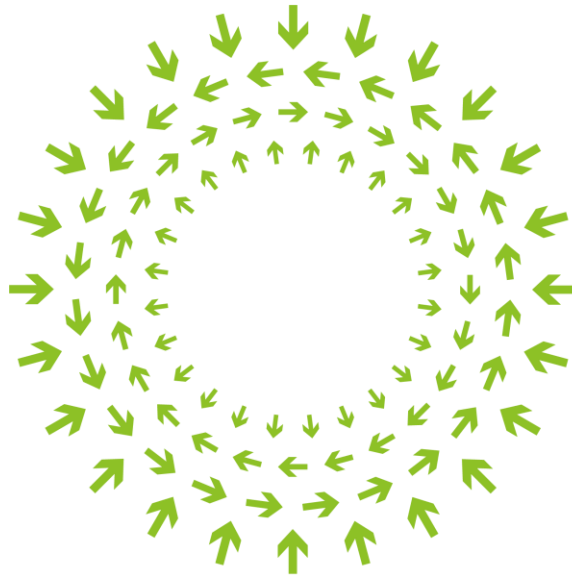




OPEN

Compute Project

DC Power Distribution Unit for V2 Open Rack

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Scope

This specification defines the technical requirements for a custom DC PDU, used for DC power distribution in a data center. At system level this device shall be installed in IT chassis and will work in conjunction with the OCP OpenRack V2 design. The DC PDU will be powered via the V2 PowerShelf.

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Overview

The DC PDU is designed to accept a nominal DC input voltage of 54V. The DC PDU box will house various power and signal connectors which will be used to power the switches and a rack monitoring device, as well as send signals to the monitoring device. There will be no fuses or other secondary safety devices in this PDU.

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1 Electrical Features

1.1 Basic Electrical Features

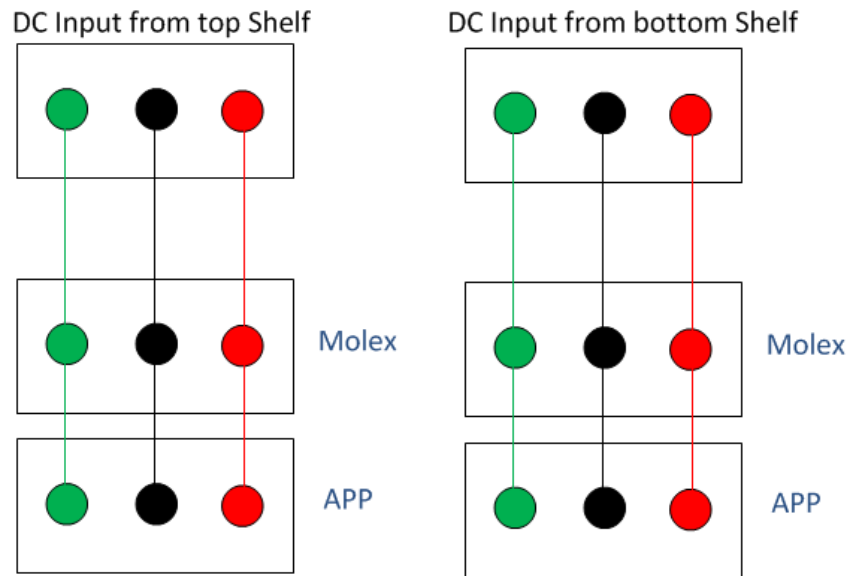


Figure 1: **Electrical schematic**

The PCB should be 2mm thick with double side copper layers of at least 2 oz (70 microns). The current per square millimeter should not exceed 4A/mm² density.

1.1.1 Input Rating

The DC PDU is designed to accept a nominal DC input voltage of 54V but can range from 40V to 72V from the V2 PowerShelf. A maximum of 600W total is allocated to power the switches and a rack-monitoring device. Each PowerShelf is capable of providing the 600W by itself, or, if two shelves are present in the rack, each will supply 300W.

1.1.2 Input Connection

The Input connector should be a female Molex Saber 7.50mm receptacle housing with a latch (44441-2003) with the Molex Saber crimp female terminal (43375-0001). The chosen connector is polarized and contains a latch for a secure connection.

