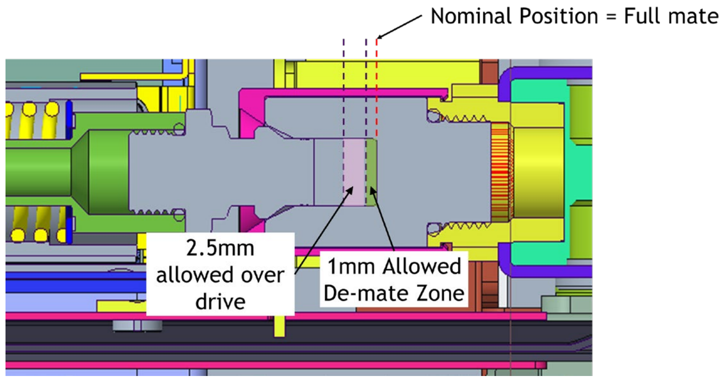


Figure 10-2. UQD Z-Float and nominal position

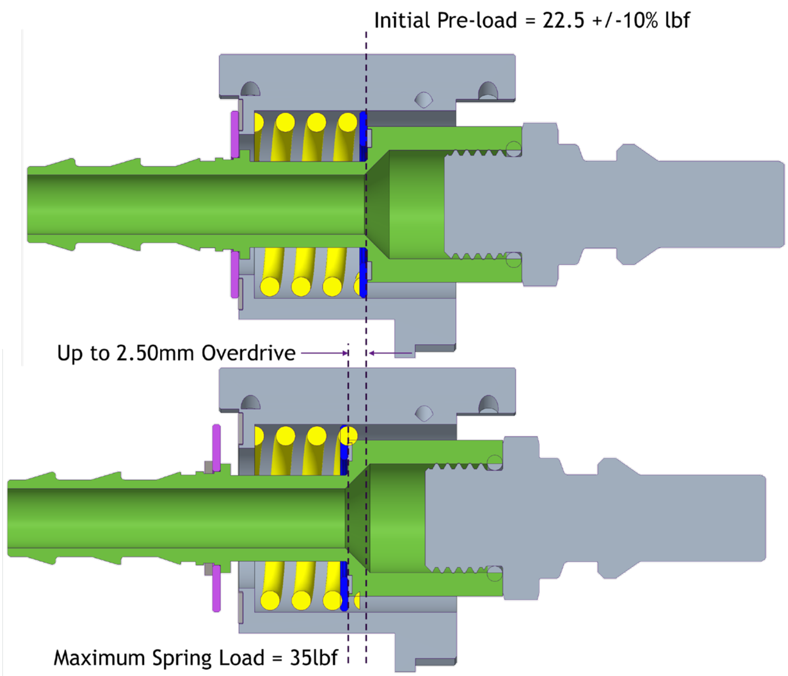


Figure 10-3. UQD Z-Float Loading

- Preload Spring – Supplier load varies 18-14lbs @ 35psi. In addition, mating force will vary based on operating temperature. Mechanism spring and preload may be adjusted as needed to meet end user's needs.

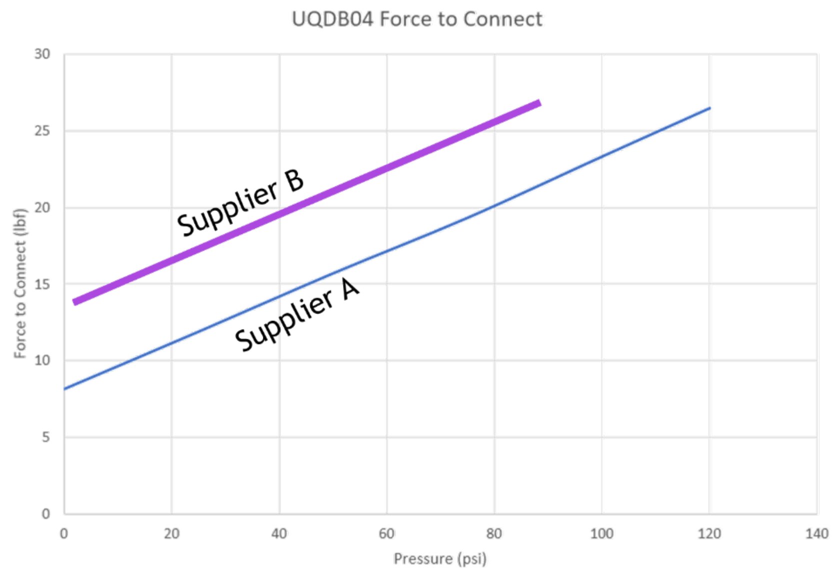


Figure 10-4. Observed UQD force range from suppliers

10.1.5 Compute Tray Liquid Cooling Interface

The figure below specifies the location of the UQD assemblies on the compute an switch tray.

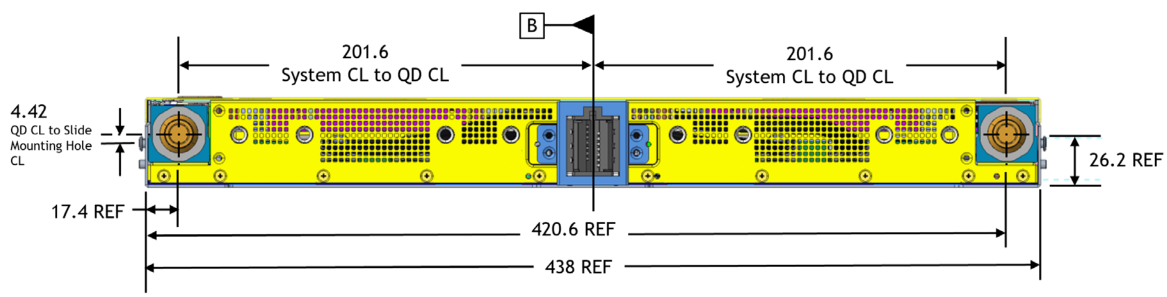


Figure 10-5. UQD Locations in 1RU Chassis

10.2 Interconnect Cartridge Definition

This section defines the interconnect cartridge volumetric and mounting locations within the MGX rack.

10.2.1 Interconnect Cartridge Drawing

The drawing below specifies the mounting and alignment locations of the Interconnect Cartridge volumetric. Note that specific connectors, guide pins etc. are not specified in document as design will vary based on specific interconnect. Details of the interconnect architecture are dependent upon specific accelerator and system architecture and are not specified in this document.

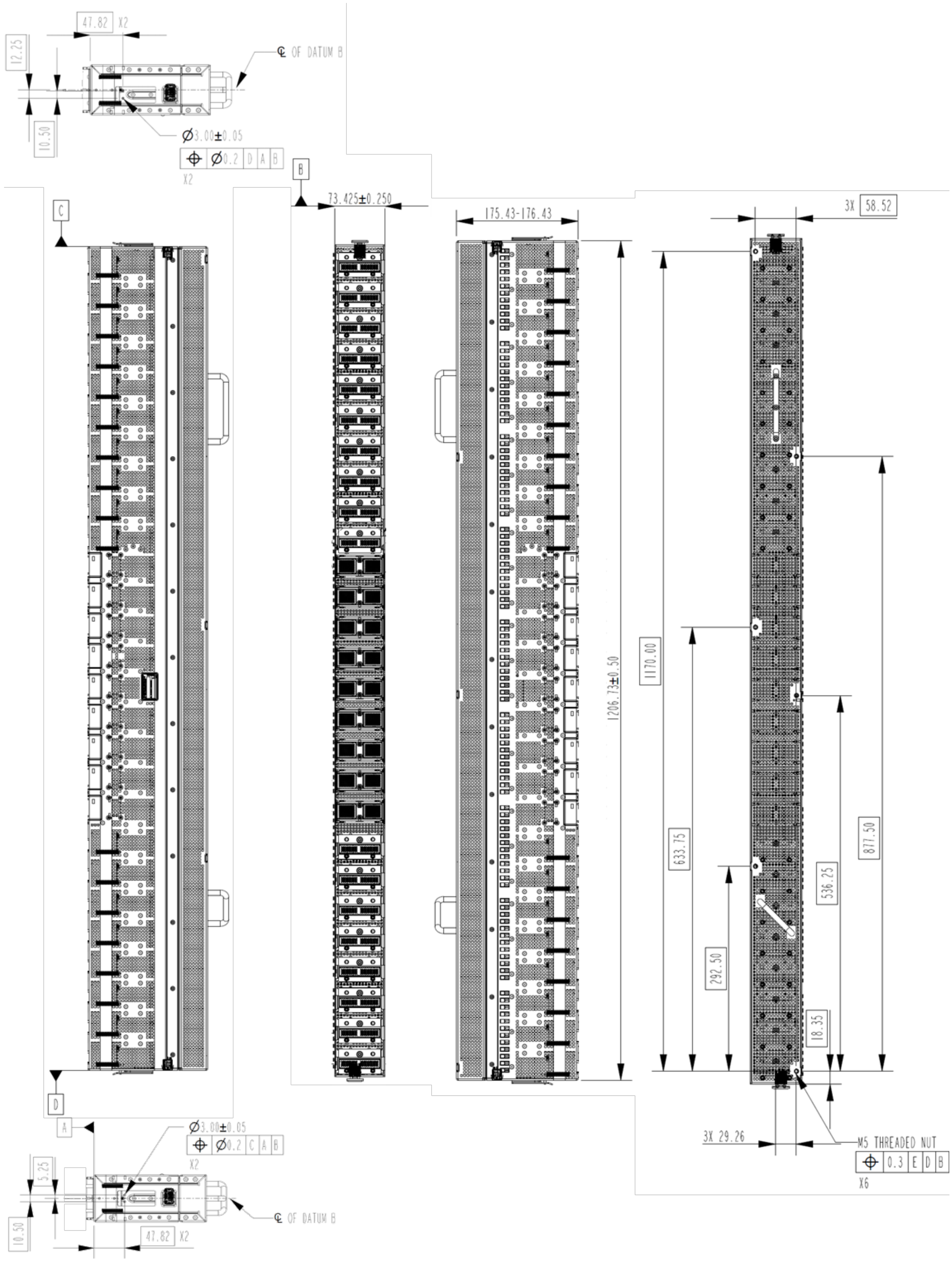

47.82 X2
12.25
10.50
℄ OF DATUM B
Ø3.00±0.05
Ø0.2 D A B
X2
B
C
73.425±0.250
175.43-176.43
3X 58.52
1206.73±0.50
1170.00
633.75
292.50
536.25
877.50
18.35
D
A
Ø3.00±0.05
Ø0.2 C A B
X2
5.25
10.50
47.82 X2
℄ OF DATUM B
3X 29.26
M5 THREADED NUT
0.3 E D B
X6

Figure 10-6. Interconnect Cartridge Detailed Dimensions

10.2.2 Interconnect Cartridge Loading and Support

The following figures describe the cartridge mounting, loading and support structure.

