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TECHNICAL SPECIFICATIONS

MINKELS
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NEXPAND

Specification document for Minkels Nexpand

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CONTENTS

1: GENERAL

- The following specifications document is intended for consultants, architects, colocation providers and system integrators/installers who wish to select different types of Data centre solutions and have technical and detailed information about each range.
- In Appendix 1, an overview of applicable standards and norms is presented.
- Certain specifications noted in red are unique characteristics for Minkels Nexpand portfolio which can be emphasised upon for tenders.

2: PRODUCTS

This document covers the specification information for the following data centre infrastructure components:

- Cabinets (server and network).

3: CABINETS

The choice for cabinets strongly depends on the application they will be used for. In this document, server and network cabinet specifications are provided for both standard applications as well as energy efficient applications by means of using cabinet airflow optimisation.

The described cabinet types are:

- Standard server cabinets
- Airflow optimised server cabinets
- Standard network cabinets
- Airflow optimised network cabinets

Key items to consider when choosing a proper cabinet are:

- The applications it's used for.
- The flexibility in the design to support a wide variety of configurations using standard components with optimised logistics.
- The way the cabinet integrates in the complete data centre infrastructure.
- The potential energy savings which can be achieved by using the appropriate accessories.

3.1: STANDARD SERVER CABINET

General:
A standard server cabinet should be able to be used as a universal 19”- cabinet suitable for housing all common IT-equipment (server, storage, connectivity equipment).

Applicable Standards:
- IEC 60297-3-100 or EIA-310-D/E
- IEC 60950 or ISO/IEC 30129 or EN 50310
- IEC 60529 (IP) and IEC 62262 (IK)
- EN 50600-2-4
- IEC 61587-1
- UL94
- REACH, RoHS, SCIP

Available Sizes:
- Width: 600, 800mm.
- Depth: 800, 1000, 1200mm.
- Height: 1200, 1978, 2200, 2422mm.
- Available equipment space: 24, 42, 47, 52U.

Finishing:
- Powder coated Black RAL 9005 fine structure *or* Signal White RAL 9003 fine structure.

Cabinet Load Capacity:
- Static load capacity of 1500 kg. Nominal load NL5 = 1500 kg according IEC 61587-1

Cabinet Stiffness:
- The cabinet complies to ST1 according IEC 61587-1

Cabinet impact resistance:
- The cabinet complies to IK07 according IEC 61587-1 / IEC 62262

Cabinet climatic and atmospheric resistance:
- The cabinet complies to class A1 and C1 according IEC 61587-1

Cabinet earthing specification:
- The cabinet complies to the earthing requirements of less than 0,1Ω between all metallic components according IEC 61587-1 without the use of separate earthing cables except for the door earthing cables.

Cooling principle:
- Cross flow with 80% perforated doors at the front and the rear of the cabinet.

Frame:
The cabinet base shall be a lightweight, conductively interconnected aluminium frame. The frame consists at least of a top and bottom sub-frame, four height posts and means of attachment. The height profiles are bolted to the top and bottom sub-frames. In case of an 800 wide cabinet, two additional aluminium profiles are attached within each sub-frame in the depth direction. These profiles have similar mounting provisions, so that a 19inch mounting area can be achieved with the same components whilst maintaining equal performance and compliance.

- The frame height profiles shall have mounting grooves which can support stepless equipment and accessories installation. The frame shall support any relevant application according IEC 60917-1.
- The frame profiles in height, width and depth direction shall have threaded mounting grooves to which components can be attached such that conductive components are electrically connected. Earthing screws provide a secure earthing connection between the frame and component.
- The frame shall distribute the cabinet weight evenly over its contact surface with the floor.
- The frame of the cabinet shall provide the possibility for installation of a *slide in side panel*™ if bayed cabinets are not initially equipped with side panels. Bayed cabinets shall be provided with an airtight seal between them if the *slide in side panel*™ is not installed.
- When cabinets are placed in a row setup, the frame shall be bayed by means of 3x external baying brackets. External baying brackets shall be attached to the frames of two cabinets, such that both frames are electrically connected.
- The frame shall be completely earthed via a central earthing point which can be connected to the rack bonding conductor conforming ISO/IEC 30129 and EN 50310. The central earthing point shall facilitate the connection to a 16 mm^2 rack bonding conductor.
- Levelling feet:
    - Base of the frame shall be equipped with levelling feet which are easily accessible for adjustment with a standard tool from the inside of the cabinet *or* the base of the frame shall not be equipped with levelling feet.
    - Cabinet levelling feet are placed at an outwards position for increased stability and are connected directly to the frame to maintain the highest load capacity.
    - In case the cabinet has a depth dimension of 800, four levelling feet are required at the corners of the bottom sub-frame. If the cabinet depth is 1000 or 1200mm, two additional central levelling feet are required in the middle between the front and rear levelling feet to maintain the cabinet static load capacity*.
    - The base of the frame shall be equipped with levelling feet which are easily accessible for adjustment with a standard tool from the inside of the cabinet. If castors are installed, they do not limit the use of levelling feet.

** This does not apply to colocation cabinets or other variants where the force is transferred to the levelling feet without passing depth profiles or variants thereof. In such cases four levelling feet are sufficient.*

- Castors:
  - The base of the frame shall be equipped with four light duty swivel castors; the maximum dynamic load, including the weight of cabinet, shall not exceed 400kg. If the optional levelling feet are adjusted to support the cabinet, the static load capacity shall be 1500kg *or* the base of the frame shall not be equipped with castors.
  - Castors shall be positioned outwards such that the cabinet is stable while being moved and ramps with light slopes can be passed.
- Logo:
  - If the front of the cabinet has no door, the front of the frame shall have a logo sticker with a designated area to provide identification of the cabinet.
  - If the rear of the cabinet has no door, the rear of the frame shall have a logo sticker with a designated area to provide identification of the cabinet.

Bottom & Roof:

The roof shall prevent dust and particles to enter the cabinet. It shall also allow proper cable entry into the cabinet.

- The roof shall be divided into one single main part and additional accessories.
  - The main roof panel shall be enforced if required to minimize hanging effects. These enforcements shall not limit the internal usable space or restrict the function of the cabinet.
    The sides of the roof panel shall have a 100mm wide longitudinal cut-out providing access for IEC 60309 compliant 3-phase 32A plugs and shall be provided with ABS cover plates. The cut-outs shall have a provision for mounting cable brushes, cable guides with bend radius compensation or airtight cable throughputs, all of which can be applied in a pitch of 100mm. The full length of the cut-out shall be covered when all positions are utilized by accessories.
  - The longitudinal roof cut-outs shall extend from the front to the rear of the cabinet and shall align straight above the cabinet internal cable ducts to provide cable guidance without hinder or unnecessary loss of space for cabling.
  - An airtight barrier can be achieved by using the right accessories at the applicable positions of the cut-out in the roof.
  - The roof can have a cut-out in the middle for additional accessories. A similar interface to the longitudinal cut-outs can be installed to allow the installation of the same accessories at this position.
  - Divider panels can be installed on top of the roof and are unobstructed by the roof design.
- The frame depth profile or depth mounting rail shall provide a groove for mounting Cable Pull Relief or other accessories.
- On top of the roof, a modular cable duct divider system shall be able to manage copper, power and fibre cabling (structured cabling and patch cables). The cable duct system shall have a pitch of 100mm in the width direction of the channel. It shall be possible to place covers on the duct system to create an airtight duct that is protected against dust/debris and other forms of unwanted intrusion. The roof system shall have a provision for attaching cable ties. The cable duct system components shall correspond the width of the cabinet. The duct system shall alternatively have bridge components to connect two cabinets that are placed apart. These bridge duct components shall be available to create a duct or multiple ducts with a width of 100, 200 or 400mm.
- The cabinet roof panel shall not exclude the use of the mounting rails for other accessories. Neither the roof itself, nor any accessories installed to the frame in this way, shall negatively impact the airtightness.

