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## ORv3 48V Busbar and Connector Update



**OCP**  
GLOBAL  
SUMMIT

NOVEMBER 9-10, 2021

# ORv3 Busbar and Connector Update

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# What has Changed for ORv3



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- 48V Standard using Laminated Bus Bar
- Power Shelf uses connector instead of bolted connection to busbars and can be placed at any location in the rack
- Additional Bus Bar Connector Features:
  - Increased Current Capacity for Connectors
  - Chassis Ground Contacts on Connectors
  - Sense Contacts in the IT Gear Connector
- Dimensional Changes to the Bus Bar
  - Wider Opening
  - Conductive Surface on the Bus Bar Cage Interior
  - Busbar is Touch Safe


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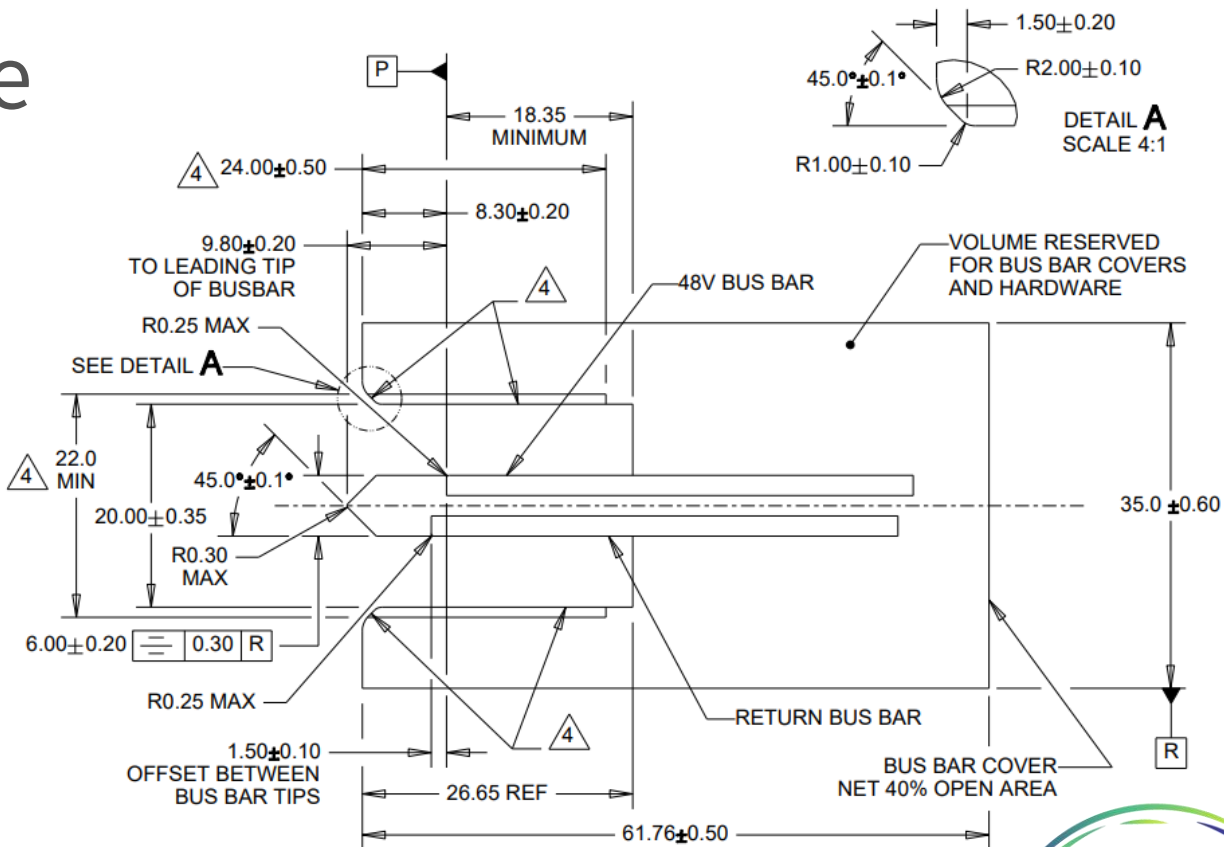