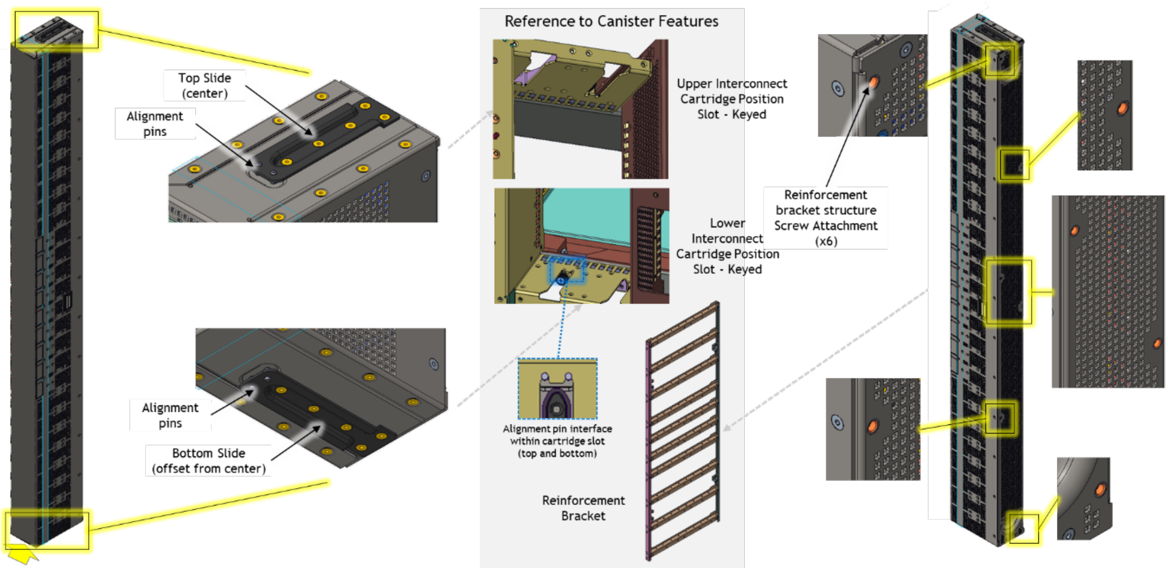


Figure 10-7. Cartridge loading and support overview

	UQDB	Interconnect	Interconnect	Busbar Power	Interconnect	Interconnect	UQDB
Mating (Ma.x)	35.0	56.1	56.1	22.5	56.1	56.1	35.0
Mating (Typ.)	22.5	44.8	44.8	22.5	44.8	44.8	22.5
Un-Mating (Min.)	~18	14.1	14.1	2.7	14.1	14.1	~18

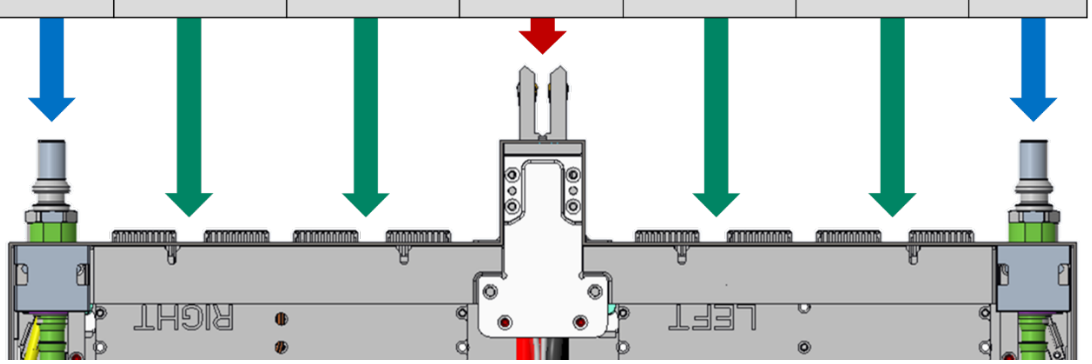


Figure 10-8. Switch tray interface loading (lbs.)

	UQDB	Interconnect	Interconnect	Busbar Power	Interconnect	Interconnect	UQDB
Mating (Ma.x)	35.0	38.7	38.7	22.5	38.7	38.7	35.0
Mating (Typ.)	22.5	26.8	26.8	<22.5>	26.8	26.8	22.5
Un-Mating (Min.)	~18	6.7	6.7	2.7	6.7	6.7	~18

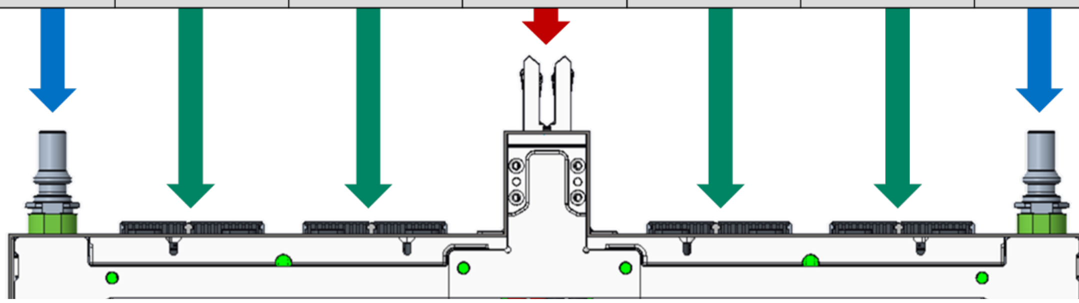


Figure 10-9. Compute Tray Loading (lbs.)

10.2.3 Key Bracket and Support 2D

The following drawings detail the critical to function dimensions and tolerances of the key support and alignment components of the rack for the manifolds and interconnect cartridges. Refer to the 3D CAD for additional details not specified.