Interior:

- The basic interior of the cabinet shall consist of four powder coated steel 19” Vertical Mounting Rails (VMR) according IEC 60297-3-100 and EIA-310-D/E in the same colour as the cabinet.
  - The 19” VMRs shall be provisioned, at the user facing surface, with a triple 9,5mm square hole pattern aligned with the cabinet height units (U) to accommodate front panels, chassis, sub-racks, and IT equipment.
  - The 19” VMR shall be provisioned at the side facing surface with an accessory mounting pattern with a pitch in line with the cabinet height units.
  - The 19” VMRs shall be numbered per height unit for identification. The numbering shall start at the bottom to enable easier identification for similar position on different height cabinets. If this configuration is not desired, exchanging the right and left 19” VMR would reverse the order of numbering. Reversed numbers are not added to maintain a singular definition per position.
  - The 19” VMRs shall be provisioned, at the user facing surface, with a hole pattern for the optional attachment of cable management accessories.
  - The 19” VMRs shall be placed at 80 *or* 125 *or* 230 mm from the front of the cabinet. This distance is defined between the front surface of the 19” VMR and the front surface of the door.
  - The distance between the front and rear of the 19” VMRs shall be 590mm in case of an 800mm deep cabinet *or* 740mm in case of 1000mm and 1200mm deep cabinets. This distance shall be adjustable to any position within the boundaries of the frame, these positions are not limited by predefined increments.
- The VMRs shall be connected to the frame so that the load of installed equipment is distributed to the frame without unnecessarily involving additional components.
  - The VMRs shall be able to be positioned at any place with a minimum of 60mm from the front or rear of the cabinet.
  - Reaching the attachments used for the VMRs shall be ergonomically feasible and can be done from inside the cabinet.
  - The placement of the VMRs can be identified using optional distance indicators along the profiles on which the VMRs are installed.
- Cable trays
  - If the cabinet height is 42U or more and 1000mm deep a vertical cable Tray 200mm wide is assembled at the left of the cabinet halfway between the front and rear 19” VMR *or* 2 vertical 125mm PDU cable trays are assembled of which one at the left rear and one at the right rear of the cabinet. The PDU cable trays shall have a provision for toolless mounting of PDUs *or* no cable tray.

- If the cabinet height is 42U or more and 1200mm deep, a vertical cable Tray 200mm wide is assembled at the left of the cabinet halfway between the front and rear 19" VMR *or* 2 vertical 300mm cable trays are assembled. One of which at the left and one at the right of the cabinet halfway between the front and rear 19" VMR *or* 4 125mm PDU cable trays of which 2 are assembled at the left rear and 2 are assembled at the right rear of the cabinet *or* no cable tray. The PDU cable trays shall have a provision for toolless mounting of PDUs.

- The cabinet shall support a vertically mounted 0U rack-PDU in the rear of the cabinet at any of the following different places. For an 800mm wide cabinet between the 19" VMR and the side of the cabinet facing the rear door opening *or* 2-fold on the rear height post facing the centre of the cabinet *or* in front of the 19" VMR facing the rear door opening *or* on the rear height post facing the centre of the cabinet.

Doors:

- (front and/or rear) Single cabinet door shall provide 80% perforation and contain an enclosed space for the locking mechanism *or* in case of a double cabinet door, provide 80% perforation and contain a space which can be closed off for critical parts of the locking mechanism *or* a single cabinet door shall provide a visual through layered safety glass and contain an enclosed space for the locking mechanism *or* single cabinet door shall provide no visual of the interior and contain an enclosed space for the locking mechanism.
  - The high 80% perforation shall give an optimal balance between high energy efficiency due to low air obstruction and mechanical performance.
  - Door shall be hinged on two or three points, depending on the height of the door and their impact on the door stiffness. Door opening direction shall be able to be changed after installation.
  - Double doors shall be hinged on 2 x 2 points or 2 x 3 points depending on the door height.
  - The opened door shall be able to be taken off the cabinet without the use of tools. The top hinge pin may be longer than the other hinge pins to improve the ease of assembly.
  - The free-standing opening angle shall be 260 degrees. Opening angle of the door shall be 150 degrees in case the cabinets are bayed.
- The door shall be equipped with a two-point locking mechanism.
  - The locking mechanism and rods both for single and double doors shall be inaccessible to people without access to the cabinet interior to prevent tampering.
- Doors can be equipped with swivel handles from different manufacturers which and can hold locking mechanisms: standard swivel handle with half euro profile cylinder *or* standard swivel handle with combination lock with key override *or* electronic handle with RFID access *or* a SmartLock.
- For the integration and covering of cabling for electronic locking, cabling shall be enclosed within the door or covered with a cable management accessory. The integrated cable management shall be separated from moving components or outside influences *or* no door cable cover.
- The door shall have a logo plate with a designated area to provide space for a cabinet identification label.
- Doors are connected to the frame via an earthing cable in compliance with the applicable standards.

Sides:

- Sides of the cabinets shall be suitable for placing a single piece sheet metal side panel *or* no side panel.
- Side panels shall lock into place using two locking points per panel with: a toggle lock with a square key *or* a cylinder lock with a key.
- Side panels are connected to the frame in compliance with the applicable standards for earthing. An earthing clip attached to the height profile can provide a sure connection via a quarter turn lock. Because cabling can be forgotten to reinstall, and the earthing clip will automatically function after reinstalling the side panel, this feature can be considered an advantage over more commonly used methods.
- The same side panels shall be usable on the left and right side of the cabinet.
- It shall be possible to optionally place a *slide in side panel*™ between two bayed cabinets without the need to remove any of the cabinets, a (pre)installed half height divider shall, and a panel guide at the top and bottom of the cabinet, shall support both *slide in side panels*™. In this way it shall be possible to mechanically divide the interiors of neighbouring installed cabinets.

3.2: AIRFLOW OPTIMISED SERVER CABINET

General:
An airflow optimised server cabinet should be able to be used as a universal 19”-cabinet suitable for housing common IT-equipment (server, storage, and connectivity equipment) and prevent conditioned air to leak away or be negatively impacted. This is important to ensure the highest possible energy efficiency and to facilitate a delta-P pressure-controlled aisle containment solution.

Applicable Standards:
- IEC 60297-3-100 or EIA-310-D/E
- IEC 60950 or ISO/IEC 30129 or EN 50310
- IEC 60529 (IP) and IEC 62262 (IK)
- EN 50600-2-4
- IEC 61587-1
- UL94
- IEC 62966-2
- REACH, RoHS, SCIP

Available Sizes:
- Width: 600, 800mm.
- Depth: 800, 1000, 1200mm.
- Height: 1200, 1978, 2200, 2422mm.
- Available equipment space: 24, 42, 47, 52U.

