Open Cassette Specification

V1.0

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1. License (OCP CLA Option)

2. Scope & Overview

Scope:

This document defines the technical specifications for the Open Cassette used in Open Compute Project Open cassettes for any project which requires a flexible chassis solution in single phase open bath solutions.

Overview:

The open cassette specification defines a generic housing method for IT hardware where flexibility and usability in multiple cooling solutions is the focus. This cassette specification allows standardization of the IT housing so the interfaces with the rack or tank for placement can be standardized. This includes standardized options for cooling.

This chassis has been developed for single-phase immersion. It might be suited for also two-phase immersion, but that still needs to be evaluated.

3. Features

3.1 Placement interface

The cassette features a squared outline that allows it to be fitted into corresponding racks in mounting systems both vertical and horizontal. To assist with easy vertical placement, the cassettes have two optional guiding tabs at the bottom. The cassettes have a maximum specified depth (see paragraph 5), ensuring they will not protrude from their allotted space within the mounting system and thus collide with other cassette units or the guidance mechanism.

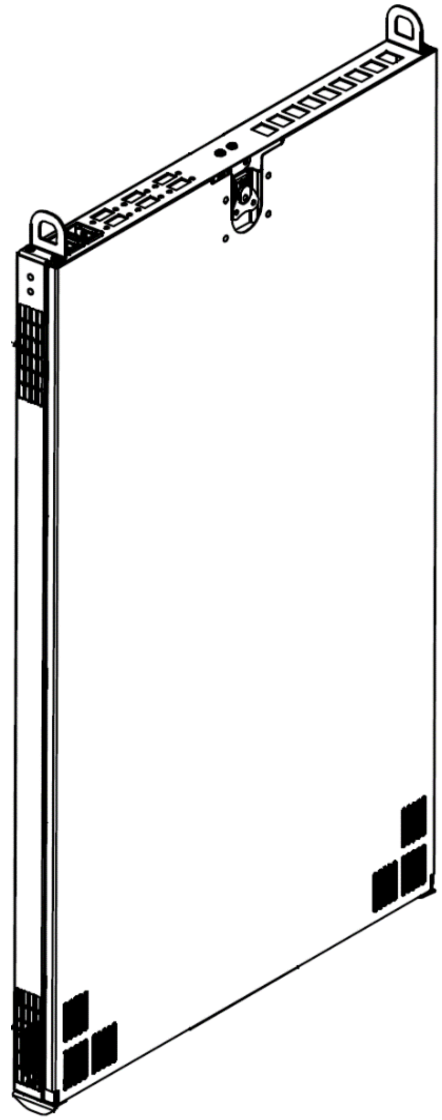
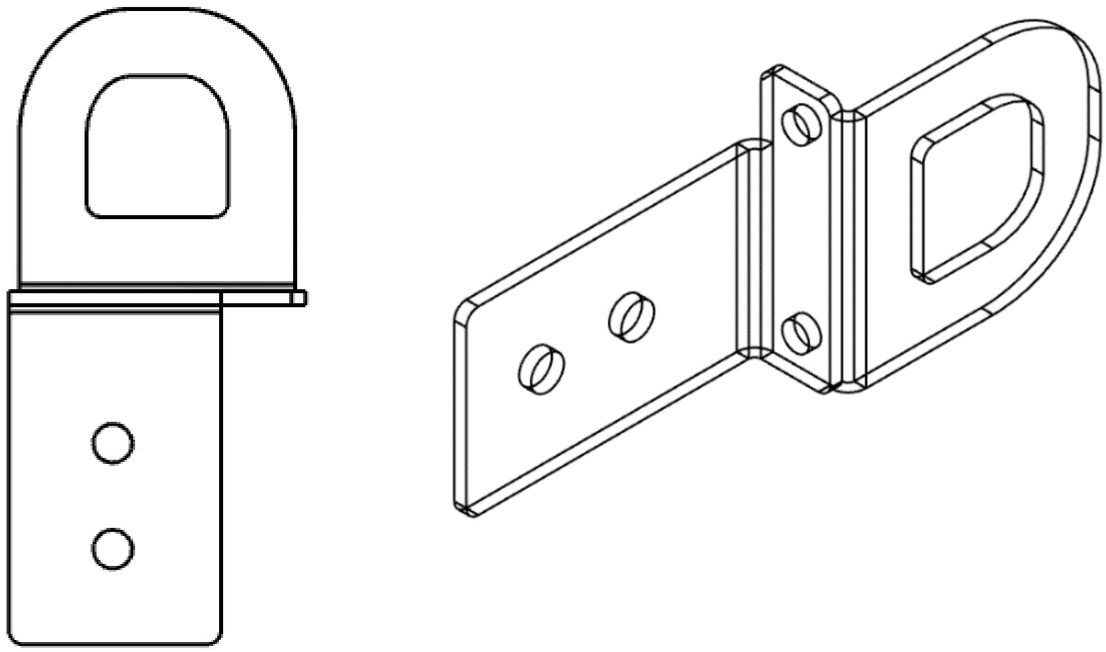