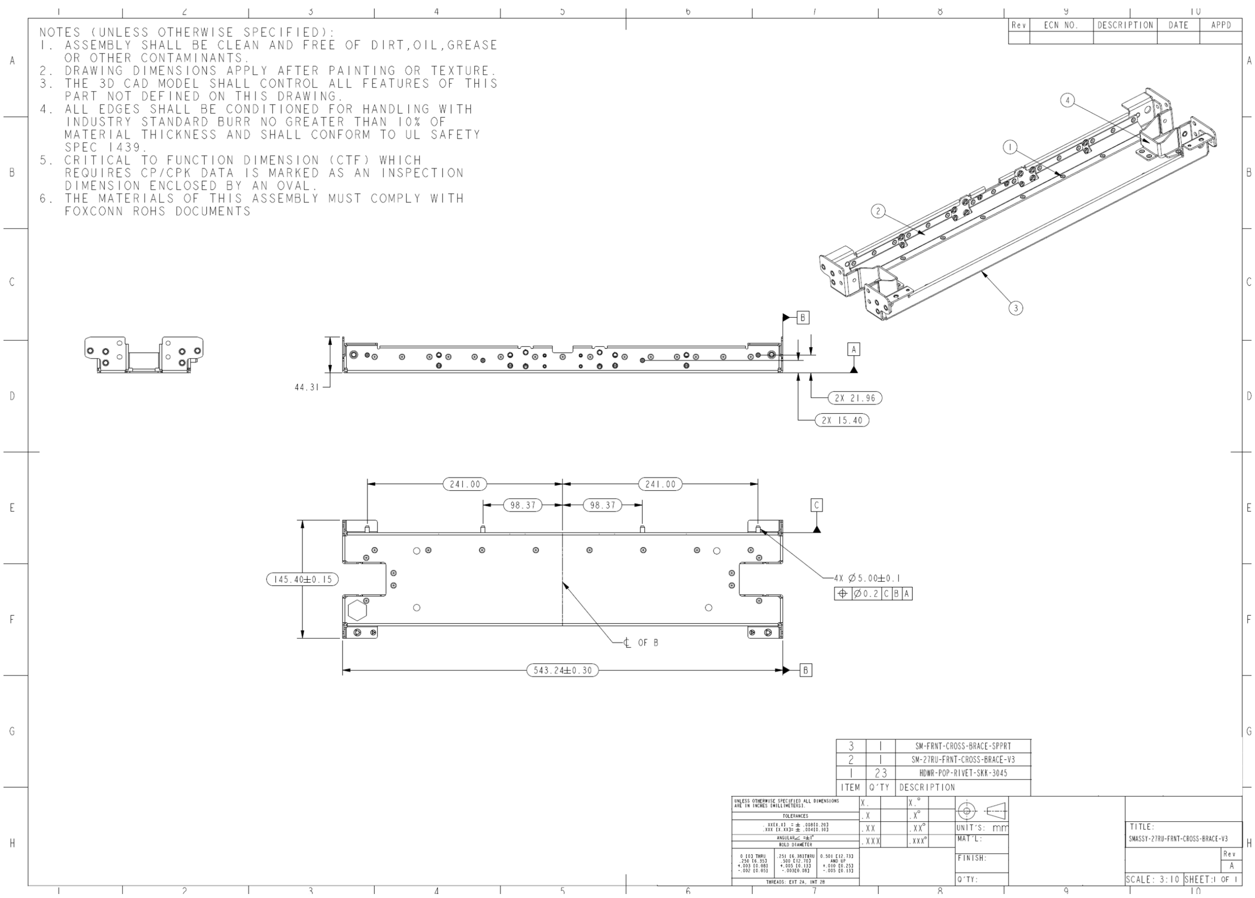


Figure 10-10. Rack Stiffener Drawing

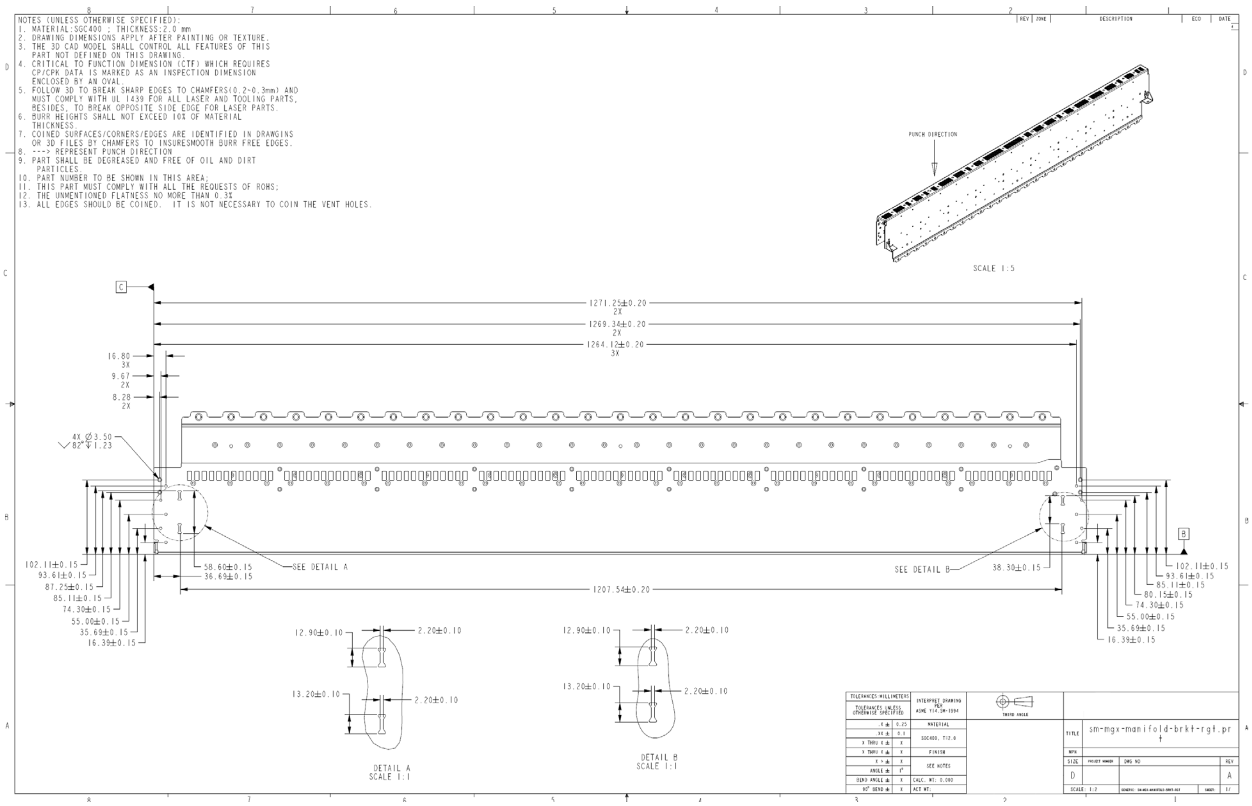


Figure 10-11. Right bracket channel drawing 1

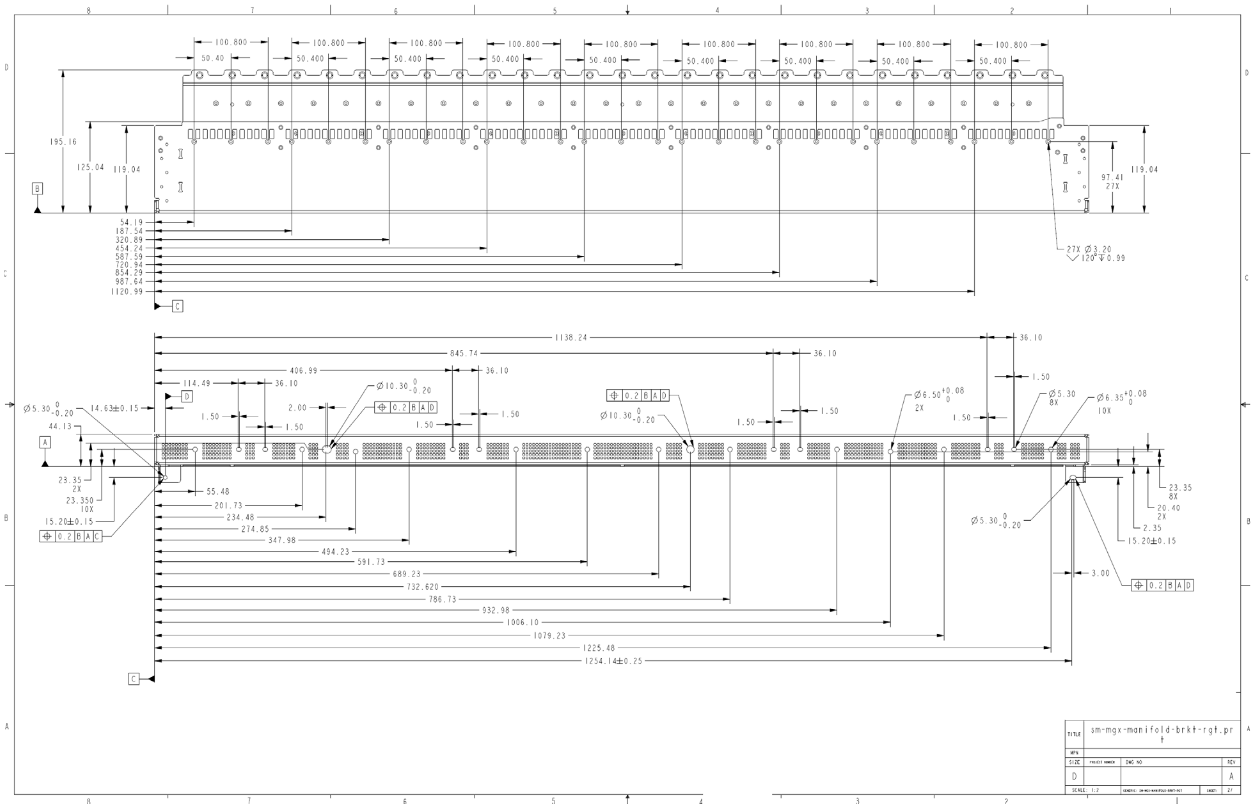


Figure 10-12. Right channel bracket drawing 2

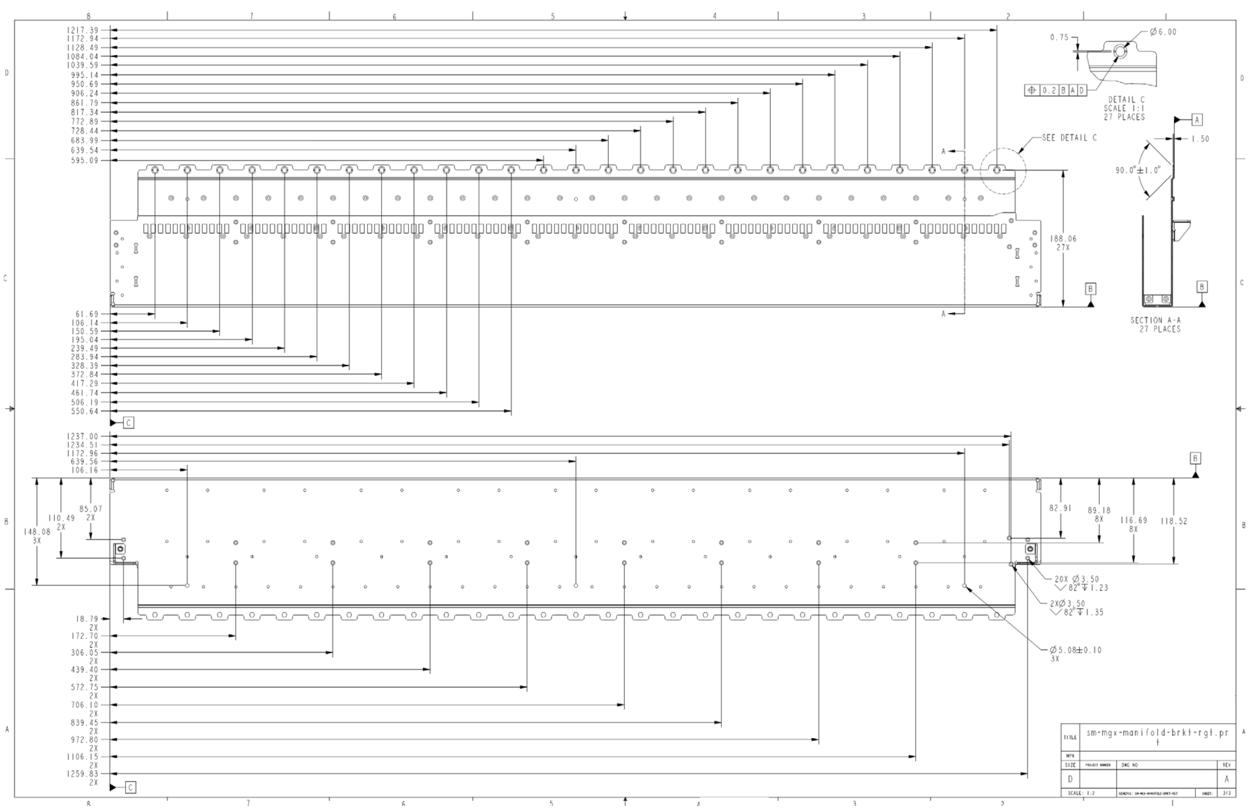


Figure 10-13. Right channel bracket drawing 3

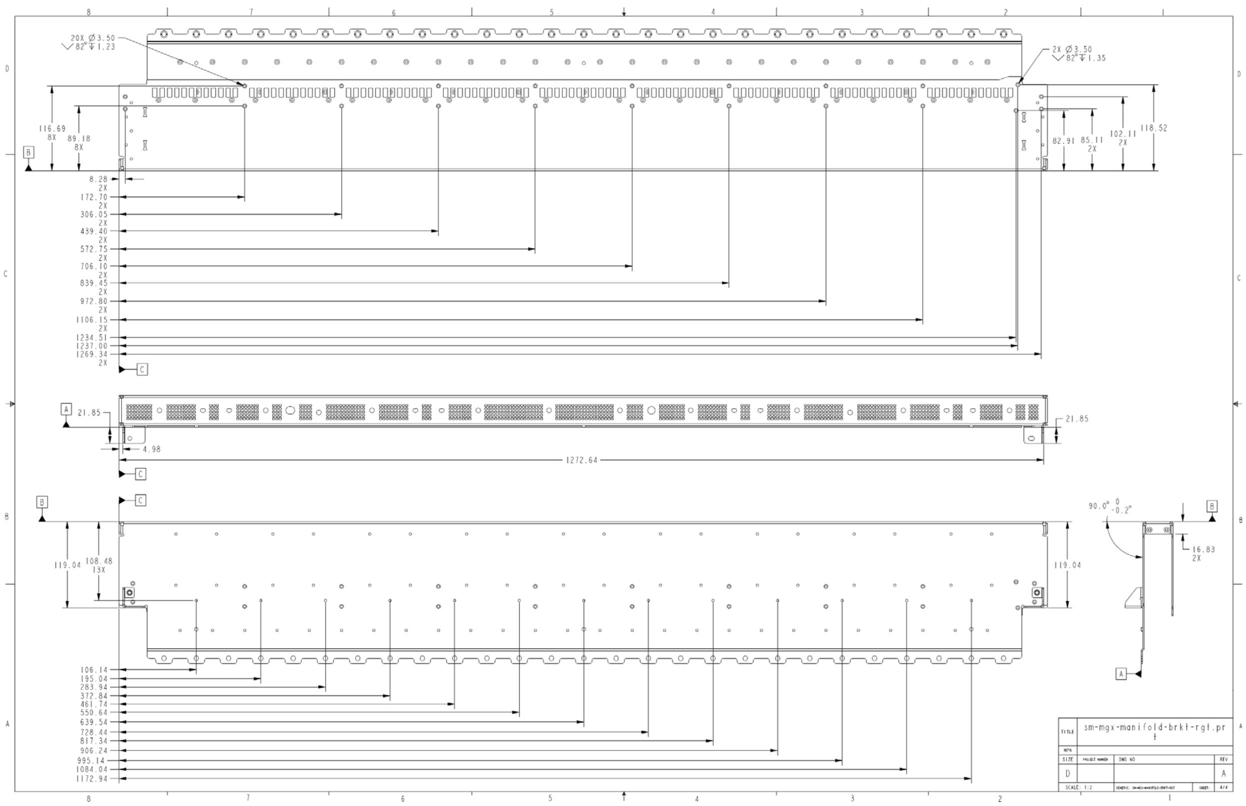


Figure 10-14. Right channel bracket drawing 4

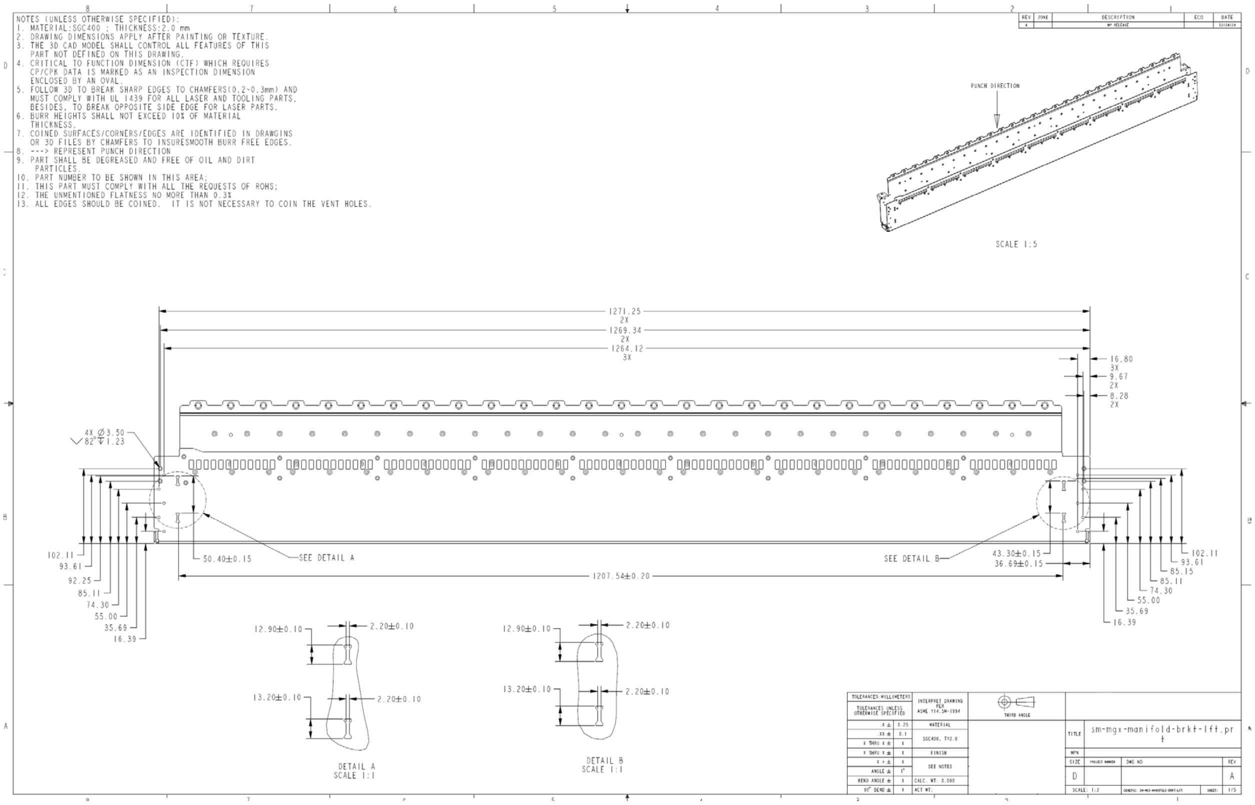


Figure 10-15. Left channel bracket drawing 1

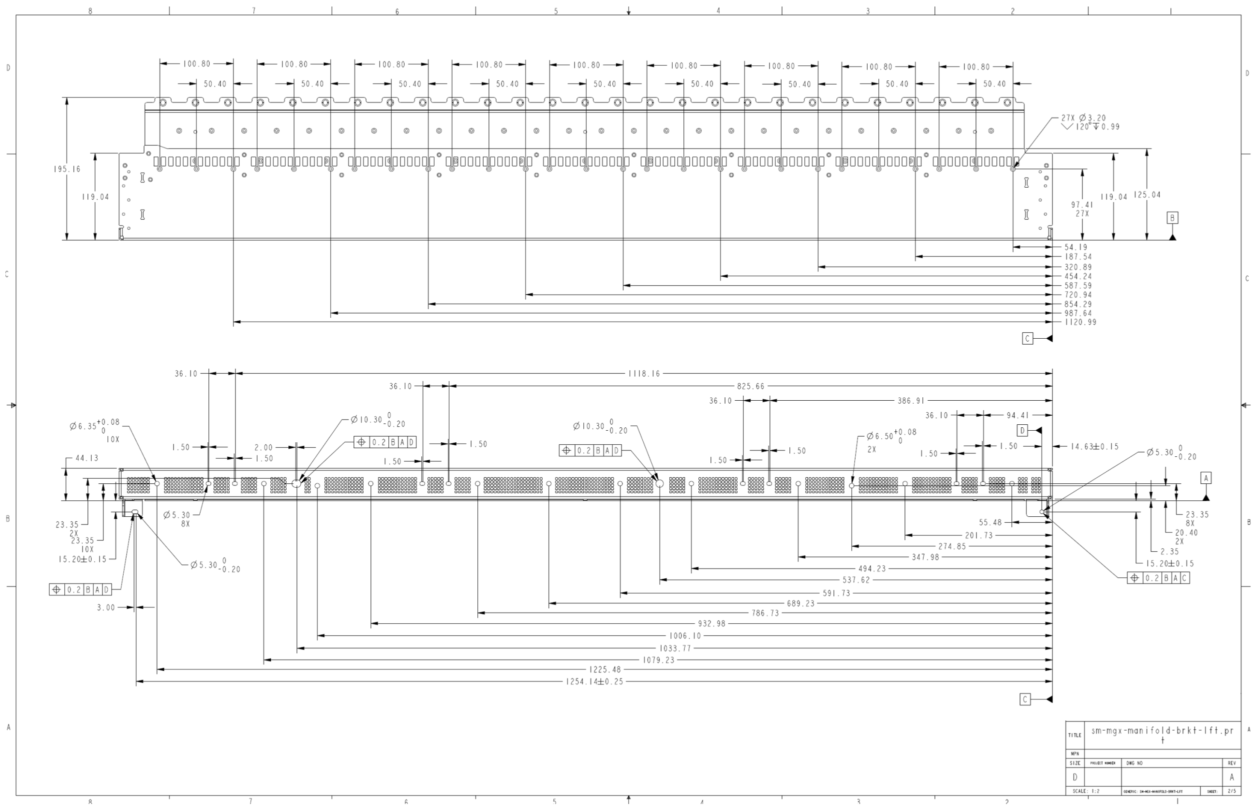


Figure 10-16. Left channel bracket drawing 2

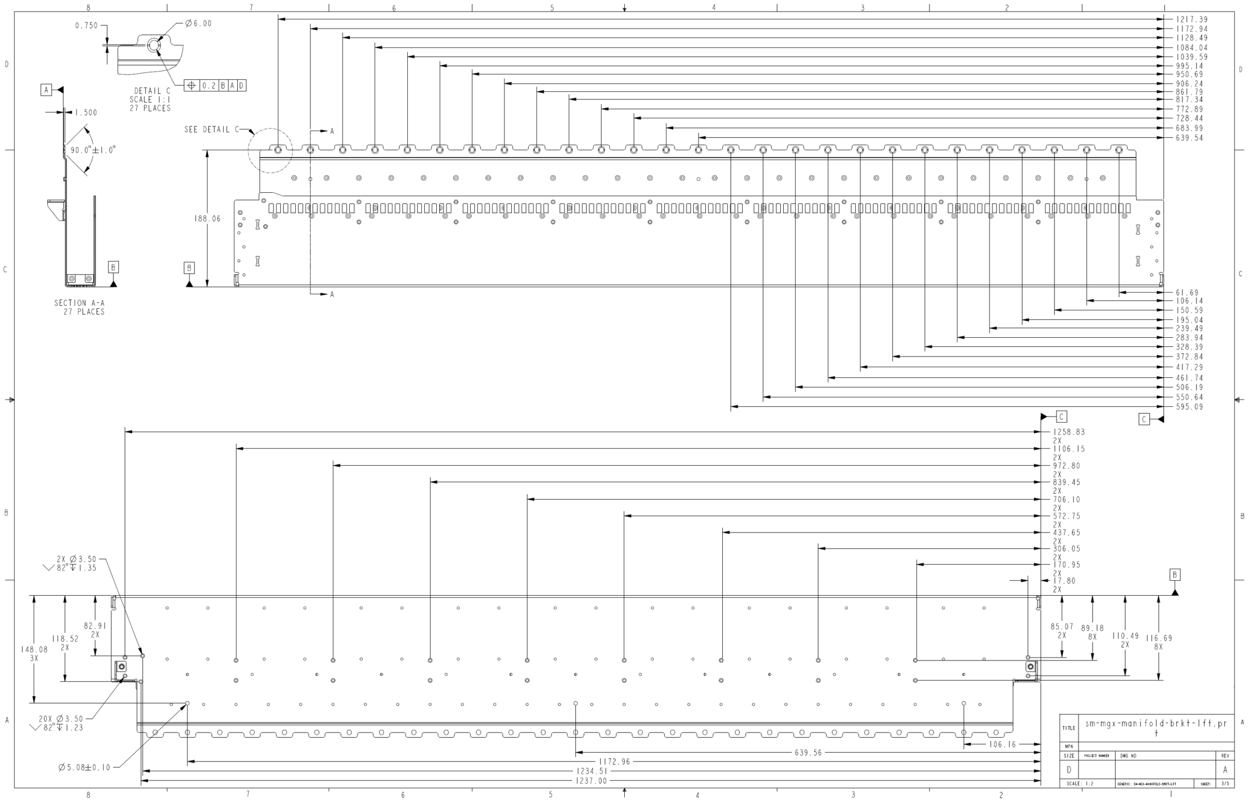


Figure 10-17. Left channel bracket drawing 3

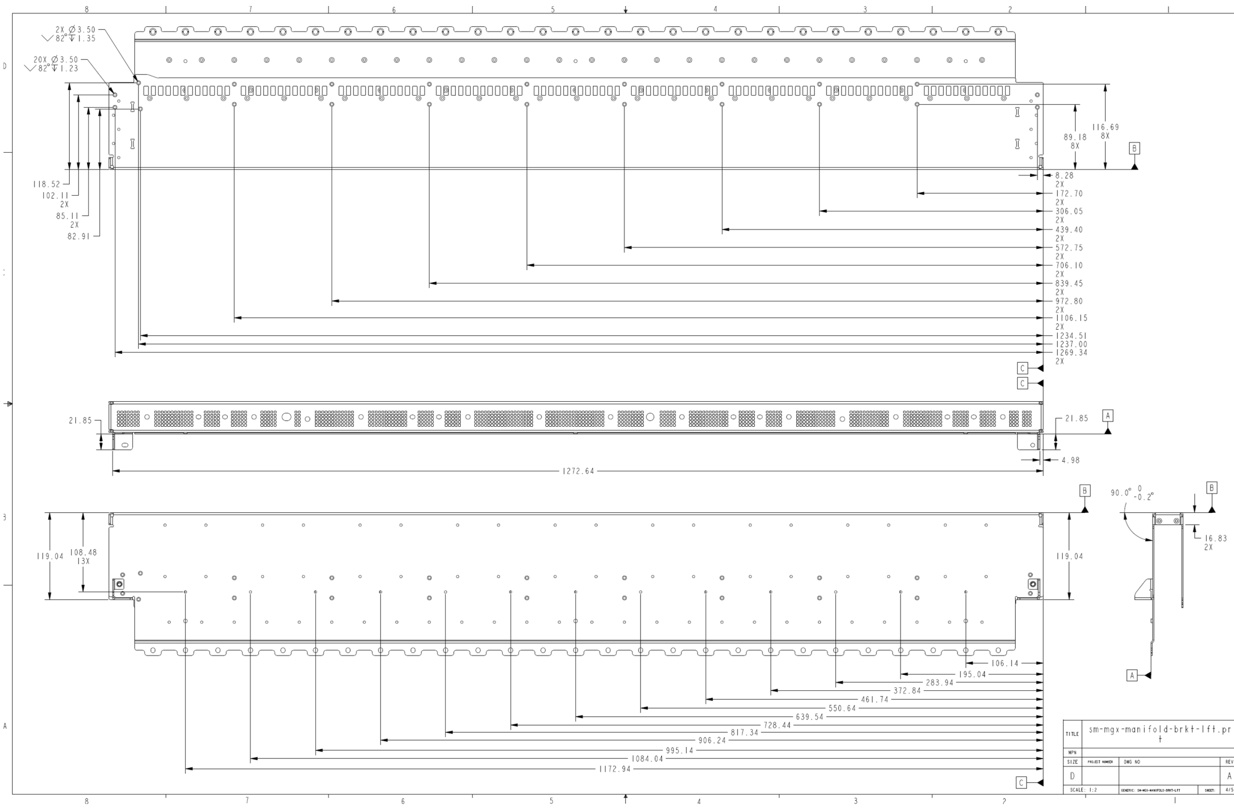


Figure 10-18. Left channel bracket drawing 4

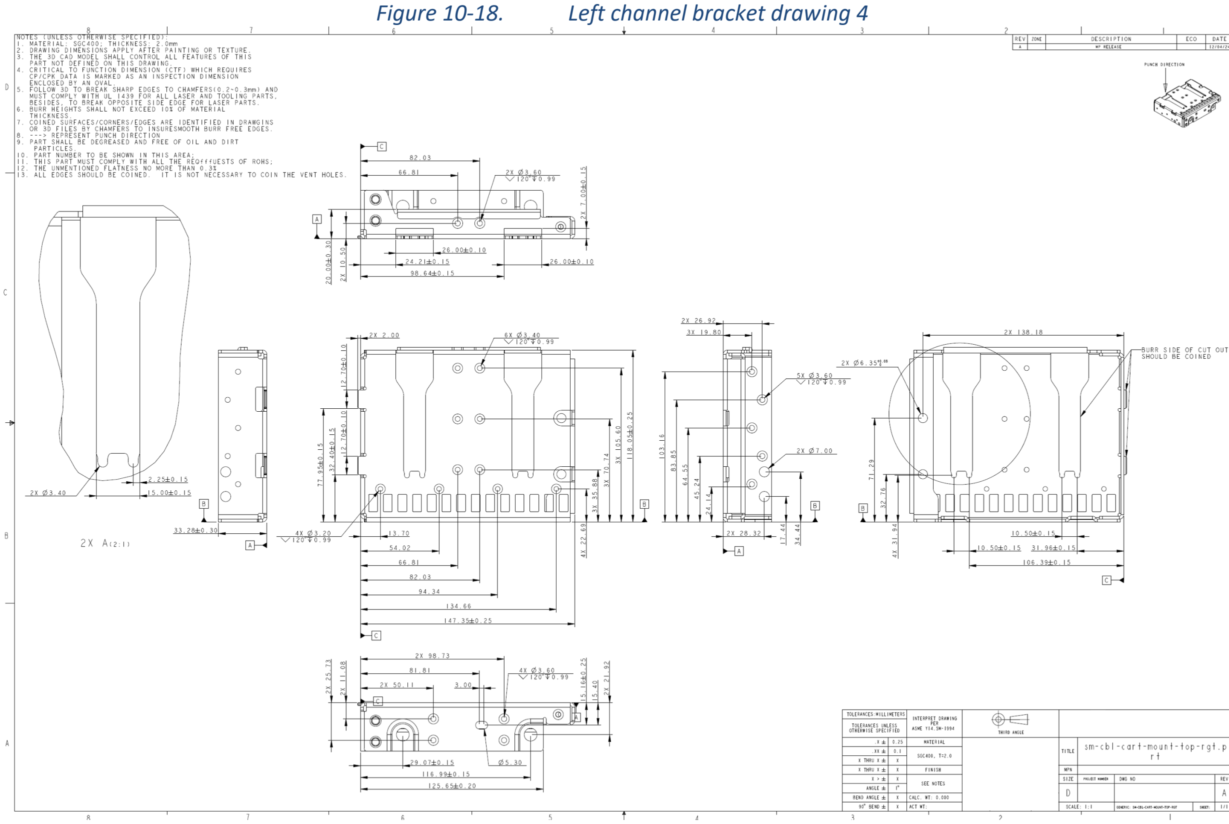