Finishing
- Powder coated Black RAL 9005 fine structure *or* Signal White RAL 9003 fine structure.

Cabinet Load Capacity:
- Static load capacity of 1500 kg. Nominal load NL5 = 1500 kg according IEC 61587-1

Cabinet Stiffness:
- The cabinet complies to ST1 according IEC 61587-1

Cabinet impact resistance:
- The cabinet complies to IK07 according IEC 61587-1 / IEC 62262

Cabinet climatic and atmospheric resistance:
- The cabinet complies to class A1 and C1 according IEC 61587-1

Cabinet earthing specification:
- The cabinet complies to the earthing requirements of less than 0,1Ω between all metallic components according IEC 61587-1 without the use of separate earthing cables except for the door earthing cables.

Cooling principle:
- Cross flow with 80% perforated doors at the front and the rear of the cabinet, including airflow optimisation. Maximum air leakage at 5Pa static pressure should be below 40 m^3/hr (2200mm height cabinet).

Frame:
The cabinet base shall be a lightweight, conductively interconnected aluminium frame. The frame consists at least of a top and bottom sub-frame, four height posts and means of attachment. The height profiles are bolted to the top and bottom sub-frames. In case of an 800 wide cabinet, two additional aluminium profiles are attached within each sub-frame in the depth direction. These profiles have similar mounting provisions, so that a 19inch mounting area can be achieved with the same components whilst maintaining equal performance and compliance.

- The frame height profiles shall have mounting grooves which can support stepless equipment and accessories installation. The frame shall support any relevant application according IEC 60917-1.
- The frame profiles in height, width and depth direction shall have threaded mounting grooves to which components can be attached such that conductive components are electrically connected. Earthing screws provide a secure earthing connection between the frame and component.
- The frame shall distribute the cabinet weight evenly over its contact surface with the floor.
- The frame of the cabinet shall provide the possibility for installation of a *slide in side panel*™ if bayed cabinets are not initially equipped with side panels. Bayed cabinets shall be provided with an airtight seal between them if the *slide in side panel*™ is not installed.
- When cabinets are placed in a row setup, the frame shall be bayed by means of 3x external baying brackets. External baying brackets shall be attached to the frames of two cabinets, such that both frames are electrically connected.
- The frame shall be completely earthed via a central earthing point which can be connected to the rack bonding conductor conforming ISO/IEC 30129 and EN 50310. The central earthing point shall facilitate the connection to a 16 mm^2 rack bonding conductor.
- Levelling feet:
    - The base of the frame shall be equipped with levelling feet which are easily accessible for adjustment with a standard tool from the inside of the cabinet *or* the base of the frame shall not be equipped with levelling feet.
    - Cabinet levelling feet are placed at an outwards position for increased stability and are connected directly to the frame to maintain the highest load capacity.
    - In case the cabinet has a depth dimension of 800, four levelling feet are required at the corners of the bottom sub-frame. If the cabinet depth is 1000 or 1200mm, two additional central levelling feet are required in the middle between the front and rear levelling feet to maintain the cabinet static load capacity*.
    - The base of the frame shall be equipped with levelling feet which are easily accessible for adjustment with a standard tool from the inside of the cabinet. If castors are installed, they do not limit the use of levelling feet.

** This does not apply to colocation cabinets or other variants where the force is transferred to the levelling feet without passing depth profiles or variants thereof. In such cases four levelling feet are sufficient.*

- Castors:
  - The base of the frame shall be equipped with four light duty swivel castors; the maximum dynamic load, including the weight of cabinet, shall not exceed 400kg. If the optional levelling feet are adjusted to support the cabinet, the static load capacity shall be 1500kg *or* the base of the frame shall not be equipped with castors.
  - Castors shall be positioned outwards such that the cabinet is stable while being moved and ramps with light slopes can be passed.

- Airtight plinth:
  - The base of the frame shall be equipped with a plinth for making an airtight front or rear of the cabinet. This plinth in combination with levelling feet provides a height adjustment range of 0-25 mm or seals the bottom in combination with wheels *or* the bottom of the frame is provided with two plinths for making an airtight front and rear of the cabinet, these plinths in combination with levelling feet provides a height adjustment range of 0-25mm or seals the bottom in combination with wheels *or* the base of the frame shall not be equipped with an airtight plinth.
- Logo:
  - If the front of the cabinet has no door, the front of the frame shall have a logo sticker with a designated area to provide identification of the cabinet.
  - If the rear of the cabinet has no door, the rear of the frame shall have a logo sticker with a designated area to provide identification of the cabinet.

Bottom & Roof:

The roof shall prevent dust and particles to enter the cabinet. It shall also allow proper cable entry into the cabinet.

- The roof shall be divided into one single main part and additional accessories.
  - The main roof panel shall be enforced if required to minimize hanging effects. These enforcements shall not limit the internal usable space or restrict the function of the cabinet.
  - The sides of the roof panel shall have a 100mm wide longitudinal cut-out providing access for IEC 60309 3-phase 32A plugs and shall be provided with ABS cover plates. The cut-outs shall have a provision for mounting cable brushes, cable guides with bend radius compensation or airtight cable throughputs, all of which can be applied in a pitch of 100mm. The full length of the cut-out shall be covered when all positions are utilized by accessories.
  - The longitudinal roof cut-outs shall extend from the front to the rear of the cabinet and shall align straight above the cabinet internal cable ducts to provide cable guidance without hinder or unnecessary loss of space for cabling.
  - An airtight barrier can be achieved by using the right accessories at the applicable positions of the cut-out in the roof.
  - The roof can have a cut-out in the middle for additional accessories. A similar interface to the longitudinal cut-outs can be installed to allow the installation of the same accessories at this position.
  - Divider panels can be installed on top of the roof and are unobstructed by the roof design.
- The frame depth profile or depth mounting rail shall provide a groove for mounting Cable Pull Relief or other accessories.
- On top of the roof, a modular cable duct divider system shall be able to manage copper, power and fibre cabling (structured cabling and patch cables). The cable duct system shall have a pitch of 100mm in the width direction of the channel. It shall be possible to place covers on the duct system to create an airtight duct that is protected against dust/debris and other forms of unwanted intrusion. The roof system shall have a provision for attaching cable ties. The cable duct system components shall correspond the width of the cabinet. The duct system shall alternatively have bridge components to connect two cabinets that are placed apart. These bridge duct components shall be available to create a duct or multiple ducts with a width of 100, 200 or 400mm.
- The cabinet roof panel shall not exclude the use of the mounting rails for other accessories. Neither the roof itself, nor any accessories installed to the frame in this way, shall negatively impact the airtightness.