Figure 1 – Overview of the cassette

3.2 Maneuvering

A vertical mounting system often has an accompanying aid which is used to hoist/lower cassettes into the system. Each cassette should be fitted with two lifting loops on the top surface. This is used by the aide as a lifting point (see Figure 2). This must be located on the central axis of the cassette to ensure it is accessible by the aide and allow for equal weight distribution. The lifting loops should be at a suitable height so that they protrude above the dielectric liquid. The lifting loops must be sufficiently strong and sturdily mounted to allow lifting and handling of the full weight of the cassette, including IT, by lifting aids and by hand.



3.3 Interface plates

The cassette design features a removable interface plate. These interface plates accommodate the connectors required by the IT hardware (power, ethernet etc.). By using modular interface plates, the provision of connectors can be changed without having to modify the entire cassette. **Error! Reference source not found.** shows an interface plate with connector mounting holes. Figure 1 shows the interface plate in situ.

Connectors should be situated above the level of the dielectric liquid to avoid issues with wicking and to allow dry handling of interface cabling. Cable positions need to allow clear runs without crossing cables to the relevant locations. For example, the power connector should always be on the closest position to the power distribution points.

The interface plate has connection points to the cassette and the lifting mechanisms on both of the outer sides. It also has allocated room in the center to allow for the closing mechanism and it provides additional support. This leaves the rest of the surface area open and flexible for interface connectors.