Figure 10-19. Cable Cartridge Rack Mount Top Right

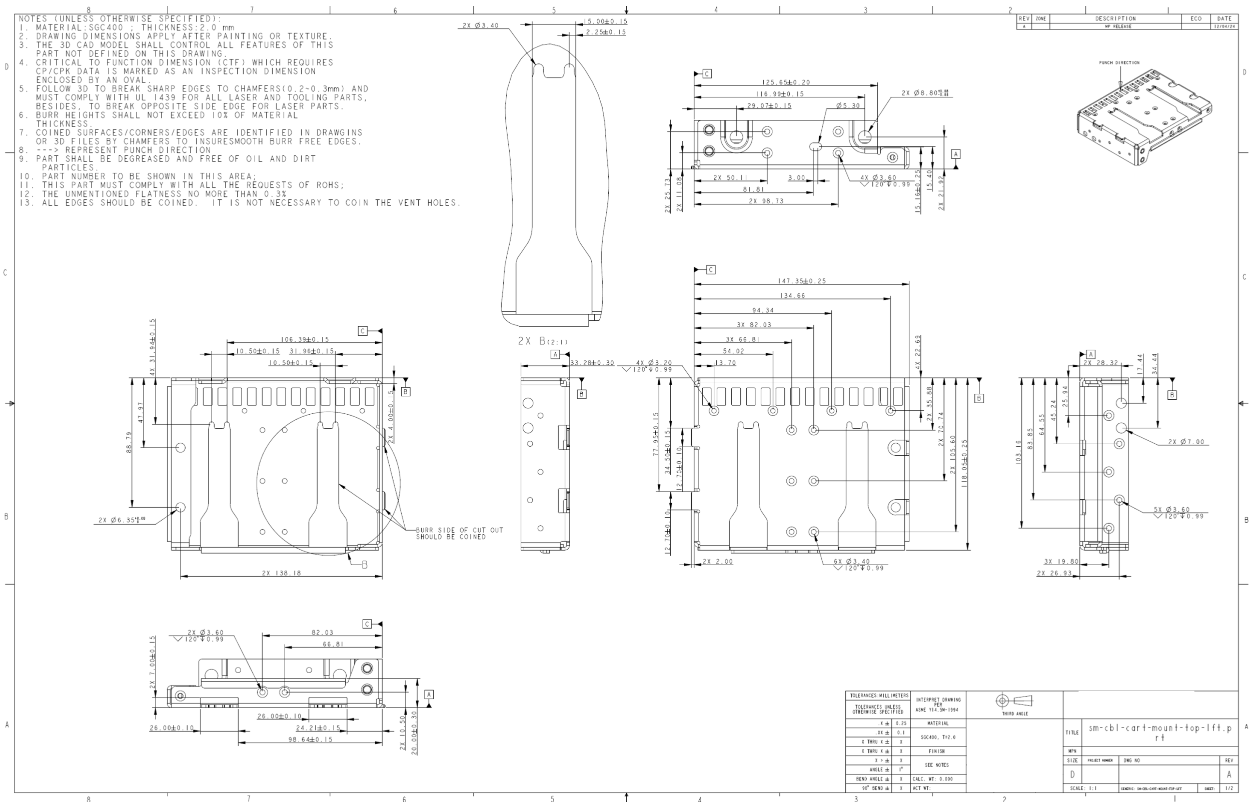


Figure 10-20. Cable Cartridge Rack Mount Top Left

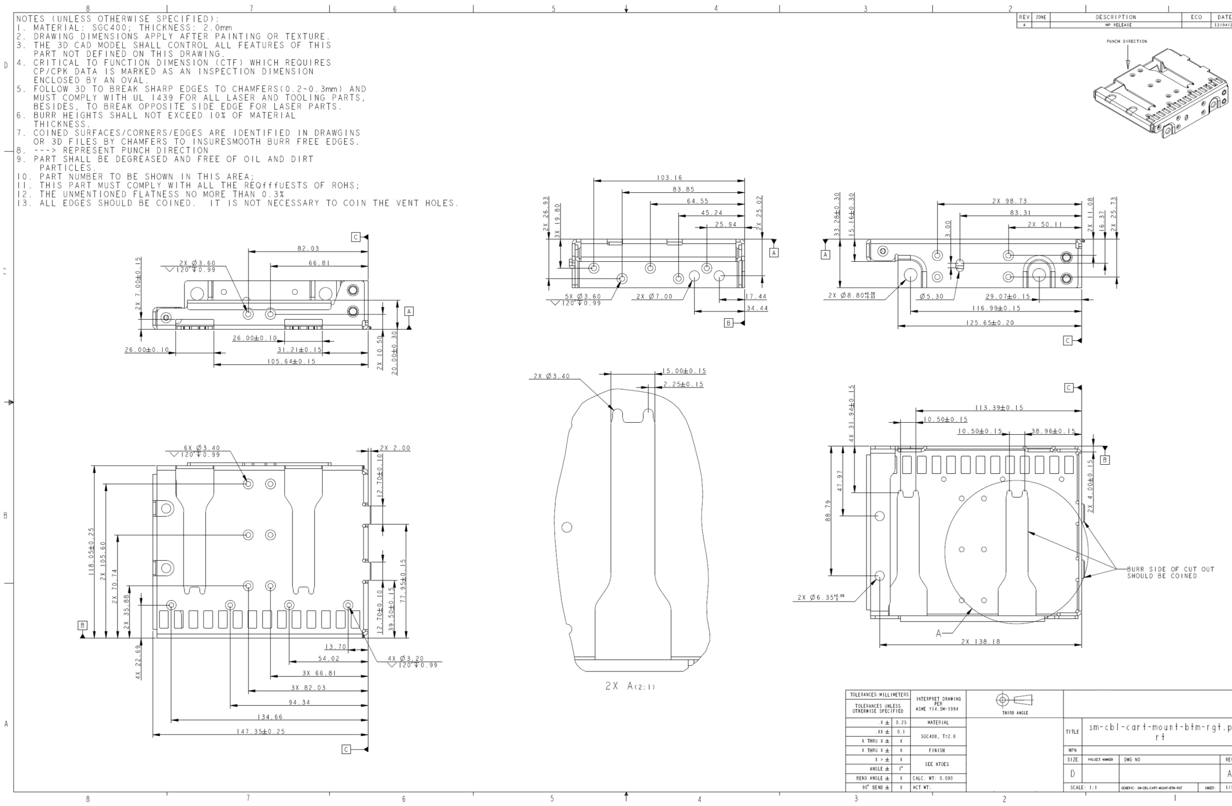


Figure 10-21. Cable Cartridge Rack Mount Bottom Right

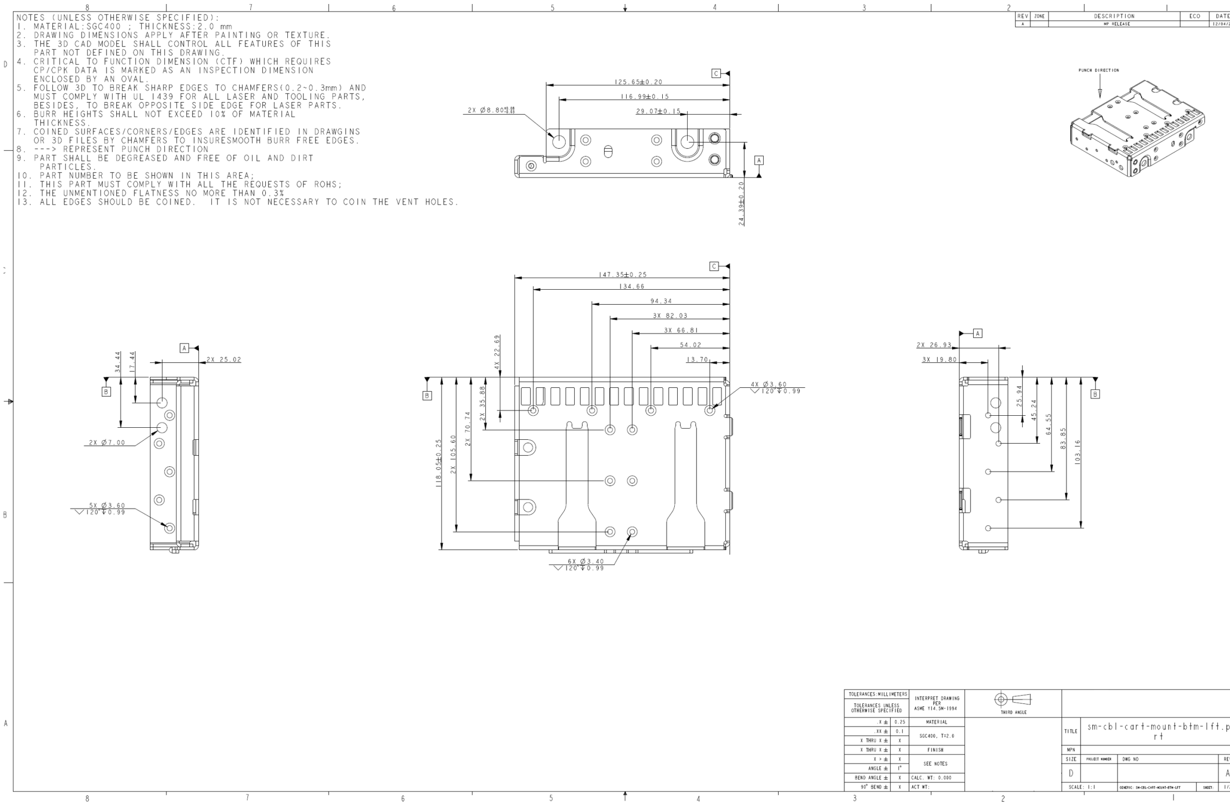


Figure 10-22. Cable Cartridge Rack Mount Bottom Left

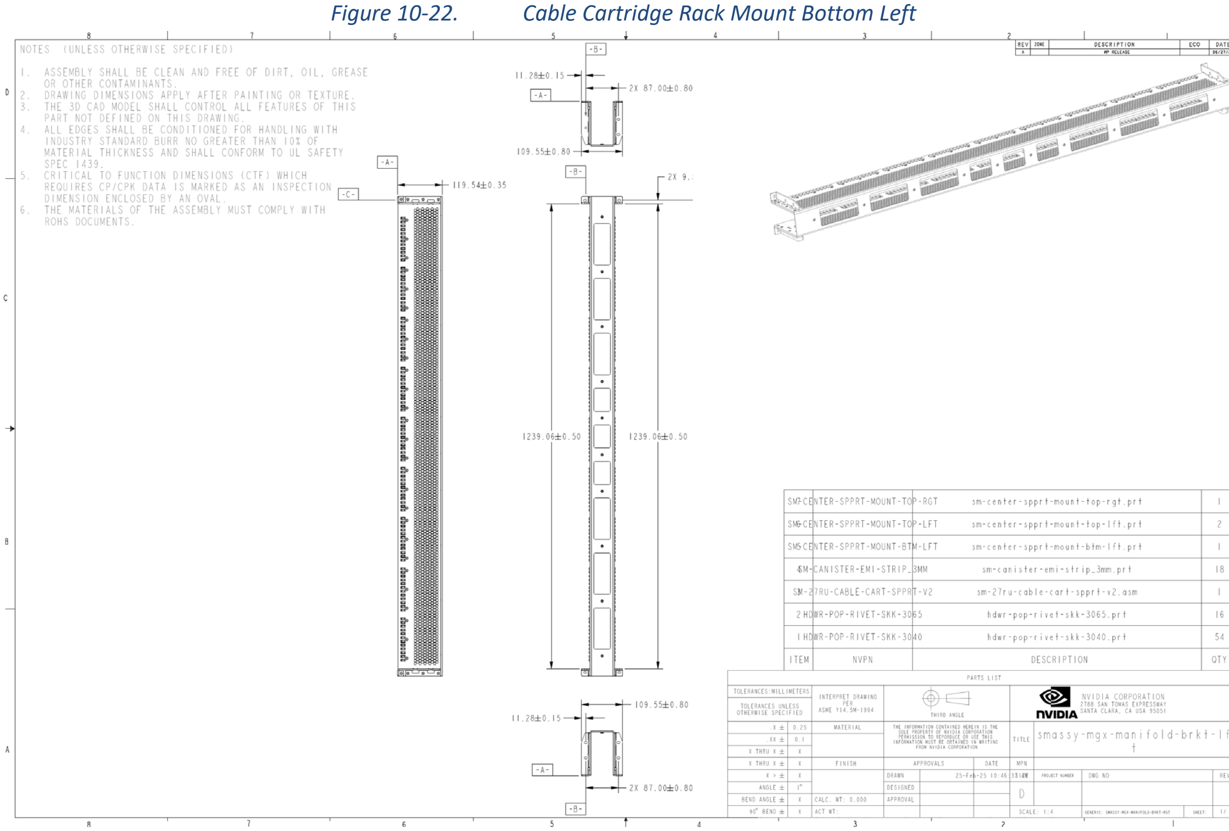


Figure 10-23. Rear Rack Brace Center Assembly

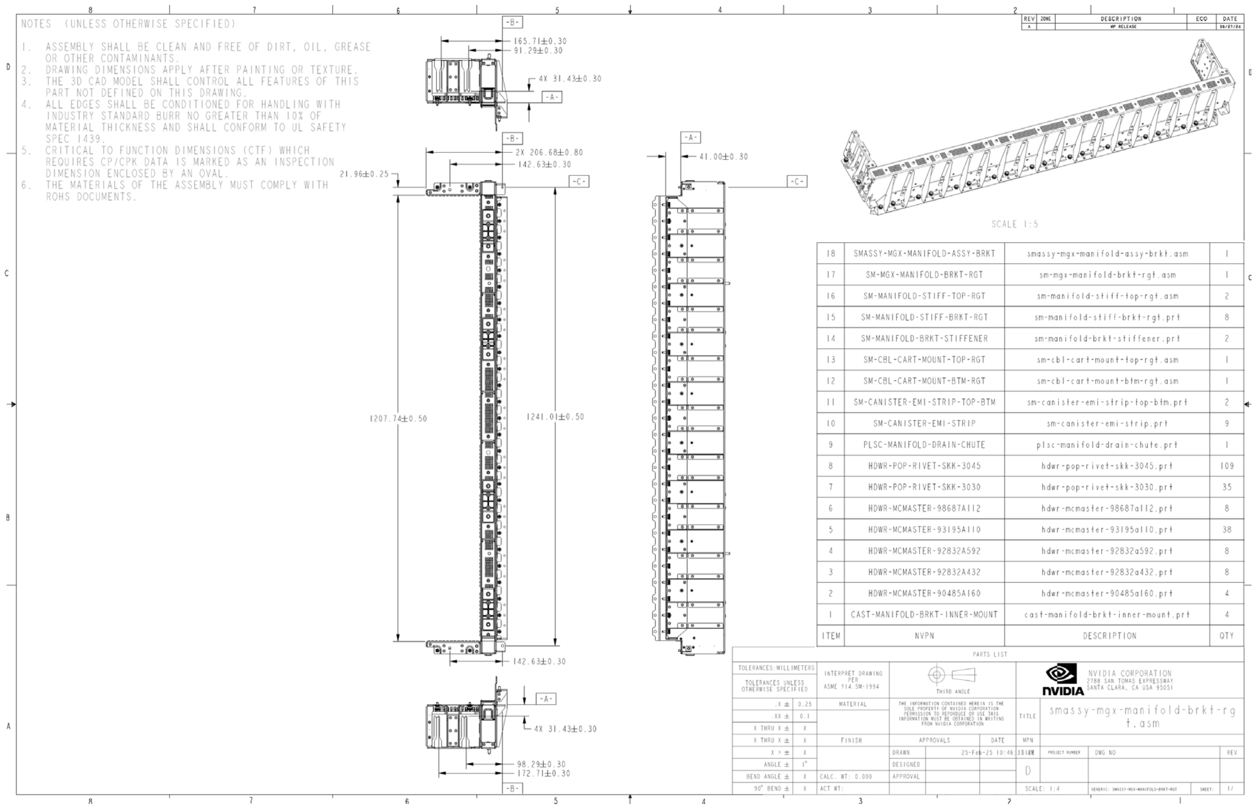


Figure 10-24. Rear Rack Brace Right Assembly

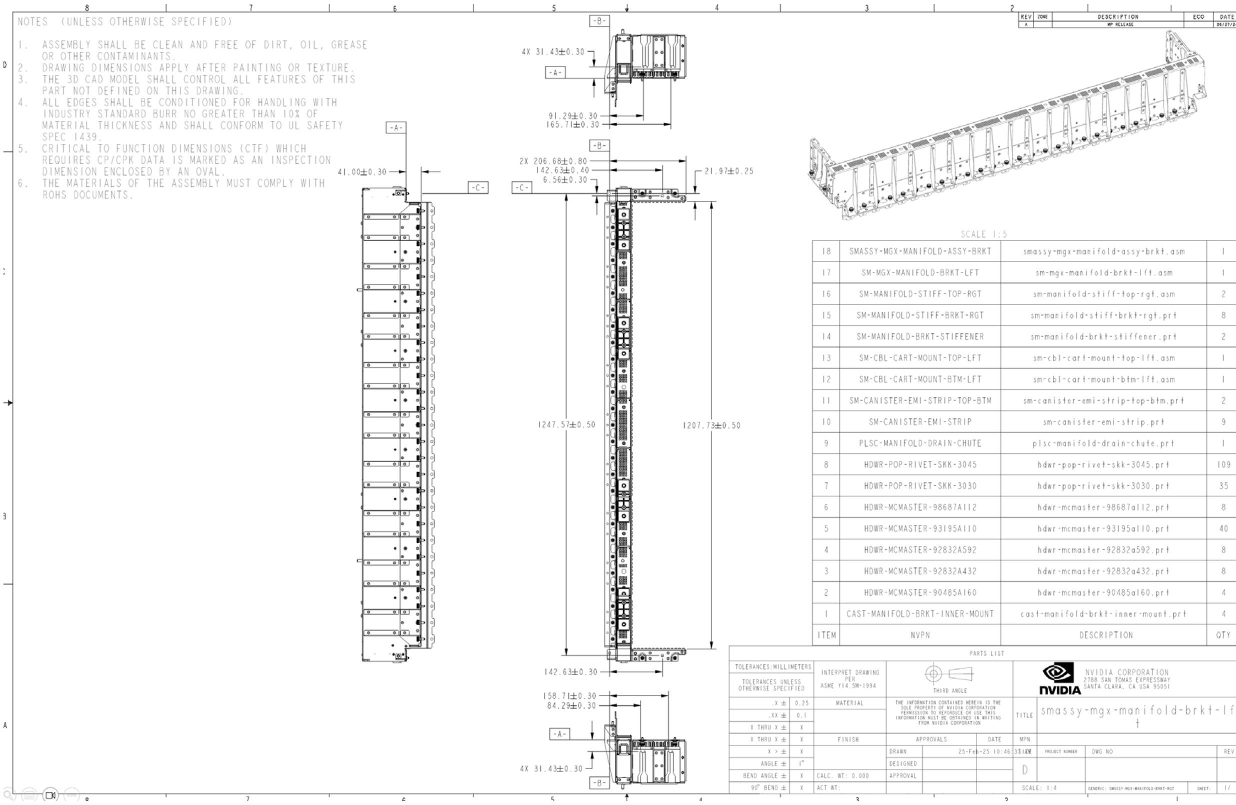


Figure 10-25. Rear Rack Brace Left Assembly

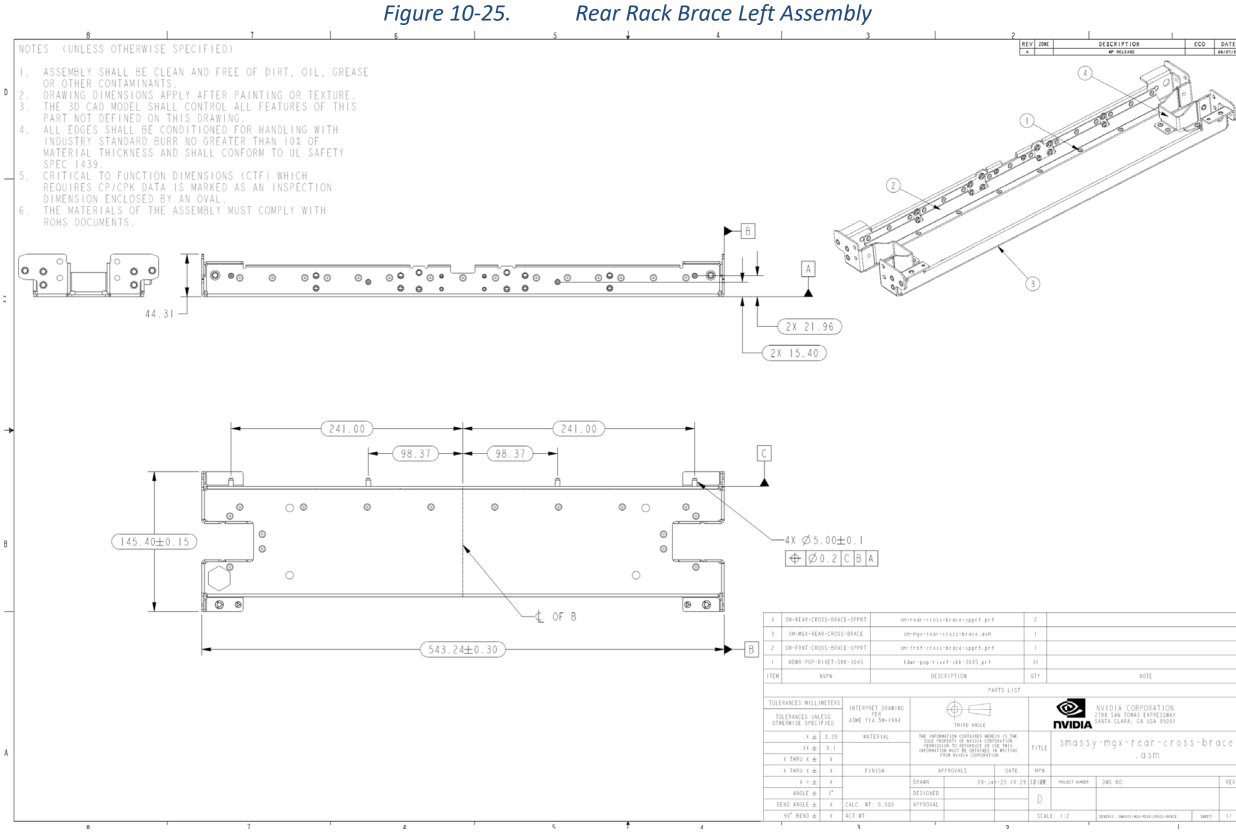
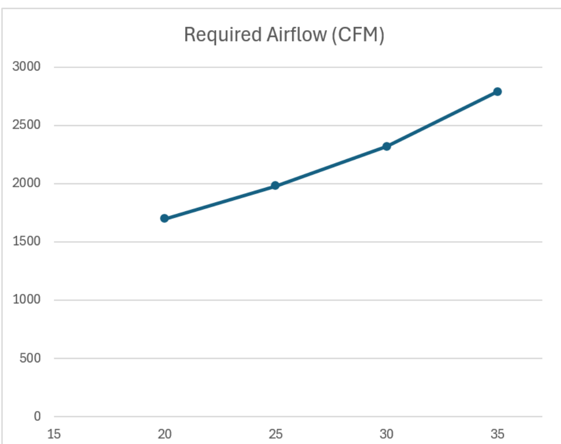


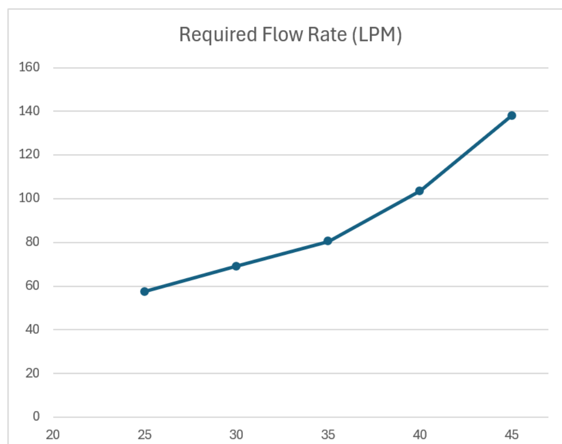
Figure 10-26. Rear Rack Cross Brace Assembly

11. Rack and Tray Thermal Requirements

The following section specifies the requirements for air and liquid cooling of individual trays and rack assembly.