# Busbar Profile

## Notes:

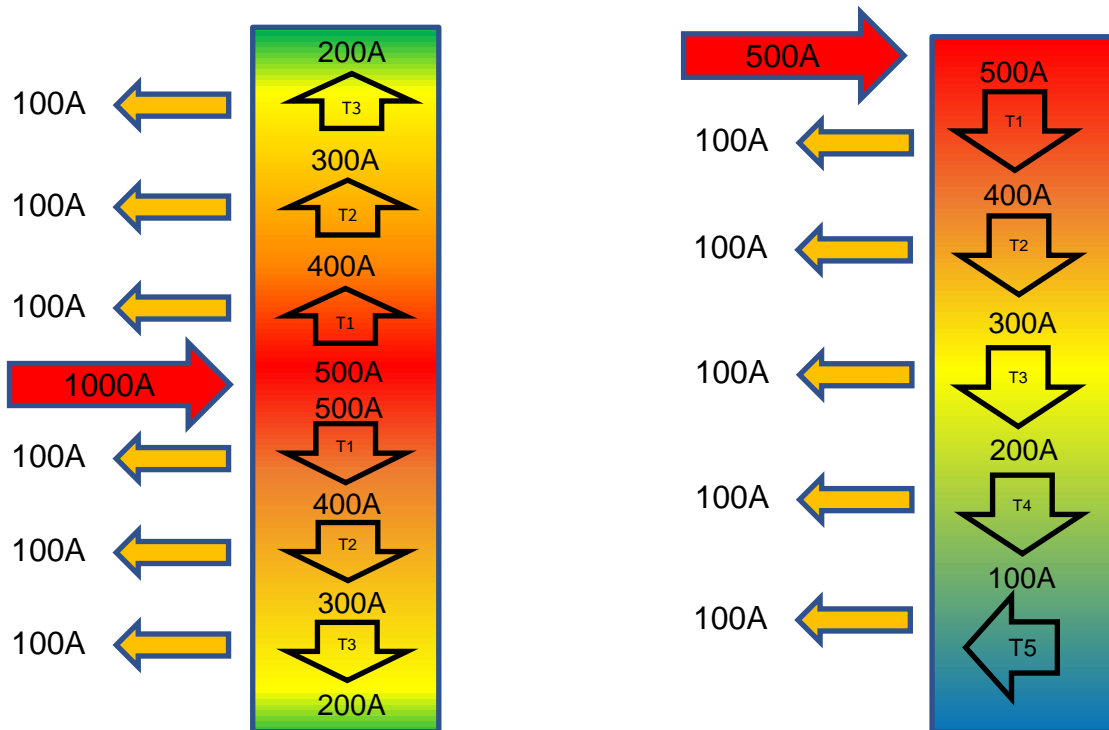
1. Busbars shall be silver plated
2. Leading edges of busbar interfaces shall be free of burrs
3. Busbar depth to remain inside of rack

 Conductive surface for chassis ground contact



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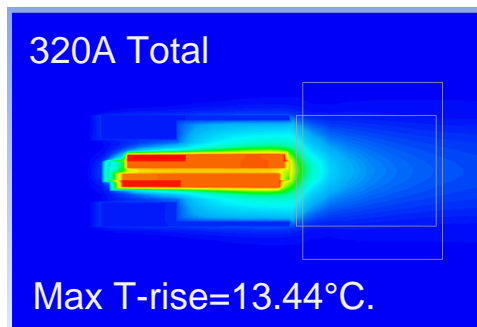
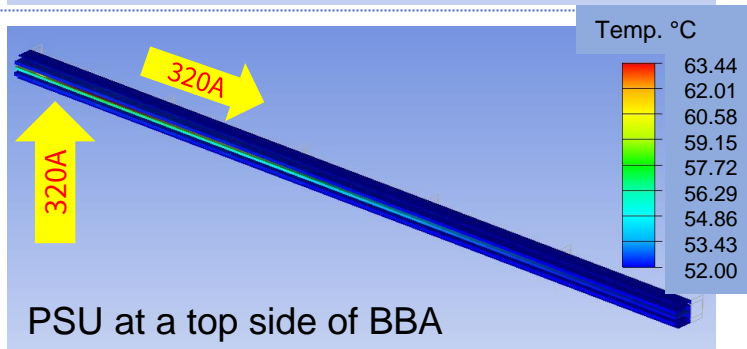
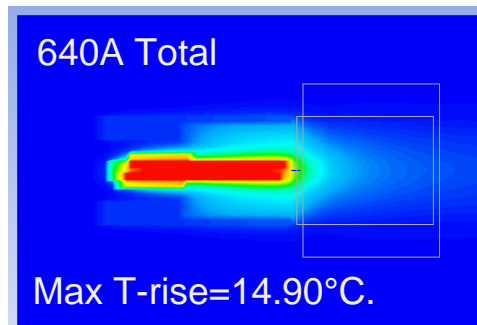
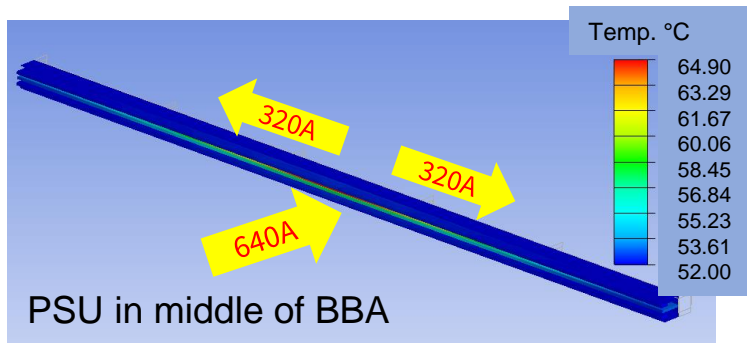
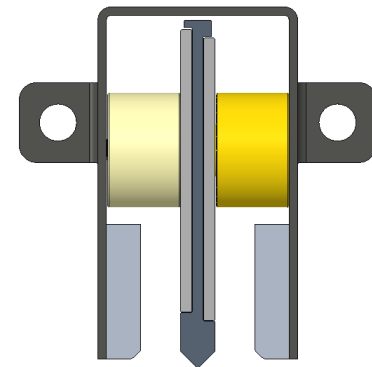
# Single vs Dual Directional Current Flow