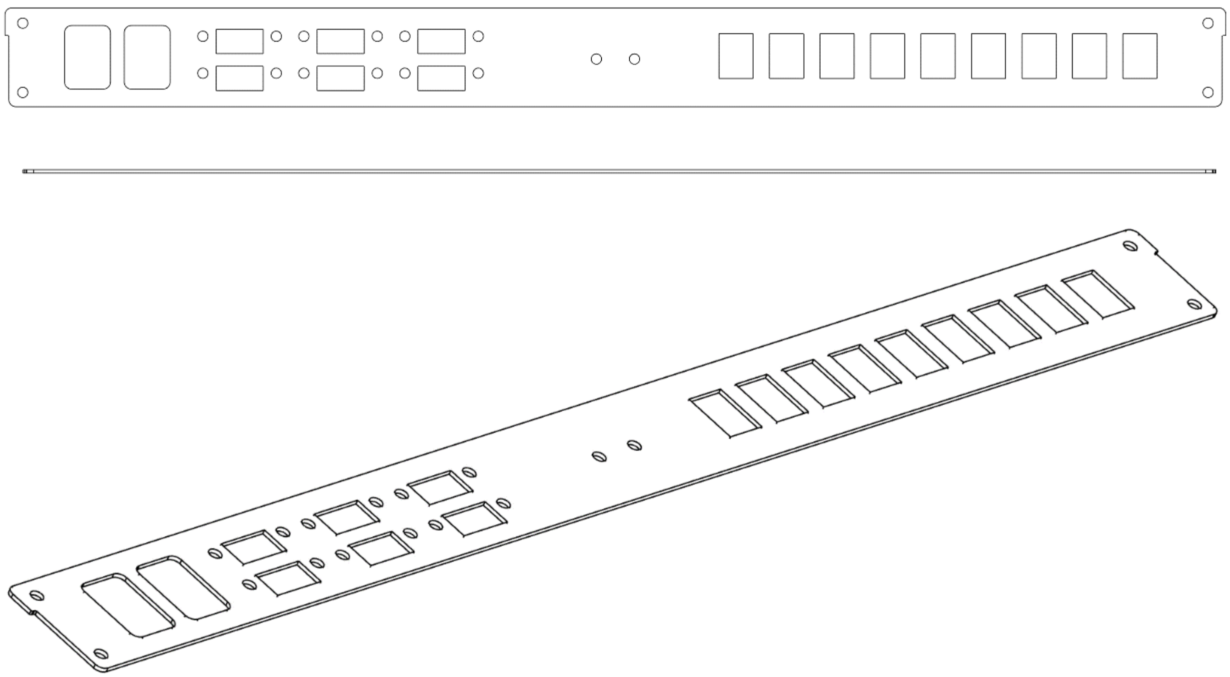


Figure 3 - Interface plate with custom connector hole pattern

3.4 Apertures

The cassette is able to facilitate the flow of both dielectric liquid and air, either one of these being necessary to transport heat from the IT equipment. For optimal convection based liquid flow there are apertures at the top and bottom sides of the cassette. Additionally, apertures at the bottom and in the side plane of the cassette are available for extra inflow and balancing within a single tank.

For forced air and liquid flow, the bottom apertures act as inflow openings and the top side apertures act as outflow of air.

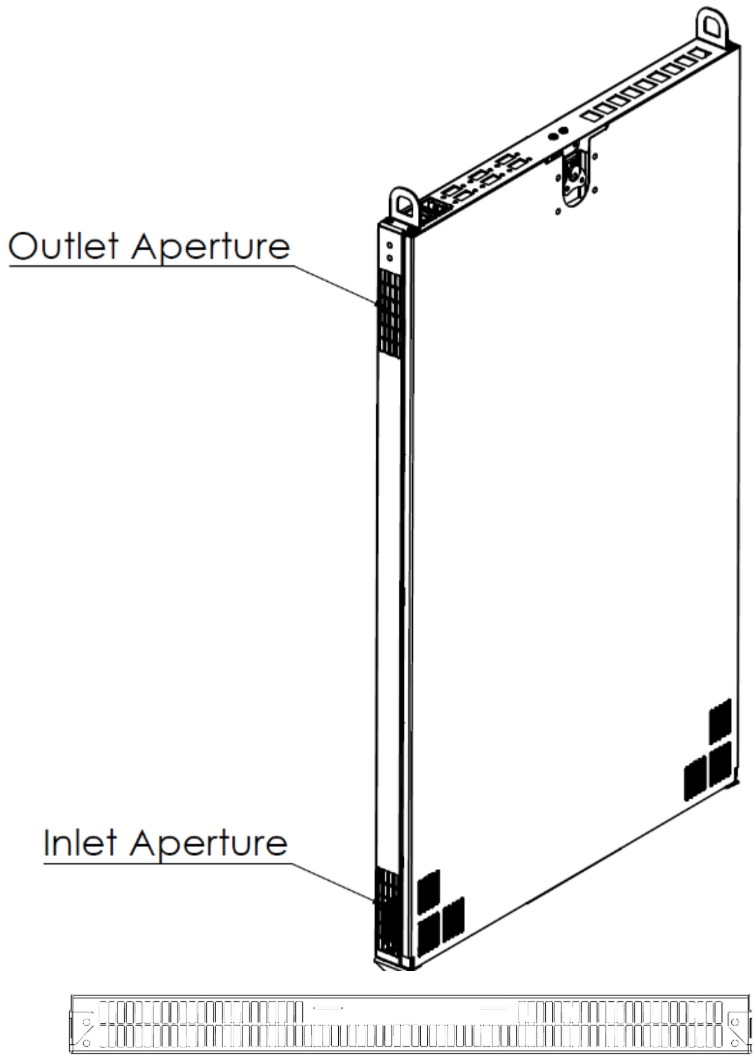


Figure 4 - Inlet and outlet apertures, isometric and bottom view

No IT hardware should be exposed by the apertures. There should be cut-outs on the side and bottom to align with the apertures on the front/back of the cassette. The purpose of these apertures is to optimize horizontal levelling of cooled dielectric liquid.

Ideally, all cassettes in a module should have the same design of front/back apertures. If the cassettes in a system have different inlet designs, then at least three cassettes with the same design of aperture should be used side by side. This ensures proper liquid balancing in a natural convection environment. This balancing ensures even temperature spread even if the load is not spread evenly.

The outlet aperture should be placed at the top of the side wall of the cassette. This must be open to 10mm below the minimum liquid level to facilitate flow.