Rack Level Requirements for Liquid Cooling	
System Target Sustained Flow Rate (lpm)	up to 130 LPM
Differential Pressure of Node at Target Flow Rate, 1x mated UQD pair	~10 psid
Rack Power	120 kW
Rack Level Liquid Heat Capture Ratio	85%
Max Operating Pressure (gauge)	5 bar (72 psig)
Min Burst Pressure (gauge)	15 bar (217 psig)
Filtration	25um and 50um





Inlet Air Temperature (°C)	Require Airflow (CFM)
20	1700
25	1980
30	2320
35	2790

Inlet Temperature (°C)	Maximum Required Liquid Flow (LPM/kW)	Total Flow Rate (LPM)
25	0.5	57.5
30	0.6	69
35	0.7	80.5
40	0.9	103.5
45	1.2	138

12. Prescribed Materials

The system must meet all local laws and regulations for material content such as ROHS. Refer to the table below for approved wetted materials for the liquid cooling loop.

Approved Wetted Materials List for PG/water-based fluids	
Metals	Notes
Brass with ,15% zinc content	
Copper	CDA110, CDA1020, CDA1220, CDA110
High Nickel Alloys	
Steels - Stainless	Most common SS alloys acceptable, including 410, 204L, 316L or higher grades
Titanium Grade 2 (UNS R50400)	
Plastics and Rubbers	Notes
EPDM	Peroxide Cured required for hoses
FEP	
HDPE - High Density Polyethylene	
PEEK	
PP - Polypropylene	
Viton A	
Viton ETP	
Viton GF	
Sealants and Lubricants	Notes
Parker Super O Lube	
Staubli G11	
Loctite 567	Not required in manifold or QDs as all fittings are BSPP or SAE with O-ring. May be used if needed on tapered fittings in secondary loops, CDUs, etc.
Brazing Materials	Notes
BCuP-2: Cu93/P7	
BCuP-3: Cu89/Ag5/P6/Other0.15	
BCuP-4: Cu87/Ag6/P7	
BCuP-5: Cu80/Ag15/P6	
B-Ni-6: Ni88.9/P11	
TF-H600F: Cu74.9/Sn15.6/P5.3/N4.2	
Materials to Avoid	Notes
Aluminum	
ABS	
CR	
CPVC	
Hastelloy B	