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# Busbar Thermal Analysis

**Flat Busbar:** Ambient temperature: 52°C. With 2.05m/s Airflow

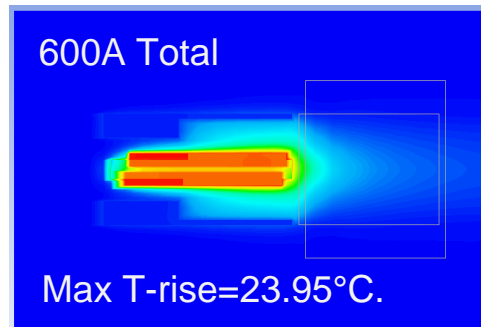
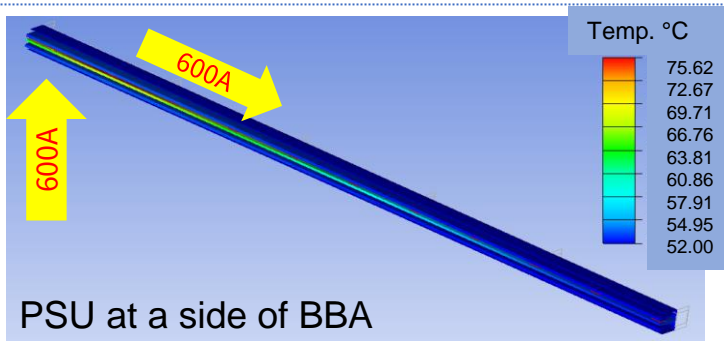
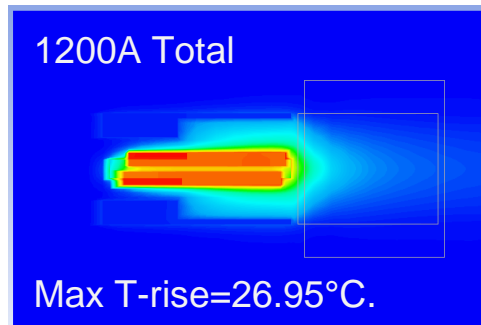
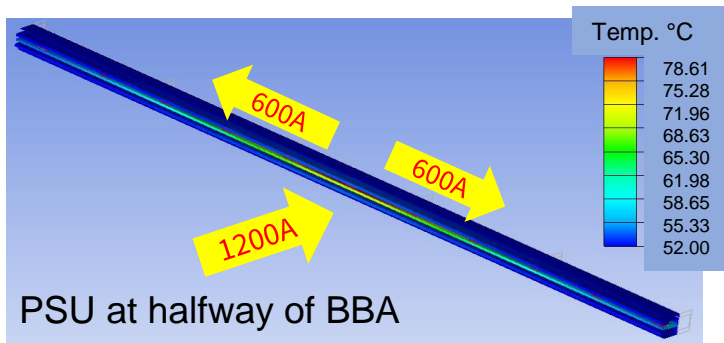
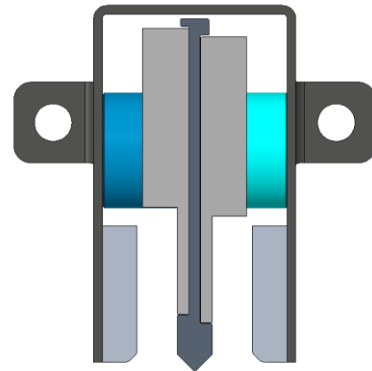