Interior:

- The basic interior of the cabinet shall consist of four powder coated steel 19” Vertical Mounting Rails (VMR) according IEC 60297-3-100 and EIA-310-D/E in the same colour as the cabinet.
  - The 19” VMRs shall be provisioned, at the user facing surface, with a triple 9,5mm square hole pattern aligned with the cabinet height units (U) to accommodate front panels, chassis, sub-racks, and IT equipment.
  - The 19” VMR shall be provisioned at the side facing surface with an accessory mounting pattern with a pitch in line with the cabinet height units.
  - The 19” VMRs shall be numbered per height unit for identification. The numbering shall start at the bottom to enable easier identification for similar position on different height cabinets. If this configuration is not desired, exchanging the right and left 19” VMR would reverse the order of numbering. Reversed numbers are not added to maintain a singular definition per position.
  - The 19” VMRs shall be provisioned, at the user facing surface, with a hole pattern for the optional attachment of cable management accessories *or* with a blind surface.
  - The 19” VMRs shall be placed at 80 *or* 125 *or* 230 mm from the front of the cabinet. This distance is defined between the front surface of the 19” VMR and the front surface of the door.
  - The distance between the front and rear of the 19” VMRs shall be 590mm in case of an 800mm deep cabinet *or* 740mm in case of 1000mm and 1200mm deep cabinets. This distance shall be adjustable to any position within the boundaries of the frame, these positions are not limited by predefined increments.
- The VMRs shall be connected to the frame so that the load of installed equipment is distributed to the frame without unnecessarily involving additional components.
  - The VMRs shall be able to be positioned at any place with a minimum of 60mm from the front or rear of the cabinet.
  - Reaching the attachments used for the VMRs shall be ergonomically feasible and can be done from inside the cabinet.

- The placement of the VMRs can be identified using optional distance indicators along the profiles on which the VMRs are installed.

- The cabinet shall be provided with an airtight barrier along the front VMRs in case of “cold containment” (conditioned air comes from within the contained space), or along the rear VMRs in case of “hot containment” (conditioned air comes from outside the contained space). VMRs are configured with a 60 (70 for a 600mm wide cabinet) to 150mm depth adjustable *or* 60 (70 for a 600mm wide cabinet) to 250mm adjustable version.
  - The air barrier to contain conditioned air continues from the front VMR plane to the top and bottom of the cabinet via airtight plates. These top-bottom plates extend beyond the front position of the VMR to provide a designated reach for flexible VMR placement. The maximum VMR distance depends on the variant of the top-bottom plates and other accessories.
  - 600mm wide cabinets shall be equipped with side plates to prevent air from leaking via the left and right sides of the cabinet. These side plates shall be attached to the 19” VMRs and the vertical frame profile to create an airtight seal between these components *or* 800mm wide cabinets shall be equipped with side plates to prevent air from leaking via the left and right sides of the cabinet. These side plates shall be attached to the vertical frame profile and to side skirts which are attached to the 19” VMRs to create an airtight seal between these components. Side skirts are practically an airtight extension of the VMR towards the side plate.
- Cable trays
  - If the cabinet height is 42U or more and 1000mm deep, a vertical cable tray 200mm wide is assembled at the left of the cabinet halfway between the front and rear 19” VMR *or* 2 vertical 125mm PDU cable trays are assembled. One of which at the left rear and one at the right rear of the cabinet. The PDU cable trays shall have a provision for toolless mounting of PDUs *or* no cable tray.
  - If the cabinet height is 42U or more and 1200mm deep a vertical cable Tray 200mm wide, is assembled at the left of the cabinet half way between the front and rear 19” VMR *or* 2 vertical 300mm cable trays are assembled of which one at the left and one at the right of the cabinet half way between the front and rear 19” VMR *or* 4 125mm PDU cable trays of which 2 are assembled at the left rear and 2 are assembled at the right rear of the cabinet *or* no cable tray. The PDU cable trays shall have a provision for toolless mounting of PDUs.
- The cabinet shall support a vertically mounted 0U rack-PDU in the rear of the cabinet at any of the following different places. For an 800mm wide cabinet between the 19” VMR and the side of the cabinet facing the rear door opening *or* 2 fold on the rear height post facing the centre of the cabinet *or* in front of the 19” VMR facing the rear door opening *or* on the rear height post facing the centre of the cabinet.

Doors:

- (front and/or rear Single cabinet door shall provide 80% perforation and contain an enclosed space for the locking mechanism *or* in case of a double cabinet door, provide 80% perforation and contain a space which can be closed off for critical parts of the locking mechanism *or* a single cabinet door shall provide a visual through layered safety glass and contain an enclosed space for the locking mechanism *or* single cabinet door shall provide no visual of the interior and contain an enclosed space for the locking mechanism.
  - The high 80% perforation shall give an optimal balance between high energy efficiency due to low air obstruction and mechanical performance.
  - Door shall be hinged on two or three points, depending on the height of the door and their impact on the door stiffness. Door opening direction shall be able to be changed after installation.
  - Double doors shall be hinged on 2 x 2 points or 2 x 3 points depending on the door height.
  - The opened door shall be able to be taken off the cabinet without the use of tools. The top hinge pin may be longer than the other hinge pins to improve the ease of assembly.
  - The free-standing opening angle shall be 260 degrees. Opening angle of the door shall be 150 degrees in case the cabinets are bayed.
- The door shall be equipped with a two-point locking mechanism.
  - The locking mechanism and rods both for single and double doors shall be inaccessible to people without access to the cabinet interior to prevent tampering.
- Doors can be equipped with swivel handles from different manufacturers which and can hold locking mechanisms: standard swivel handle with half euro profile cylinder *or* standard swivel handle with combination lock with key override *or* electronic handle with RFID access *or* a SmartLock.
- For the integration and covering of cabling for electronic locking, cabling shall be enclosed within the door or covered with a cable management accessory. The integrated cable management shall be separated from moving components or outside influences *or* no door cable cover.
- The door shall have a logo plate with a designated area to provide space for a cabinet identification label.
- Doors are connected to the frame via an earthing cable in compliance with the applicable standards.

Sides:

- Sides of the cabinets shall be suitable for placing a single piece sheet metal side panel *or* no side panel.
- Side panels shall lock into place using two locking points per panel with: a toggle lock with a square key *or* a cylinder lock with a key.
- Side panels are connected to the frame in compliance with the applicable standards for earthing. An earthing clip attached to the height profile can provide a sure connection via a quarter turn lock. Because cabling can be forgotten to reinstall, and the earthing clip will automatically function after reinstalling the side panel, this feature can be considered an advantage over more commonly used methods.
- The same side panels shall be usable on the left and right side of the cabinet.
- It shall be possible to optionally place a *slide in side panel*™ between two bayed cabinets without the need to remove any of the cabinets, a (pre)installed half height divider shall, and a panel guide at the top and bottom of the cabinet, shall support both *slide in side panels*™. In this way it shall be possible to mechanically divide the interiors of neighbouring installed cabinets.

3.3: STANDARD NETWORK CABINET

General:
A standard server cabinet should be able to be used as a universal 19”- cabinet suitable for housing all common passive and active network equipment.

Applicable Standards:
- IEC 60297-3-100 or EIA-310-D/E
- IEC 60950 or ISO/IEC 30129 or EN 50310
- IEC 60529 (IP) and IEC 62262 (IK)
- EN 50600-2-4
- IEC 61587-1
- UL94
- REACH, RoHS, SCIP

Available Sizes:
- Width: 600, 800mm.
- Depth: 1000, 1200mm.
- Height: 1978, 2200, 2422mm.
- Available equipment space: 42, 47, 52U.

Finishing:
- Powder coated Black RAL 9005 fine structure *or* Signal White RAL 9003 fine structure.