Lead	
Non-stainless steels	
PVC	
Zinc	

13. References

1. "Open Rack V3 Base Specification", OCP,Link: Open Rack V3 Base Specification, URL: https://drive.google.com/file/d/1-8JbXI10MwaVs8pctSAsa5It5czUyKff/view
2. "Open Rack Busbar Specification", OCP, Link: Open Rack Busbar Specification, URL: https://www.opencompute.org/contributions?refinementList%5Bproject%5D%5B0%5D=Rack%20%26%20Power&refinementList%5Bfamily%5D%5B0%5D=OpenRack%20v2&refinementList%5Bcontributor%5D%5B0%5D=RITTAL&page=1&configure%5BfacetFilters%5D%5B0%5D=archived%3Afalse
3. "Universal Quick Disconnect Blind-Mate (UQDB) Specification", OCP, Link: Universal Quick Disconnect Blind-Mate Specification, URL: https://www.opencompute.org/documents/uqdb-spec-1-0-pdf
4. "Universal Quick Disconnect (UQD) Specification", OCP, Link: Universal Quick Disconnect (UQD) Specification. URL: https://www.opencompute.org/documents/ocp-universal-quick-disconnect-uqd-specification-rev-1-0-2-pdf
5. "OCP DC-SCM Specification", OCP, OCP DC-SCM Rev 2.1 Ver1.1 RC3

Appendix A - Checklist for IC approval of this Specification (to be completed by contributor(s) of this Spec)

Complete all the checklist items in the table with links to the section where it is described in this spec or an external document .

Item	Status	Link to detailed explanation
Has this contribution been presented to an OCP Project group during a project call or engineering workshop?	Yes or No	If “No”, please state the reason.
Approval by Project Leads	Yes or No	If “No”, please state the reason.
Is this contribution entered into the OCP Contribution Portal?	Yes or No	If “No”, please state the reason.
Was it approved in the OCP Contribution Portal?	Yes or No	If “No”, please state the reason.