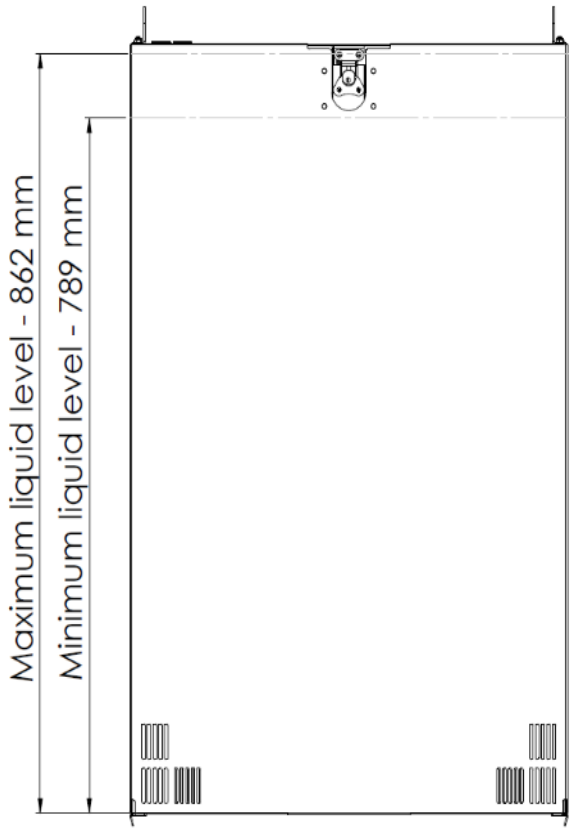


Figure 5 - Maximum and minimum liquid levels, relative to cassette

Note: The optimal shape, size and exact locations of any apertures may differ with respect to the immersion style, immersion vendor technology and/or IT design. The shown images are examples only.

4. Construction

4.1 Material

The cassette has been designed to be constructed from 304 stainless steel sheet. However, this does not preclude the use of other materials. Any materials used for cassette construction should meet the following conditions:

- Must work in a temperature range of 10 – 100°C without excessive change in dimensions or physical characteristics;
- Must not be compromised by the dielectric liquid;
- Must not contaminate the dielectric liquid;
- Must be rigid enough to support the IT components;
- Must be able to protect IT components from damage (physical damage, electrical damage e.g. short circuit etc.);
- Must have an electrochemical potential difference of NO MORE than 0.15V with 304 stainless steel for at least the outside bounds in contact with the cassette guidance.

4.2 Isolation

With a conducting cassette body, electrical isolation is required to ensure a short circuit of the IT equipment does not occur. The material used for isolation purposes should also meet the criteria listed in section 4.1.

5. Dimensions

5.1 Guidance frame

Any tank system has a rack into which the cassettes must fit. The dimensions of the channel available to the cassette are shown in Table 1. These dimensions do not take into consideration manufacturing tolerances hence, any cassette designed to fit in the tank should be smaller than the dimensions shown. That is, these are the absolute maximum dimensions of the cassette cross section.

Table 1 – Channel dimensions

Dimension	**Value**
Width	540mm
Height (1U)	44.8mm
Height (OU)	49mm
Height (2U)	89.6mm

5.2 Cassette body

For the cassette to fit into the tank, the cassette body should not exceed the dimensions shown in Table 2. The height is specified to ensure the top of the unit protrudes above the level of the dielectric liquid. Options of the cassette size are available in 1U, 1OU and 2U as per table below. Other dimensions remain the same across the options.

Table 2 - Cassette body dimensions

Dimension	**Value**
General	
Length	872mm
Length (including lifting loops and guidance tabs)	912mm
Width	536mm
1U	
Height	44mm
1OU	
Height	47mm
2U	
Height	88mm