The connector will be connected via a UL2586 AWG#14 three-wire cord that delivers power to the DC PDU box via a suitable strain relief. The two input power cord lengths are defined in the mechanical diagram below. The cord should be a suitable industrial-grade power cable, Underwriter Laboratories (UL) recognized and Conformité Européenne (CE) certified, with the three conductors enclosed in a further insulating layer so that it resembles a single cable when viewed externally.

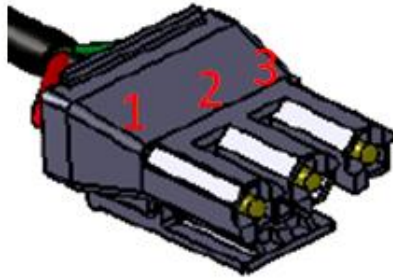


Figure 2: **Molex 44441-2003**

Pin 1 is denoted as '+54Vdc' (red)

Pin 2 is denoted as 'RTN' (black)

Pin 3 is denoted as 'GND' (green)

1.1.3 Rack Monitor Input

There will be two RJ45 input connectors located on the DC PDU box which will be connected from each PowerShelf.

NOTE: The colors in the following figure are not standard.

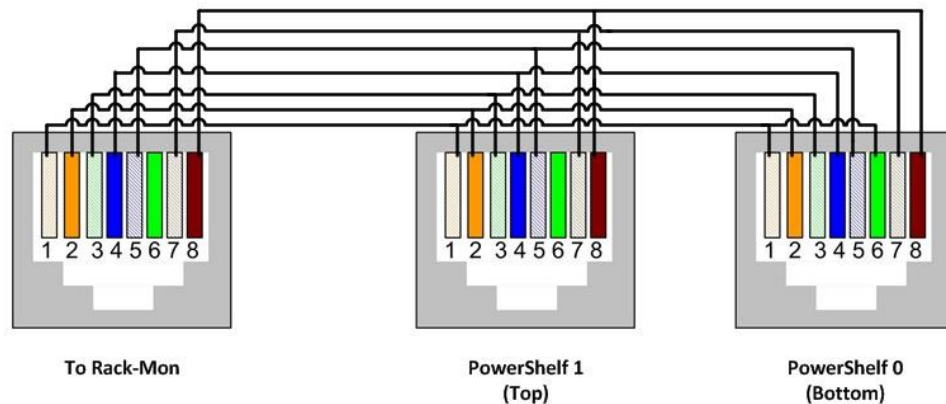


Figure 3: **Communication wiring**

1.2 Output

There will be four power outputs and one RJ45 communication output. There will be two Molex Sabre Male (P/N: 43160-3103) connectors as well as two APP P/N: 115169G1 (PP15) all connected via right angle connectors on the PCB. The connector orientation should be as shown on the PDU. To ensure rigidity, board locks should be used for the connectors. Mounting wings are preferred for the Anderson Connector to securely fasten it to the board. Two 5mm green LEDs shall also be placed on the bottom surface of the PDU connector to indicate that a valid 54Vdc nominal voltage is present (40 to 72Vdc).