Cabinet Load Capacity:
- Static load capacity of 1500 kg. Nominal load NL5 = 1500 kg according IEC 61587-1

Cabinet Stiffness:
- The cabinet complies to ST1 according IEC 61587-1

Cabinet impact resistance:
- The cabinet complies to IK07 according IEC 61587-1 / IEC 62262

Cabinet climatic and atmospheric resistance:
- The cabinet complies to class A1 and C1 according IEC 61587-1

Cabinet earthing specification:
- The cabinet complies to the earthing requirements of less than 0,1Ω between all metallic components according IEC 61587-1 without the use of separate earthing cables except for the door earthing cables.

Cooling principle:
- Cross flow with 80% perforated doors at the front and the rear of the cabinet.

Frame:
The cabinet base shall be a lightweight, conductively interconnected aluminium frame. The frame consists at least of a top and bottom sub-frame, four height posts and means of attachment. The height profiles are bolted to the top and bottom sub-frames. In case of an 800 wide cabinet, two additional aluminium profiles are attached within each sub-frame in the depth direction. These profiles have similar mounting provisions, so that a 19inch mounting area can be achieved with the same components whilst maintaining equal performance and compliance.

- The frame height profiles shall have mounting grooves which can support stepless equipment and accessories installation. The frame shall support any relevant application according IEC 60917-1.
- The frame profiles in height, width and depth direction shall have threaded mounting grooves to which components can be attached such that conductive components are electrically connected. Earthing screws provide a secure earthing connection between the frame and component.
- The frame shall distribute the cabinet weight evenly over its contact surface with the floor.
- The frame of the cabinet shall provide the possibility for installation of a *slide in side panel*™ if bayed cabinets are not initially equipped with side panels. Bayed cabinets shall be provided with an airtight seal between them if the *slide in side panel*™ is not installed.
- When cabinets are placed in a row setup, the frame shall be bayed by means of 3x external baying brackets. External baying brackets shall be attached to the frames of two cabinets, such that both frames are electrically connected.
- The frame shall be completely earthed via a central earthing point which can be connected to the rack bonding conductor conforming ISO/IEC 30129 and EN 50310. The central earthing point shall facilitate the connection to a 16 mm^2 rack bonding conductor.
- Levelling feet:
    - The base of the frame shall be equipped with levelling feet which are easily accessible for adjustment with a standard tool from the inside of the cabinet *or* the base of the frame shall not be equipped with levelling feet.
    - Cabinet levelling feet are placed at an outwards position for increased stability and are connected directly to the frame to maintain the highest load capacity.
    - In case the cabinet has a depth dimension of 800, four levelling feet are required at the corners of the bottom sub-frame. If the cabinet depth is 1000 or 1200mm, two additional central levelling feet are required in the middle between the front and rear levelling feet to maintain the cabinet static load capacity*.

** This does not apply to colocation cabinets or other variants where the force is transferred to the levelling feet without passing depth profiles or variants thereof. In such cases four levelling feet are sufficient.*

- Castors:
  - The base of the frame shall be equipped with four light duty swivel castors; the maximum dynamic load, including the weight of cabinet, shall not exceed 400kg. If the optional levelling feet are adjusted to support the cabinet, the static load capacity shall be 1500kg *or* the base of the frame shall not be equipped with castors.
  - Castors shall be positioned outwards such that the cabinet is stable while being moved and ramps with light slopes can be passed.
- Logo:
  - If the front of the cabinet has no door, the front of the frame shall have a logo sticker with a designated area to provide identification of the cabinet.
  - If the rear of the cabinet has no door, the rear of the frame shall have a logo sticker with a designated area to provide identification of the cabinet.

Bottom & Roof:

The roof shall prevent dust and particles to enter the cabinet. It shall also allow proper cable entry into the cabinet.

- The roof shall be divided into one single main part and additional accessories.
  - The main roof panel shall be enforced if required to minimize hanging effects. These enforcements shall not limit the internal usable space or restrict the function of the cabinet.
  - The sides of the roof panel shall have a 100mm wide longitudinal cut-out providing access for IEC 60309 3-phase 32A plugs and shall be provided with ABS cover plates. The cut-outs shall have a provision for mounting cable brushes, cable guides with bend radius compensation or airtight cable throughputs, all of which can be applied in a pitch of 100mm. The full length of the cut-out shall be covered when all positions are utilized by accessories.
  - The longitudinal roof cut-outs shall extend from the front to the rear of the cabinet and shall align straight above the cabinet internal cable ducts to provide cable guidance without hinder or unnecessary loss of space for cabling.
  - An airtight barrier can be achieved by using the right accessories at the applicable positions of the cut-out in the roof.
  - The roof can have a cut-out in the middle for additional accessories. A similar interface to the longitudinal cut-outs can be installed to allow the installation of the same accessories at this position.
  - Divider panels can be installed on top of the roof and are unobstructed by the roof design.
- The frame depth profile or depth mounting rail shall provide a groove for mounting Cable Pull Relief or other accessories.
- On top of the roof, a modular cable duct divider system shall be able to manage copper, power and fibre cabling (structured cabling and patch cables). The cable duct system shall have a pitch of 100mm in the width direction of the channel. It shall be possible to place covers on the duct system to create an airtight duct that is protected against dust/debris and other forms of unwanted intrusion. The roof system shall have a provision for attaching cable ties. The cable duct system components shall correspond the width of the cabinet. The duct system shall alternatively have bridge components to connect two cabinets that are placed apart. These bridge duct components shall be available to create a duct or multiple ducts with a width of 100, 200 or 400mm.
- The cabinet roof panel shall not exclude the use of the mounting rails for other accessories. Neither the roof itself, nor any accessories installed to the frame in this way, shall negatively impact the airtightness.

Interior:

- The basic interior of the cabinet shall consist of four powder coated steel 19” Vertical Mounting Rails (VMR) according IEC 60297-3-100 and EIA-310-D/E in the same colour as the cabinet.
  - The 19” VMRs shall be provisioned, at the user facing surface, with a triple 9,5mm square hole pattern aligned with the cabinet height units (U) to accommodate front panels, chassis, sub racks and IT equipment.
  - The 19” VMR shall be provisioned at the side facing surface with an accessory mounting pattern with a pitch in line with the cabinet height units.
  - The 19” VMRs shall be numbered per height unit for identification. The numbering shall start at the bottom to enable easier identification for similar position on different height cabinets. If this configuration is not desired, exchanging the right and left 19” VMR would reverse the order of numbering. Reversed numbers are not added to maintain a singular definition per position.
  - The 19” VMRs shall be provisioned, at the user facing surface, with a hole pattern for the optional attachment of cable management accessories.
  - The 19” VMRs shall be placed at 125 *or* 230 mm from the front of the cabinet. This distance is defined between the front surface of the 19” VMR and the front surface of the door.
  - The distance between the front and rear of the 19” VMRs shall be 590mm in case of an 800mm deep cabinet *or* 740mm in case of 1000mm and 1200mm deep cabinets. This distance shall be adjustable to any position within the boundaries of the frame, these positions are not limited by predefined increments.
- The VMRs shall be connected to the frame so that the load of installed equipment is distributed to the frame without unnecessarily involving additional components.
  - The VMRs shall be able to be positioned at any place with a minimum of 60mm from the front or rear of the cabinet.
  - Reaching the attachments used for the VMRs shall be ergonomically feasible and can be done from inside the cabinet.
  - The placement of the VMRs can be identified using optional distance indicators along the profiles on which the VMRs are installed.
- Cable trays
  - If the cabinet height is 42U or more and 1000mm deep a vertical cable Tray 200mm wide is assembled at the left of the cabinet halfway between the front and rear 19” VMR *or* 2 vertical 125mm PDU cable trays are assembled of which one at the left rear and one at the right rear of the cabinet. The PDU cable trays shall have a provision for toolless mounting of PDUs *or* no cable tray.