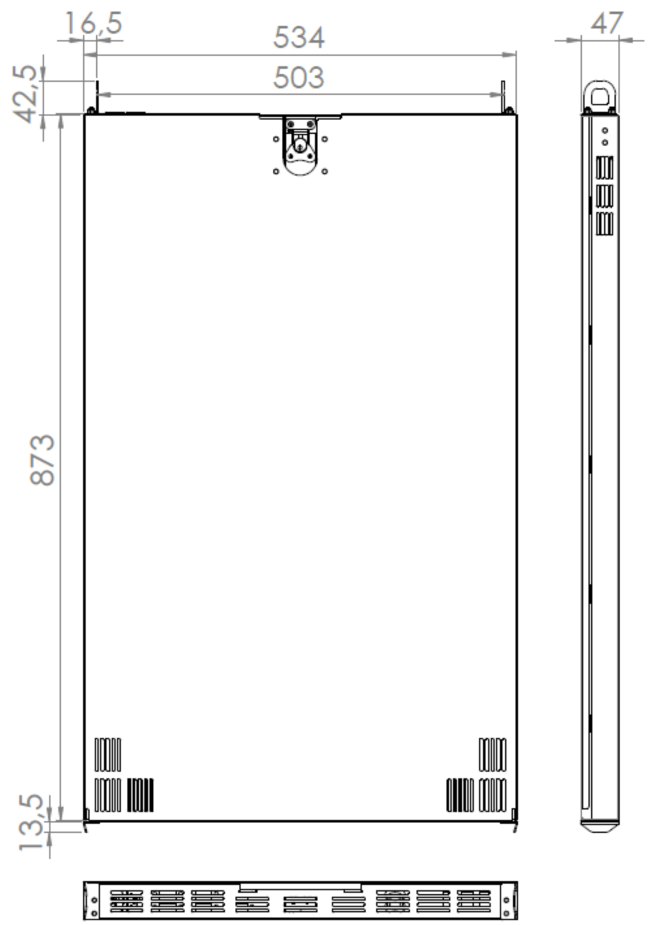


Figure 6 – Dimensions of the 1OU cassette

5.3 Guidance tabs

The guidance tabs are located at the bottom of the module and are used to help guide the cassette into the guidance frame. The guidance tabs and mounting of the tabs may not extend out of the outside frame of the cassette (other than at the bottom) to prevent seizing in the guidance frame. The guidance tabs must also be able to take the weight of the full cassette while handling.

The guidance tabs are an optional addition. If they are not required for the placement of the cassette they can be omitted.

The bottom of the cassette should remain flat to allow for a hard stop on a flat surface when placed vertically.

Table 3 – Guidance tabs dimensions

Dimension	Value
Height	13.5mm
Side Angle	15°

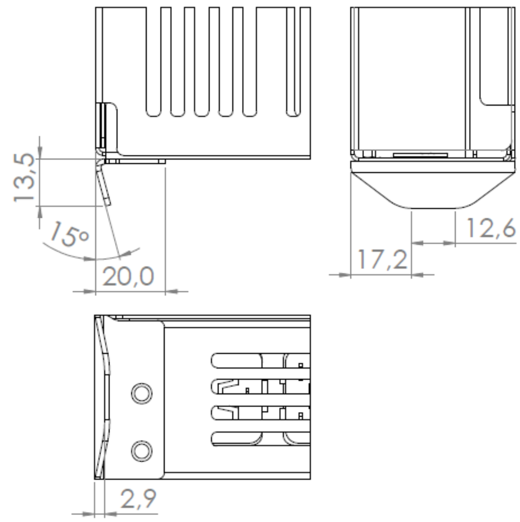


Figure 8 - Guidance tab dimensions

5.4 Lifting loops

Lifting loops are placed on the outside tops of the cassette and are designed to take the weight of the cassette in a vertical orientation when lifting and maneuvering. In a horizontal orientation, the lifting loops can be used to pull out the servers from a rack by hand.

Lifting loops must be able to take the full weight of the cassette.

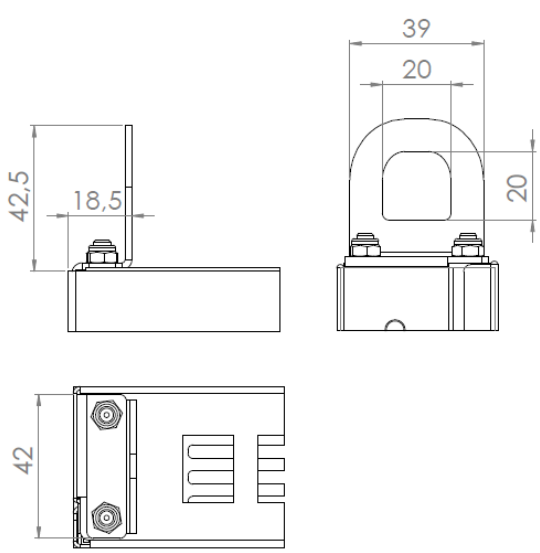


Figure 9 – Lifting loop dimensions

5.5 Locking mechanism and interface plate support

The lid of the cassette has a locking mechanism that can be manipulated without tools. This lock and its structure function as support for the interface plates and prevents sagging of the lid in the open position.

