



Facebook

Open Rack Specification V2

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1.0 Introduction

1.1 Goal

This document will provide the detailed product specification that a rack supplier needs to develop Facebook's implantation of Open Rack V2.

1.2 License

License

As of January 5, 2015, the following persons or entities have made this Specification available under the [Open Compute Hardware License Agreement \(OCPHL-R\)](#): FACEBOOK.

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1.3 Reference Documents

06-000060 Facebook Mechanical drawing for the rack and any sub-assemblies under this assembly.

2.0 Rack requirements

2.1 Geometry

Height: ~2210mm nominal

Width: 600mm nominal

Depth: 1067mm nominal

OpenU Height: 48mm

The rack must comply with all dimensions, tolerances and specifications defined by the 2D Facebook mechanical drawing 06-000060 and the Open Compute Standard V1.1.

2.1.1 Base Rack Config

The Rack will consist of a base framework with additional optional add-on kits. The base rack frame will provide the lowest orderable config. This base rack config will support 500kg of IT gear under the dynamic conditions in section 2.31.

2.1.2 Heavy Rack Config

In addition to the base config, the rack may be upgradeable to support a heavy config with additional bolt on members. In this config, the rack will support 1400kg of IT gear under the dynamic conditions in section 2.31.

The rack must be convertible between the base configuration and the heavy configuration (and the other way around) in the field using hand tools. Side access to the rack during conversion is allowed, but discouraged.

Rack shall provide support for 2 PDU as defined by Facebook specification 06-000060.

2.2 Optional Rack Kits

This section describes the requirements for the different optional add-on kits. It is expected that the all of the rack kits will be provided by the rack manufacturer. Each of the kits shall be designed so it can be removed and installed in the rack while in the field.

Each optional kit shall conform to the associated 2D Facebook mechanical drawing supplied for each kit.

2.2.1 Side Panel

The side panel provide a way of preventing air recirculation when the rack is located at the end of the row. The kit will consist of a pair of panels.

The side panel need to stay in place what the rack is rolled around during the movement tests described in [2.4](#). This kit will not be installed when the rack is shipped, so it does not need to pass transport testing.

It is preferred that the side panel will install without the need of tools or hardware.

There should be only one side panel that installs into either the left or right side of the rack at a time since the panel is used at the end of a cabinet row.

This kit must comply with the mechanical print to that it is interchangeable amongst suppliers.

2.2.2 IT support bracket

The IT support bracket is an optional kit that provides a limited shelf for support of the IT gear in the rack.

The IT Support shall:

- support 80kg per set under dynamic load as defined in section 2.31 without taking any permanent deformation.

- support 50kg static load applied to the leading 25mm of the support brackets without taking any permanent.

People must be able to remove the IT Support brackets from inside the rack. People will NOT have access from the outside of the rack.

2.2.3 Power Shelf Support bracket

The power shelf support bracket provides a retention area for the FB power shelf. The bracket set shall be capable of supporting 50kg under the dynamic conditions specified in section 2.31.

2.2.4 EIA to OpenU Rack Adapter

The adapter will convert traditional 1U EIA gear to a single OpenU slot. The adapter will support a weight 12kg under the dynamic conditions specified in section 2.31. The attachment to the IT gear will be defined by Facebook engineering. Tools may be used to attach the adapter to the IT gear.

2.2.5 Zone 2 Kit

Racks that are located in a row benefit from support provided by the racks next to them under seismic conditions. This kit will be added on to the base rack and provide a physical connection

between adjacent racks in a row. A set of 3 racks tied together with this kit will pass a seismic load test per NEBS GR63 in section 2.31 with an evenly distributed IT load of 1400kg. A single or pair of racks does not need to comply.

This kit will provide any parts and hardware needed to install the kit onto the rack. Access to the rear of the power shelf cannot be impeded by the kit so that service can be performed without removing the kit. Tools may be used to install and remove this kit. Installation access is only from the front, top or rear surfaces of the rack and may use hand tools for installation and removal.