- If the cabinet height is 42U or more and 1200mm deep, a vertical cable Tray 200mm wide is assembled at the left of the cabinet halfway between the front and rear 19" VMR *or* 2 vertical 300mm cable trays are assembled. One of which at the left and one at the right of the cabinet halfway between the front and rear 19" VMR *or* 4 125mm PDU cable trays of which 2 are assembled at the left rear and 2 are assembled at the right rear of the cabinet *or* no cable tray. The PDU cable trays shall have a provision for toolless mounting of PDUs.

- The cabinet shall support a vertically mounted 0U rack-PDU in the rear of the cabinet at any of the following different places. For an 800mm wide cabinet between the 19" VMR and the side of the cabinet facing the rear door opening *or* 2-fold on the rear height post facing the centre of the cabinet *or* in front of the 19" VMR facing the rear door opening *or* on the rear height post facing the centre of the cabinet.

Doors – In case of passive and active equipment:

- (front and/or rear) Single cabinet door shall provide 80% perforation and contain an enclosed space for the locking mechanism *or* in case of a double cabinet door, provide 80% perforation and contain a space which can be closed off for critical parts of the locking mechanism
  - The high 80% perforation shall give an optimal balance between high energy efficiency due to low air obstruction and mechanical performance.
  - Door shall be hinged on two or three points, depending on the height of the door and their impact on the door stiffness. Door opening direction shall be able to be changed after installation.
  - Double doors shall be hinged on 2 x 2 points or 2 x 3 points depending on the door height.
  - The opened door shall be able to be taken off the cabinet without the use of tools. The top hinge pin may be longer than the other hinge pins to improve the ease of assembly.
  - The free-standing opening angle shall be 260 degrees. Opening angle of the door shall be 150 degrees in case the cabinets are bayed.
- The door shall be equipped with a two-point locking mechanism.
  - The locking mechanism and rods both for single and double doors shall be inaccessible to people without access to the cabinet interior to prevent tampering.
- Doors can be equipped with swivel handles from different manufacturers which and can hold locking mechanisms: standard swivel handle with half euro profile cylinder *or* standard swivel handle with combination lock with key override *or* electronic handle with RFID access *or* a SmartLock.
- For the integration and covering of cabling for electronic locking, cabling shall be enclosed within the door or covered with a cable management accessory. The integrated cable management shall be separated from moving components or outside influences *or* no door cable cover.
- The door shall have a logo plate with a designated area to provide space for a cabinet identification label.
- Doors are connected to the frame via an earthing cable in compliance with the applicable standards.

Doors – In case of only passive network equipment:

- A single cabinet door shall provide a visual through layered safety glass and contain an enclosed space for the locking mechanism
  - Door shall be hinged on two or three points, depending on the height of the door and their impact on the door stiffness. Door opening direction shall be able to be changed after installation.
  - Double doors shall be hinged on 2 x 2 points or 2 x 3 points depending on the door height.
  - The opened door shall be able to be taken off the cabinet without the use of tools. The top hinge pin may be longer than the other hinge pins to improve the ease of assembly.
  - The free-standing opening angle shall be 260 degrees. Opening angle of the door shall be 150 degrees in case the cabinets are bayed.
- The door shall be equipped with a two-point locking mechanism.
  - The locking mechanism and rods both for single and double doors shall be inaccessible to people without access to the cabinet interior to prevent tampering.
- Doors can be equipped with swivel handles from different manufacturers which and can hold locking mechanisms: standard swivel handle with half euro profile cylinder *or* standard swivel handle with combination lock with key override *or* electronic handle with RFID access *or* a SmartLock.
- For the integration and covering of cabling for electronic locking, cabling shall be enclosed within the door or covered with a cable management accessory. The integrated cable management shall be separated from moving components or outside influences *or* no door cable cover.
- The door shall have a logo plate with a designated area to provide space for a cabinet identification label.
- Doors are connected to the frame via an earthing cable in compliance with the applicable standards.

Sides:

- Sides of the cabinets shall be suitable for placing a single piece sheet metal side panel *or* no side panel.
- Side panels shall lock into place using two locking points per panel with: a toggle lock with a square key *or* a cylinder lock with a key.
- Side panels are connected to the frame in compliance with the applicable standards for earthing. An earthing clip attached to the height profile can provide a sure connection via a quarter turn lock. Because cabling can be forgotten to reinstall, and the earthing clip will automatically function after reinstalling the side panel, this feature can be considered an advantage over more commonly used methods.
- The same side panels shall be usable on the left and right side of the cabinet.
- It shall be possible to optionally place a *slide in side panel*™ between two bayed cabinets without the need to remove any of the cabinets, a (pre)installed half height divider shall, and a panel guide at the top and bottom of the cabinet, shall support both *slide in side panels*™. In this way it shall be possible to mechanically divide the interiors of neighbouring installed cabinets.

3.4: AIRFLOW OPTIMISED NETWORK CABINET

General:
An airflow optimised server cabinet should be able to be used as a universal 19”-cabinet suitable for housing common passive and active IT-equipment (server, storage, and connectivity equipment) and prevent conditioned air to leak away or be negatively impacted. This is important to ensure the highest possible energy efficiency and to facilitate a delta-P pressure-controlled aisle containment solution.

Applicable Standards:
- IEC 60297-3-100 or EIA-310-D/E
- IEC 60950 or ISO/IEC 30129 or EN 50310
- IEC 60529 (IP) and IEC 62262 (IK)
- EN 50600-2-4
- IEC 61587-1
- UL94
- IEC 62966-2
- REACH, RoHS, SCIP

Available Sizes:
- Width: 600, 800mm.
- Depth: 1000, 1200mm.
- Height: 1978, 2200, 2422mm.
- Available equipment space: 42, 47, 52U.

Finishing:
- Powder coated Black RAL 9005 fine structure *or* Signal White RAL 9003 fine structure.

Cabinet Load Capacity:
- Static load capacity of 1500 kg. Nominal load NL5 = 1500 kg according IEC 61587-1

Cabinet Stiffness:
- The cabinet complies to ST1 according IEC 61587-1

Cabinet impact resistance:
- The cabinet complies to IK07 according IEC 61587-1 / IEC 62262

Cabinet climatic and atmospheric resistance:
- The cabinet complies to class A1 and C1 according IEC 61587-1

Cabinet earthing specification:
- The cabinet complies to the earthing requirements of less than 0,1Ω between all metallic components according IEC 61587-1 without the use of separate earthing cables except for the door earthing cables.

Cooling principle:
- Cross flow with 80% perforated doors at the front and the rear of the cabinet, including airflow optimisation. Maximum air leakage at 5Pa static pressure should be below 40 m3/hr (2200mm height cabinet).