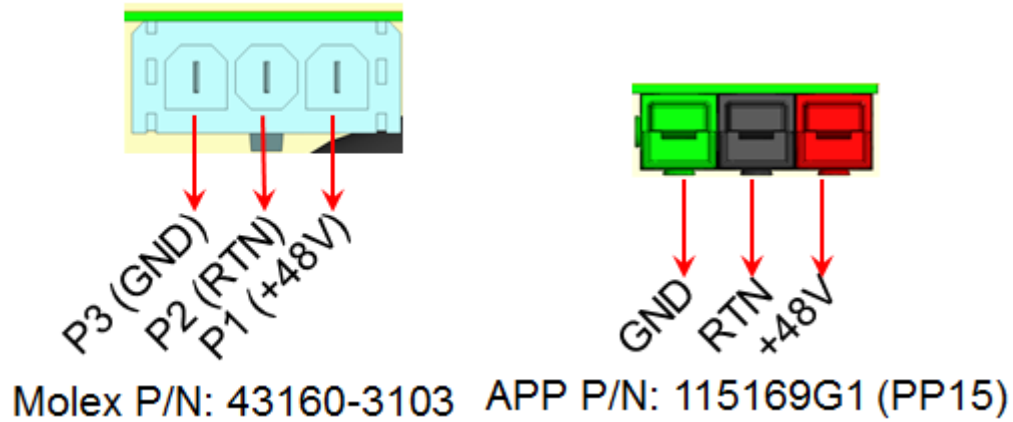


Figure 4: DC output connectors

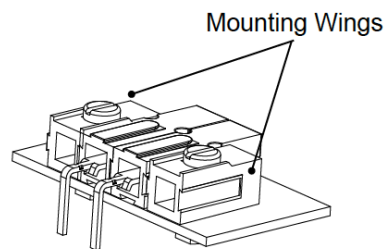


Figure 5: Anderson PowerPole Mounting Wings

1.2.1 Output Polarity

The output polarities of the DC connectors are defined in Figure 4 above.

2 Mechanical

2.1 Dimensions

The PDU shall be sized as per the mechanical drawing at the end of this specification.

2.2 Mounting Interfaces

The DC PDU should be mounted using five tabs. It shall be locked in with the two latches both on the top surface of the PDU, which allows for toolless installation. The latches should be green, preferably Pantone 375C. Refer to the mechanical drawing at the end of this specification.

2.3 Finish

The DC PDU chassis should be made by pre-plated metal and painted per RAL 9005 JET BLACK. The DC PDU shall have the appropriate silk screening in a permanent and legible manner in a high contrast color, such as RAL 9010 PURE WHITE as shown in the mechanical diagram below.

3 Regulatory Compliance Approvals

3.1 Agency Approval

The DC PDU shall be UL recognized and in accordance with the UL/CSA 60950-1 safety standard, as well as CE certified and restriction of hazardous substances (RoHS) compliant.

3.2 Production Line Test

3.2.1 High Potential Test

Full production, 100%, of the DC PDU shall comply with the minimum Hi-Pot (High Potential) test described below. The test shall be applied between the DC input side (+54Vdc and return) to the earth ground chassis (GND).

Parameter	Setting
Voltage	500Vdc (minimum)
Trip current sensitivity	10mA (maximum)
Voltage ramp time	100V/s (minimum)
Dwell time	1 second (minimum)
Breakdown arc detection	10μS (maximum)

3.2.2 Voltage Polarity Test

One hundred percent of the DC PDU should be verified for correct polarity as per Section 3.3.1.

4 Environmental

4.1 Temperature

4.1.1 Operating Ambient Temperature

The ambient operating temperature range should be from -5°C to +45°C.

4.1.2 Storage

The storage temperature range should be from -40°C to 70°C.

4.1.3 Transit

The transportation temperature range should be from -55°C to 85°C (short term storage, 72 hours).

4.2 Humidity

4.2.1 Operating

Operating relative humidity, 10% to 90% (non-condensing).

4.2.2 Non-operating

5% to 95% relative humidity, 38.7°C maximum wet bulb temperature with no cosmetic damage.

4.3 Altitude

4.3.1 Operating

The operating altitude with no de-rating should be from 0 to 10,000 feet (0 to 3,000 meters), altitude change rate between testing conditions to be at least 2,000 ft/min.

4.3.2 Non-operating

The non-operating altitude with no de-rating should be from 0 to 49,000 feet (0 to 15,000 meters), altitude change rate between testing conditions to be at least 2,000 ft/min.

4.4 Vibration and Shock

The DC PDU should meet shock and vibration tests per IEC78-2-(*) & IEC721-3-(*) with the specifications listed below. During operating vibration and shock tests, the devices shall exhibit full compliance to the specification without any electrical discontinuities. During non-operating tests, damage of any kind, including physical damages, should not occur nor hinder the functionalities of the devices per the specifications below.

4.4.1 Vibration Operating

Sinusoidal vibration: 0.25 G zero to peak. Frequency is 10 to 500 Hz, 0.25 oct/min in each of three mutually perpendicular axes. Three sweeps from 10 to 500 to 10 Hz in each axis shall be tested.