2.2.6 Zone4 Kit

In Highly seismic areas, the rack must provide protection for the equipment. This add-on kit will provide connection between up to 3 racks and any additional support need to protect the IT gear under NEBS GR63 Zone 4 in section 2.3.1. This kit will provide any parts and hardware needed to install the kit onto the rack. Access to the rear of the power shelf cannot be impeded by the kit so that service can be performed without removing the kit. Installation access is only from the front, top or rear surfaces of the rack and may use hand tools for installation and removal.

2.2.7 Dual to single power zone convertor strap

The base config of the rack comes with 2 power zones. For certain low power configurations, the rack will need a kit that will allow power to travel from the lower power zone to the upper power zone. The kit will consist of 2 small busbars that will bridge the gap between the 2 zones and the hardware needed to attach them. All of the hardware used to make this connection will be stainless steel.

This kit must comply with the mechanical print to that it is interchangeable amongst suppliers.

2.2.8 Floor Power Conduit

In traditional raised floor data centers the AC power is provide under raised floor tiles. This kit consists of a protective conduit for the AC cable to run from under the floor to the top of the rack where Open Rack V2 is provided power in Facebook designed data centers. This kit will allow Open Rack V2 to safely deploy in more traditional data center locations.

2.2.9 Hot-aisle Air Containment

This Kit will fill the area from the top of the rack to the interface with the data center located 2206.4mm above the floor. This kit may use tools for assembly and disassembly if needed. The Kit will be installed by data center technicians once the rack arrives onsite.

This kit must comply with the mechanical print to that it is interchangeable amongst suppliers.

2.2.10 PDU Blanking Panel

This kit will fill the void in the rack canopy when a PDU is not installed in the rack to prevent air re-circulation.

2.3 Structure

The rack will have a rating for the IT load. The IT load rating will include all of the power systems, IT gear, IT support brackets, PDUs and cables added into the rack, but excludes the weight of the rack weldment, busbars, or optional rack kits.

2.31 Dynamic Conditions

The rack is required to support the rated IT load under the following conditions:

- 1> Shipping under ASTM D4169-09, Assurance Level II, Mechanized handling, truck, no stacking, distribution cycle 2, with the rack levelling feet raised and using packaging approved by the end user.
- 2> NEBS GR63 zone 2 with the rack levelling feet lowered. Racks may be ganged together using the Zone 2 kit into a triplet prior to test.
- 3> NEBS GR63 zone 4 with the rack levelling feet lowered. Racks may be ganged together using the Zone 4 kit into a triplet prior to test

2.32 Leveling Feet

The rack will provide 4 levelling feet to remove the weight off of the casters once deployed in the data center. The feet shall:

Be delivered from the rack supplier in the raised condition and stay in that condition under ASTM D4169-09 as defined in 2.31.

Be capable of raising and lower the feet to their maximum height using only an electric driver with a hex bit 8mm across the flats

Be capable of cycling three times up and down under maximum IT load without damage to the rack or the leveler.

Be capable of supporting the rack under maximum weight under the GR63 zone 4 as defined in 2.31.

Will have a swivel base to prevent the rack from walking when the feet are deployed.

Be capable of raising the rack casters a minimum of 35mm off of the floor.

2.33 Seismic Bolt Locations

The rack will provide 4 slots 19mm in diameter for seismic bolts located per Figure 1 and 3xM12 nuts to receive seismic bolts located as shown in Figure 2. These locations shall be capable of supporting the rack under maximum weight under the GR63 zone 4 as defined in 2.31.

Clearance must be provided for installation and removal of the seismic bolts and needed tools.