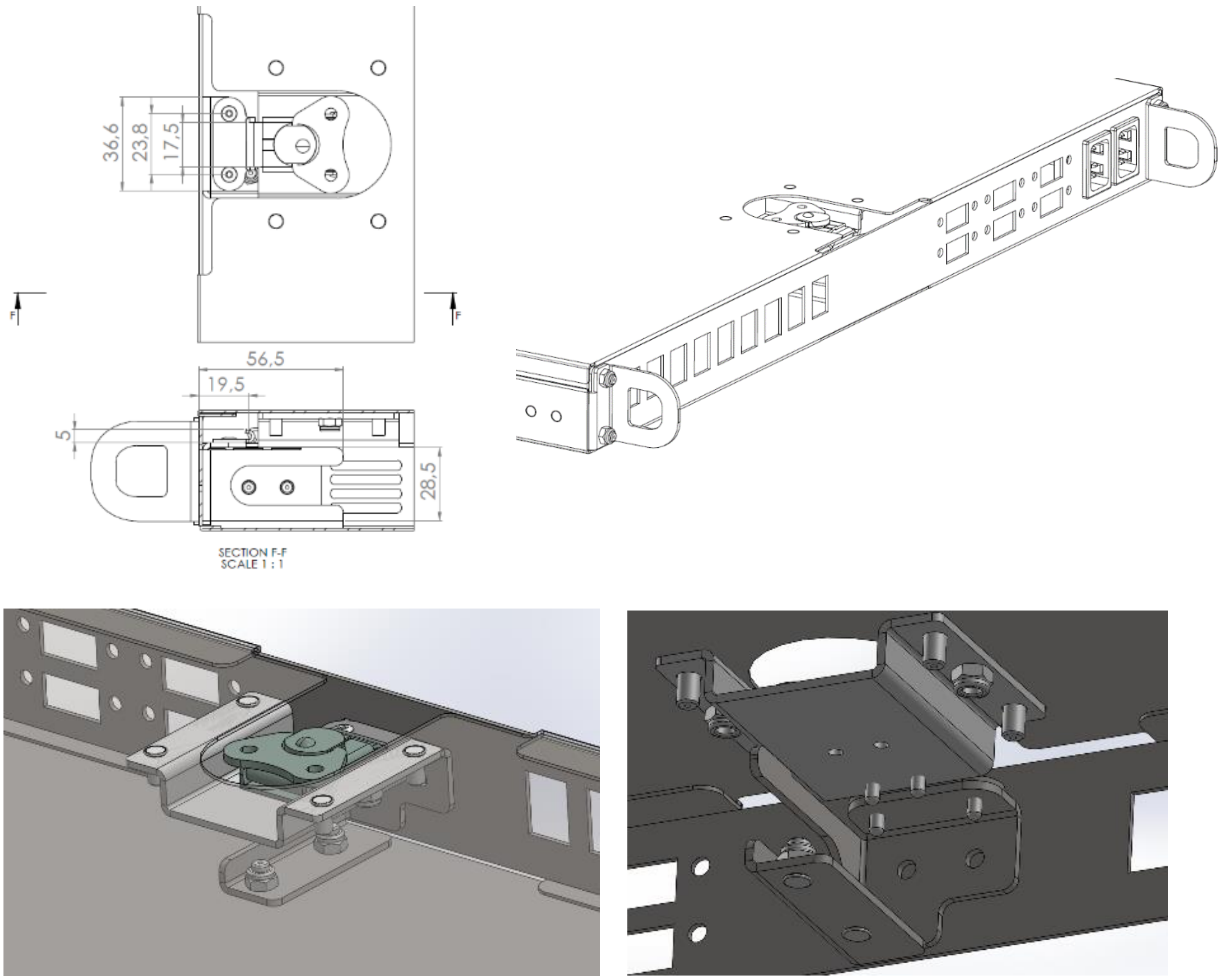


Figure 10 – Lifting mechanism dimensions and 3D representation

The Rotary Draw Latch used can be sourced from any global supplier.

Rotary draw latch product codes

Item	Stainless part#	Steel part#	Source
Latch	K3-1660-52	K3-1660-07	Various suppliers
Keeper	k3-0334-52	K3-0334-07	Various suppliers

Note: The rotary draw latch is an example of how easy closing of the chassis can be achieved. It is an example only.