4.4.2 Vibration Non-operating

Sinusoidal vibration: 0.75 G zero-to-peak, 10 to 500 Hz, 0.5 oct/min. The test shall be one sweep from 10 to 500 Hz in each of the three mutually perpendicular axes.

4.4.3 Shock Operating

Half sine wave shock: 5 G, 11ms duration, three half sine wave shocks in each direction of three mutually perpendicular axes.

4.4.4 Shock Non-operating

Half sine wave shock: 140 G, 2ms duration, half sine wave shock in each direction of three mutually perpendicular axes. There shall be one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs.

5 Reliability, Quality, Miscellaneous

5.1 Spec Compliance, Quality, FA, Warranty

- The vendor is responsible that the PDU meets the specifications as stand-alone unit as well as at the system level. The vendor is also responsible for assuring that the PDU shipped in production will conform to this specification, with no deviations.
- A specification compliance matrix will be submitted for each PDU revision.

- The vendor is responsible for exceeding the production quality standards achieved on the pilot run build, without fluctuations.
- Failure analysis on defective RMA units shall be provided with a corrective action plan, within two weeks after units are received at the vendor's facility.
- The vendor shall warrant the PDU for defects & workmanship for a period of two years from the date of shipment, when the device is operated within specifications. The warranty is fully transferable to any end user. A standard VOID warranty sticker shall be applied.

5.2 Mass Production: First Article Samples

Prior to final project release and mass production, the vendor will submit a few production pilot run samples, including the following documentation:

- All the pertinent development docs, production docs, and reports, necessary to release the product for mass production.
- The pilot samples shall be built in the allocated facility for mass production, and using hard tooled chassis and parts (where applicable).
- A full specification compliance matrix, full test report, and production line final test PASS tickets.
- Samples that passed the burn-in process planned for production (if any).
 - Samples must be shipped using a shipping box that is approved for production.
- A mechanical FAI report shall be submitted that shows compliance with all of the notes and dimensions in the mechanical drawing shown in Section 8 below.
- The units are certified, and the safety label is applied (*)

(*) A Pending Certification sticker may be allowed until the certification process is complete.

5.3 Quality Control, Process, Burn-In

- Incoming Quality: < 0.1% rejections
- Cpk values will exceed 1.33 (Pilot Build & Production)

5.4 Packaging

The PDU shall be shipped using a custom package. The quality of the packing assembly will be such that the PDU will not be damaged during transportation. Units must arrive in optimum conditions and be ready for immediate use.

A shipping box shock test shall be proposed by the vendor and submitted to the recipient for audit and approval.

5.5 Documentation

The vendor shall provide the following documentation (prototypes may not include portions of these documents) if applicable:

- Schematics, component placement, board layout (PDF format)

- Build of materials list, including an approved vendor list (AVL)
- Mechanical drawings (PDF format. Native 3D files and/or DXFs will be provided to perform collaborative work on the design, for seamless device integration at the system-level chassis)
- High potential test, ground bond test, isolation, surge test, thermal test

NOTE: The vendor shall propose a qualification test plan and a reliability test plan.

5.6 Change Authorization, Revision Control

Once the project is released to mass production, no design changes, AVL (Approved Vendor List) changes, manufacturing process or materials changes are allowed without prior written authorization from Facebook.

An AVL is a list of all the components listed in the BOM. Any change requests must be submitted with proper documentation showing the details of the changes, and reason for the changes, including changes affecting form, fit, function, safety, or serviceability of the product. Major changes in the product (or in the manufacturing process) will require re-qualification and/or re-certification to the product. Thus, a new set of first-article samples may be required to complete the engineering change order (ECO) process.

Any modifications after approval would phase-in during production without causing any delays or shifting the current production schedule. Enough ECO advance notice shall be given to all appropriate entities in the supply chain in such occurrences.

Revision Control: copies of all ECOs affecting the product will be provided to the Vendor for sign off.

6 Mechanical Drawing

Please review the mechanical drawings for the DC PDU.