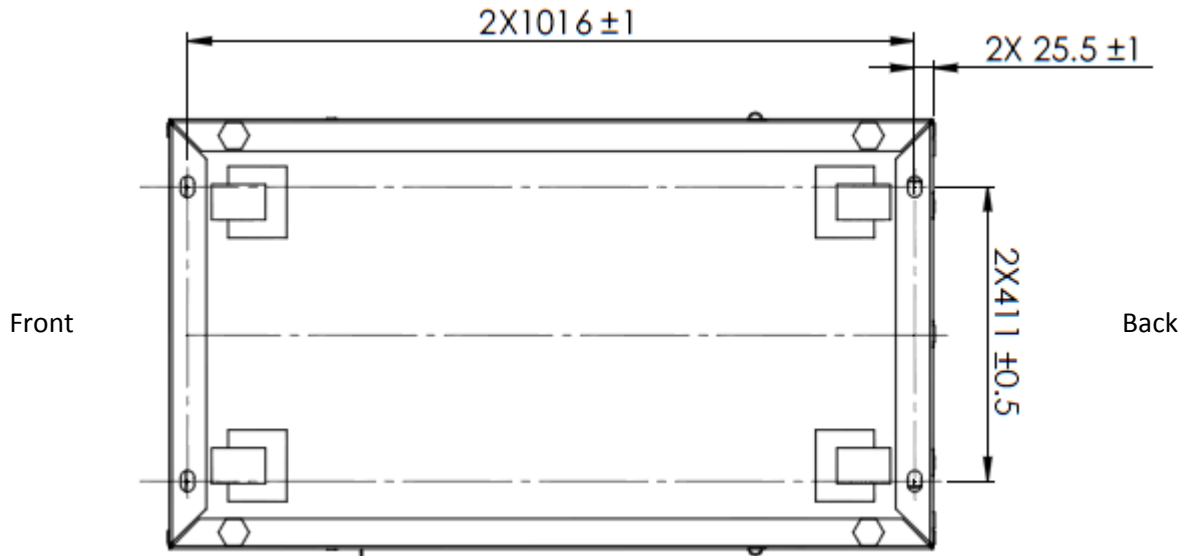


Figure 1. Seismic bolt hole locations

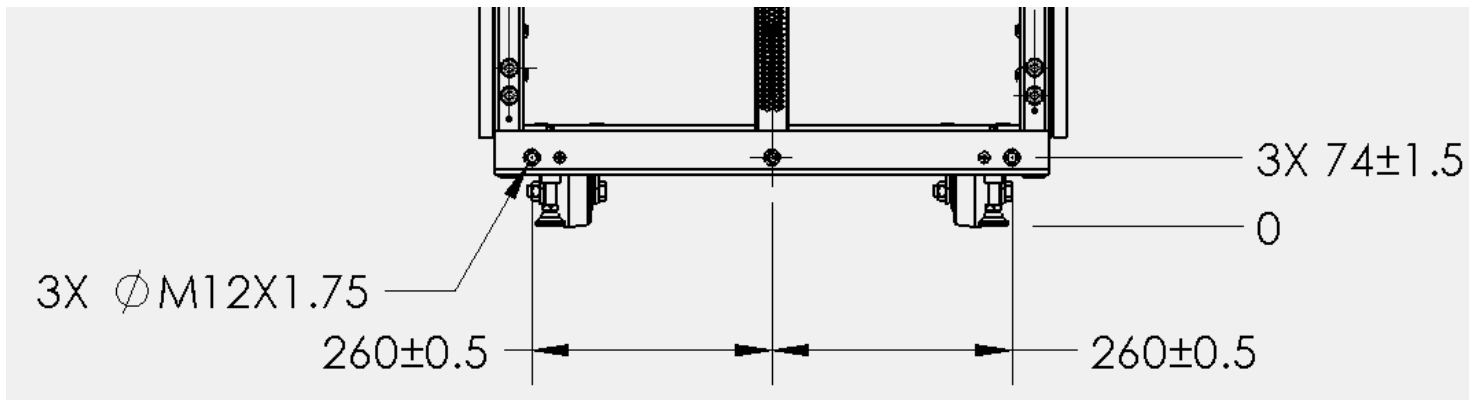


Figure 2. Rear Seismic bolt locations

2.4 Movement

The following tests will be performed with the rack at the maximum rated IT load.

- Roll over a 6mm vertical step with each caster independently at 0.5m/s
- Transitioning a 1" wide gap in the floor while fully loaded at 0.5m/s
- Transition a 5 degree ramp
- Roll a minimum of 800m on a concrete floor at 0.8m/s

After completing the four tests above, the

force (kgw) required to push the rack from a non-moving position along a smooth, flat cement floor shall be less than 5% the total combined weight (kgw) of the rack and IT Gear.