Frame:
The cabinet base shall be a lightweight, conductively interconnected aluminium frame. The frame consists at least of a top and bottom sub-frame, four height posts and means of attachment. The height profiles are bolted to the top and bottom sub-frames. In case of an 800 wide cabinet, two additional aluminium profiles are attached within each sub-frame in the depth direction. These profiles have similar mounting provisions, so that a 19inch mounting area can be achieved with the same components whilst maintaining equal performance and compliance.

- The frame height profiles shall have mounting grooves which can support stepless equipment and accessories installation. The frame shall support any relevant application according IEC 60917-1.
- The frame profiles in height, width and depth direction shall have threaded mounting grooves to which components can be attached such that conductive components are electrically connected. Earthing screws provide a secure earthing connection between the frame and component.
- The frame shall distribute the cabinet weight evenly over its contact surface with the floor.
- The frame of the cabinet shall provide the possibility for installation of a *slide in side panel*™ if bayed cabinets are not initially equipped with side panels. Bayed cabinets shall be provided with an airtight seal between them if the *slide in side panel*™ is not installed.
- When cabinets are placed in a row setup, the frame shall be bayed by means of 3x external baying brackets. External baying brackets shall be attached to the frames of two cabinets, such that both frames are electrically connected.
- The frame shall be completely earthed via a central earthing point which can be connected to the rack bonding conductor conforming ISO/IEC 30129 and EN 50310. The central earthing point shall facilitate the connection to a 16 mm^2 rack bonding conductor.
- Levelling feet:
    - The base of the frame shall be equipped with levelling feet which are easily accessible for adjustment with a standard tool from the inside of the cabinet *or* the base of the frame shall not be equipped with levelling feet.
    - Cabinet levelling feet are placed at an outwards position for increased stability and are connected directly to the frame to maintain the highest load capacity.
    - In case the cabinet has a depth dimension of 800, four levelling feet are required at the corners of the bottom sub-frame. If the cabinet depth is 1000 or 1200mm, two additional central levelling feet are required in the middle between the front and rear levelling feet to maintain the cabinet static load capacity*.
    - The base of the frame shall be equipped with levelling feet which are easily accessible for adjustment with a standard tool from the inside of the cabinet. If castors are installed, they do not limit the use of levelling feet.

** This does not apply to colocation cabinets or other variants where the force is transferred to the levelling feet without passing depth profiles or variants thereof. In such cases four levelling feet are sufficient.*

- Castors:
  - The base of the frame shall be equipped with four light duty swivel castors; the maximum dynamic load, including the weight of cabinet, shall not exceed 400kg. If the optional levelling feet are adjusted to support the cabinet, the static load capacity shall be 1500kg *or* the base of the frame shall not be equipped with castors.
  - Castors shall be positioned outwards such that the cabinet is stable while being moved and ramps with light slopes can be passed.

- Airtight plinth:
  - The base of the frame shall be equipped with a plinth for making an airtight front or rear of the cabinet. This plinth in combination with levelling feet provides a height adjustment range of 0-25 mm or seals the bottom in combination with wheels *or* the bottom of the frame is provided with two plinths for making an airtight front and rear of the cabinet, these plinths in combination with levelling feet provides a height adjustment range of 0-25mm or seals the bottom in combination with wheels *or* the base of the frame shall not be equipped with an airtight plinth.

- Logo:
  - If the front of the cabinet has no door, the front of the frame shall have a logo sticker with a designated area to provide identification of the cabinet.
  - If the rear of the cabinet has no door, the rear of the frame shall have a logo sticker with a designated area to provide identification of the cabinet.

Bottom & Roof:

The roof shall prevent dust and particles to enter the cabinet. It shall also allow proper cable entry into the cabinet.

- The roof shall be divided into one single main part and additional accessories.
  - The main roof panel shall be enforced if required to minimize hanging effects. These enforcements shall not limit the internal usable space or restrict the function of the cabinet.
  - The sides of the roof panel shall have a 100mm wide longitudinal cut-out providing access for IEC 60309 3-phase 32A plugs and shall be provided with ABS cover plates. The cut-outs shall have a provision for mounting cable brushes, cable guides with bend radius compensation or airtight cable throughputs, all of which can be applied in a pitch of 100mm. The full length of the cut-out shall be covered when all positions are utilized by accessories.
  - The longitudinal roof cut-outs shall extend from the front to the rear of the cabinet and shall align straight above the cabinet internal cable ducts to provide cable guidance without hinder or unnecessary loss of space for cabling.
  - An airtight barrier can be achieved by using the right accessories at the applicable positions of the cut-out in the roof.
  - The roof can have a cut-out in the middle for additional accessories. A similar interface to the longitudinal cut-outs can be installed to allow the installation of the same accessories at this position.
  - Divider panels can be installed on top of the roof and are unobstructed by the roof design.
- The frame depth profile or depth mounting rail shall provide a groove for mounting Cable Pull Relief or other accessories.
- On top of the roof, a modular cable duct divider system shall be able to manage copper, power and fibre cabling (structured cabling and patch cables). The cable duct system shall have a pitch of 100mm in the width direction of the channel. It shall be possible to place covers on the duct system to create an airtight duct that is protected against dust/debris and other forms of unwanted intrusion. The roof system shall have a provision for attaching cable ties. The cable duct system components shall correspond the width of the cabinet. The duct system shall alternatively have bridge components to connect two cabinets that are placed apart. These bridge duct components shall be available to create a duct or multiple ducts with a width of 100, 200 or 400mm.
- The cabinet roof panel shall not exclude the use of the mounting rails for other accessories. Neither the roof itself, nor any accessories installed to the frame in this way, shall negatively impact the airtightness.

Interior:

- The basic interior of the cabinet shall consist of four powder coated steel 19” Vertical Mounting Rails (VMR) according IEC 60297-3-100 and EIA-310-D/E in the same colour as the cabinet.
  - The 19” VMRs shall be provisioned, at the user facing surface, with a triple 9,5mm square hole pattern aligned with the cabinet height units (U) to accommodate front panels, chassis, sub-racks, and IT equipment.
  - The 19” VMR shall be provisioned at the side facing surface with an accessory mounting pattern with a pitch in line with the cabinet height units.
  - The 19” VMRs shall be numbered per height unit for identification. The numbering shall start at the bottom to enable easier identification for similar position on different height cabinets. If this configuration is not desired, exchanging the right and left 19” VMR would reverse the order of numbering. Reversed numbers are not added to maintain a singular definition per position.
  - The 19” VMRs shall be provisioned, at the user facing surface, with a hole pattern for the optional attachment of cable management accessories *or* with a blind surface.
  - The 19” VMRs shall be placed at 125 *or* 230 mm from the front of the cabinet. This distance is defined between the front surface of the 19” VMR and the front surface of the door.
  - The distance between the front and rear of the 19” VMRs shall be 590mm in case of an 800mm deep cabinet *or* 740mm in case of 1000mm and 1200mm deep cabinets. This distance shall be adjustable to any position within the boundaries of the frame, these positions are not limited by predefined increments.
- The VMRs shall be connected to the frame so that the load of installed equipment is distributed to the frame without unnecessarily involving additional components.
  - The VMRs shall be able to be positioned at any place with a minimum of 60mm from the front or rear of the cabinet.
  - Reaching the attachments used for the VMRs shall be ergonomically feasible and can be done from inside the cabinet.