6. Usage and examples

6.1 Thermal distribution

Thermal distribution in a convection driven liquid setup such as the Asperitas AIC24 is governed by heat generation in combination with convection. This generates a thermal layering effect that can be used to optimise thermal chassis design. Figure 11 shows typical laying and temperatures.

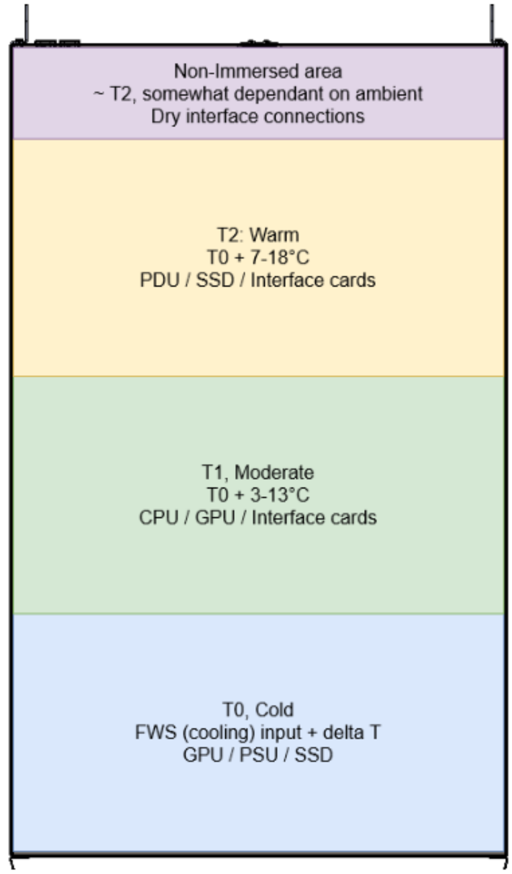


Figure 11 – Thermal distribution

6.2 Layout examples

Two example layouts are shown to indicate the possibilities with these cassettes.

Figure 13 (left) shows a CPU heavy system which is based around 3 7” dual CPU boards. This has options for switch mode power supplies or busbar connections, hence the placement in the bottom half of the cassette. These are strongly optimised thermally due to the low placement of the CPU boards and have a large buffer room above the main heat generators.

Figure 13 (right) shows a storage system with a standard 19” sized base setup which can carry up to 24 NVME drives. The drives are located at the bottom to ensure the coolest temperature and stable temperatures which are good for the lifespan and reliability of the drives. This is connected to a Dual CPU board which has a full throughput uplink to the rest of the interfaces. This cassette also features dual redundant switch mode power supplies. Similar setups are recommended for GPU or FPGA based systems where the NVME baseboard will be replaced by PCI baseboards.

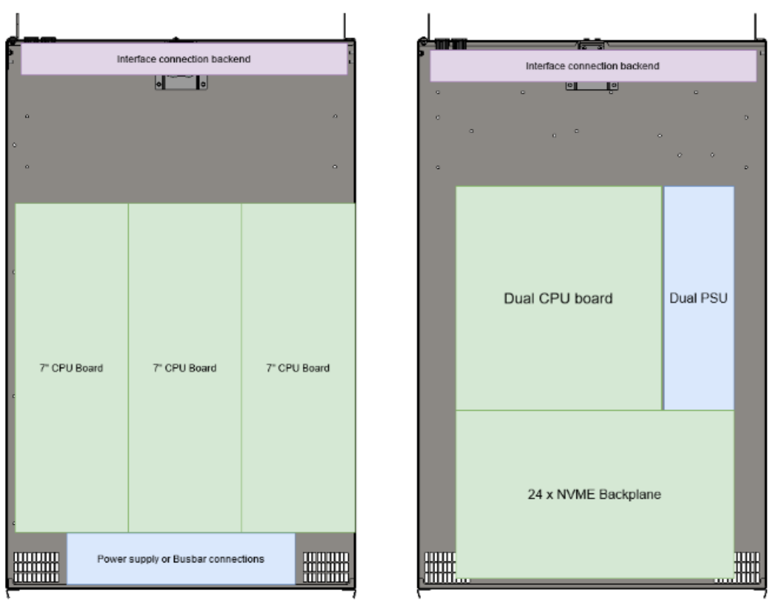


Figure 13 – Example configurations