All of the casters will swivel.

Rack shall have entry and exit angle of 15 degrees minimum.

2.5 Expected Life

Rack should be designed for an expected life of 10 years under the following environmental conditions:

Operating Temperature: 65F to 85F

Humidity: 85%max, 42F dew point minimum

2.6 Cable

Cables should be retained out of the path of the equipment bay so equipment will not damage cables during installation and removal.

Cables can be added and removed from the cable retention without tools.

To prevent cable damage, sharp edges and burrs must be removed around cable routing areas.

2.7 Color

Rack will painted with a low-gloss black powder coat such as RAL9005 except where needed to provide a ground path per [2.8](#).

2.8 Electrical

Provide 2XM5X0.8 nut features as an electrical ground to mate with McMaster-Carr 6926K211 lug or equivalent. Ground path should be plated or protected so that the conductivity of the ground path is protected from rust and corrosion over the life of the product. All ground points should pass rust grade 6 per ASTM D610-01 after 48 hours of salt spray per ASTM B117-07.

Rack shall provide an electrically conductive path from the IT equipment in the rack to the rack grounding lug on the top of the rack. This path cannot pass through any surfaces that are not protected from rust and corrosion such as un-plated surfaces. All rack ground paths should pass rust grade 6 per ASTM D610-01 after 48 hours of salt spray per ASTM B117-07.

Rack shall provide an exit hole on the top of the rack directly above the PDU to allow a WIP connector IEC60309-2, 5 pin, Type 4 to pass while connected to the PDU. Since the rack supports 2 PDUs, an exit hole is required on each side of the rack.

Rack shall provide an exit hole in the bottom of the rack 25mm x15mm minimum in size under each cable zone in the front of the rack to allow for a data cable under the floor to pass to the cable zone.

Busbars shall provide an electrical interface approved by Facebook to the power shelf. All hardware used to create an electrical connection to the busbar, such as screws, washers, studs and nuts, shall be made of stainless steel.

All of the busbar subassemblies including the busbars, busbar cages and insulating supports for the busbars inside the cage should be considered a single field replaceable unit (FRU). Tools may be used to remove the busbar subassemblies from the rack.

Busbars will provide an electrical interface to the DC busbar clip that meets Facebook's voltage drop requirements after 100 cycles of the DC busbar clip.

2.9 Regulatory

Comply with UL UL60950-1 / EN60950-1:2006 / IEC60950-1 and RoHS directive 2002/95/EC

3.0 Revision History

Author	Revision		Date
Steve Mills	1	Initial Release	21AUG13
Steve Mills	2	2.4 ADD friction limit; 2.2.9 ADD Top Hat Kit	21OCT13
Steve Mills	3	2.4 adjust friction limit	4DEC13
Steve Mills	4	General edits; 2.12 Increased weight to 1400 kg; 2.2.3 increase shelf weight to 50kg; 2.32 add length and swivel; 2.3 FIGURE 2 changed; 2.2.8 DELTED cable kit; 2.8 added support for under rack data cable	11 APR 14
Steve Mills	5	Add 2.2.8 as floor power conduit kit	14MAY14
Steve Mills	6	2.2.2 Change IT bracket mass to 80kg per shelf; 2.7 add RAL9003	23MAY14
Steve Mills	7	2.6 Change Bolt location elevation for M12	15SEP14
Steve Mills	8	Clarify:2.2.1; 2.2.5;2.2.6; 2.2.7; 2.2.9; 2.2.10 added	15JAN15
Steve Mills	9	Change 2.7 from RAL 9003 to 9005	15APR15
Steve Mills	10	Update license	23APR15
Steve Mills	11	2.3.1 Update per IC feedback "...levelling feet raised and using packaging approved by the end user."	8 JUN 15
Steve Mills	12	2.6: replace last sentence with "To prevent cable damage, sharp edges and burrs must be removed around cable routing areas." Formally approved for release by OCP	9JUL15