    - The placement of the VMRs can be identified using optional distance indicators along the profiles on which the VMRs are installed.
- The cabinet shall be provided with an airtight barrier along the front VMRs in case of “cold containment” (conditioned air comes from within the contained space), or along the rear VMRs in case of “hot containment” (conditioned air comes from outside the contained space). VMRs are configured with a 60 (70 for a 600mm wide cabinet) to 150mm depth adjustable *or* 60 (70 for a 600mm wide cabinet) to 250mm adjustable version.
    - The air barrier to contain conditioned air continues from the front VMR plane to the top and bottom of the cabinet via airtight plates. These top-bottom plates extend beyond the front position of the VMR to provide a designated reach for flexible VMR placement. The maximum VMR distance depends on the variant of the top-bottom plates and other accessories.
    - 600mm wide cabinets shall be equipped with side plates to prevent air from leaking via the left and right sides of the cabinet. These side plates shall be attached to the 19” VMRs and the vertical frame profile to create an airtight seal between these components *or* 800mm wide cabinets shall be equipped with side plates to prevent air from leaking via the left and right sides of the cabinet. These side plates shall be attached to the vertical frame profile and to side skirts which are attached to the 19” VMRs to create an airtight seal between these components. Side skirts are practically an airtight extension of the VMR towards the side plate.
- Cable trays
    - 2 vertical 300mm cable trays are assembled of which one at the left and one at the right of the cabinet halfway between the front and rear 19” VMR. The PDU cable trays shall have a provision for toolless mounting of PDUs.
- The cabinet shall support a vertically mounted 0U rack-PDU in the rear of the cabinet at any of the following different places. For a 800mm wide cabinet between the 19” VMR and the side of the cabinet facing the rear door opening *or* 2 fold on the rear height post facing the centre of the cabinet *or* in front of the 19” VMR facing the rear door opening *or* on the rear height post facing the centre of the cabinet.

Doors:

- (front and/or rear Single cabinet door shall provide 80% perforation and contain an enclosed space for the locking mechanism *or* in case of a double cabinet door, provide 80% perforation and contain a space which can be closed off for critical parts of the locking mechanism *or* a single cabinet door shall provide a visual through layered safety glass and contain an enclosed space for the locking mechanism *or* single cabinet door shall provide no visual of the interior and contain an enclosed space for the locking mechanism.
    - The high 80% perforation shall give an optimal balance between high energy efficiency due to low air obstruction and mechanical performance.
    - Door shall be hinged on two or three points, depending on the height of the door and their impact on the door stiffness. Door opening direction shall be able to be changed after installation.
    - Double doors shall be hinged on 2 x 2 points or 2 x 3 points depending on the door height.
    - The opened door shall be able to be taken off the cabinet without the use of tools. The top hinge pin may be longer than the other hinge pins to improve the ease of assembly.
    - The free-standing opening angle shall be 260 degrees. Opening angle of the door shall be 150 degrees in case the cabinets are bayed.
- The door shall be equipped with a two-point locking mechanism.
    - The locking mechanism and rods both for single and double doors shall be inaccessible to people without access to the cabinet interior to prevent tampering.
- Doors can be equipped with swivel handles from different manufacturers which and can hold locking mechanisms: standard swivel handle with half euro profile cylinder *or* standard swivel handle with combination lock with key override *or* electronic handle with RFID access *or* a SmartLock.
- For the integration and covering of cabling for electronic locking, cabling shall be enclosed within the door or covered with a cable management accessory. The integrated cable management shall be separated from moving components or outside influences *or* no door cable cover.
- The door shall have a logo plate with a designated area to provide space for a cabinet identification label.
- Doors are connected to the frame via an earthing cable in compliance with the applicable standards.

Sides:

- Sides of the cabinets shall be suitable for placing a single piece sheet metal side panel *or* no side panel.
- Side panels shall lock into place using two locking points per panel with: a toggle lock with a square key *or* a cylinder lock with a key.
- Side panels are connected to the frame in compliance with the applicable standards for earthing. An earthing clip attached to the height profile can provide a sure connection via a quarter turn lock. Because cabling can be forgotten to reinstall, and the earthing clip will automatically function after reinstalling the side panel, this feature can be considered an advantage over more commonly used methods.
- The same side panels shall be usable on the left and right side of the cabinet.
- It shall be possible to optionally place a *slide in side panel*™ between two bayed cabinets without the need to remove any of the cabinets, a (pre)installed half height divider shall, and a panel guide at the top and bottom of the cabinet, shall support both *slide in side panels*™. In this way it shall be possible to mechanically divide the interiors of neighbouring installed cabinets.

APPENDIX 1 STANDARDS

1. Cenelec EN 50600-1:2019 Information technology - Data centre facilities and infrastructures - Part 1: General concepts.
2. Cenelec EN 50600-2-2:2019 - Information technology - Data centre facilities and infrastructures - Part 2-2: Power supply and distribution.
3. Cenelec EN 50600-2-4:2015 - Information technology - Data centre facilities and infrastructures - Part 2-4: Telecommunications cabling infrastructure.
4. Cenelec CLC/TR 50600-99-1:2019 information technology - Data centre facilities and infrastructures - Part 99-1: Recommended practices for energy management (CLC version of the EU Code of Conduct on Data Centre Energy Efficiency).
5. Cenelec EN 50310:2016 Telecommunications bonding networks for buildings and other structures.
6. Cenelec EN 13501-1 Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.
7. ISO-IEC 30129 Telecommunications bonding networks for buildings and other structures.
8. 2020 Best Practice Guidelines for the EU Code of Conduct on Data Centre Energy Efficiency Version 11.1.0.
9. EIA/ECA-310-E (Revision of EIA-310-D) Cabinets, Racks Panels, and Associated equipment.
10. IEC 60917-1:2019 Modular order for the development of mechanical structures for electronic equipment practices - Part 1: Generic standard.
11. IEC 60297-3-100:2008 Mechanical structures for electronic equipment - Dimensions of mechanical structures of the 482,6 mm (19 in) series - Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets.
12. IEC 60529:1989+A1:2001+A2:2013 Degrees of protection provided by enclosures (IP Code).
13. IEC 60950-1:2006 + C1:2006 +C11:2008 + A11:2009 + A1:2010 + A12:2011 + C12:2011 + A2:2013 Information technology equipment - Safety - Part 1: General requirements.
14. IEC 60309-1 ed 4.2 2012 Plugs, socket-outlets and couplers for industrial purposes - Part 1 : general requirements.
15. IEC 60309-2 ed 4.2 2012 Plugs, socket-outlets and couplers for industrial purposes - Part 2 : dimensional interchangeability requirements for pin and contact-tube accessories.
16. IEC 60320-1 2015 Appliance couplers for household and similar general purposes - Part 1 : general requirements.
17. IEC TR 60083 February 2009 Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC.
18. IEC 62966-1/Ed.1.0 2019 Mechanical structures for electrical and electronic equipment – Aisle containment for it cabinets – Dimensions and mechanical requirements
19. IEC 62966-2/Draft 2019 Mechanical structures for electrical and electronic equipment – Aisle containment for it cabinets – Details of air flow, air separation and air cooling requirements
20. ROHS: Restriction of Hazardous Substances - 2011/65/EU (RoHS 2).
21. EN 61000 - Electromagnetic compatibility (EMC).
22. EN 16005 - Power operated pedestrian doorsets - Safety in use - Requirements and test methods.