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# Busbar Thermal Analysis

## Stepped Busbar:

Ambient temperature: 52°C. 600A in each direction . With 2.05m/s Airflow

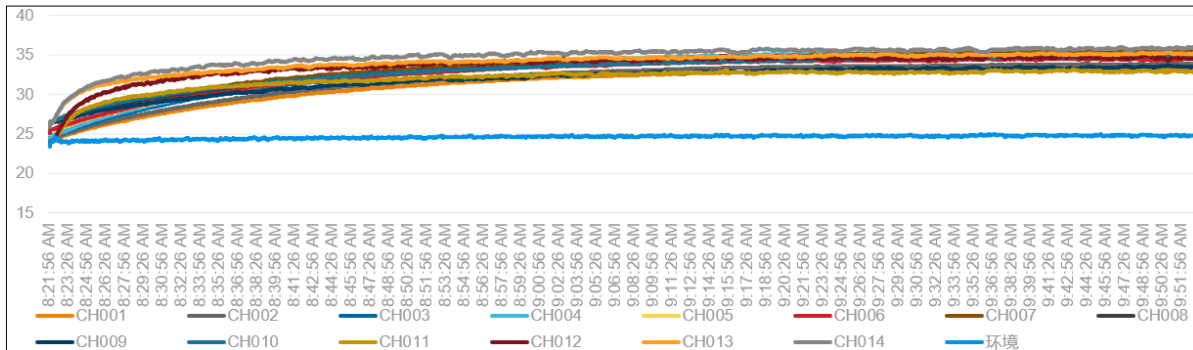
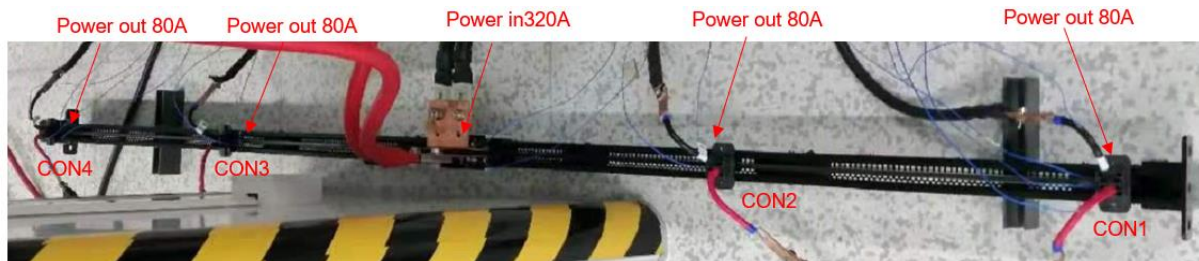


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# Busbar T-rise test

## T-rise Testing Thermocouple Locations

320A@48V DC test for 90min, 80A DC output 4 places as shown below(0.5 M increments)



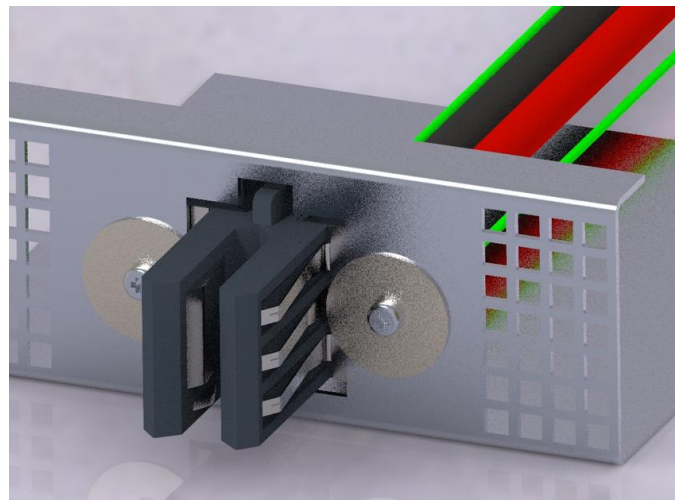
- Ambient Temperature: 25°C
- No Airflow
- Max T-rise=11.5°C

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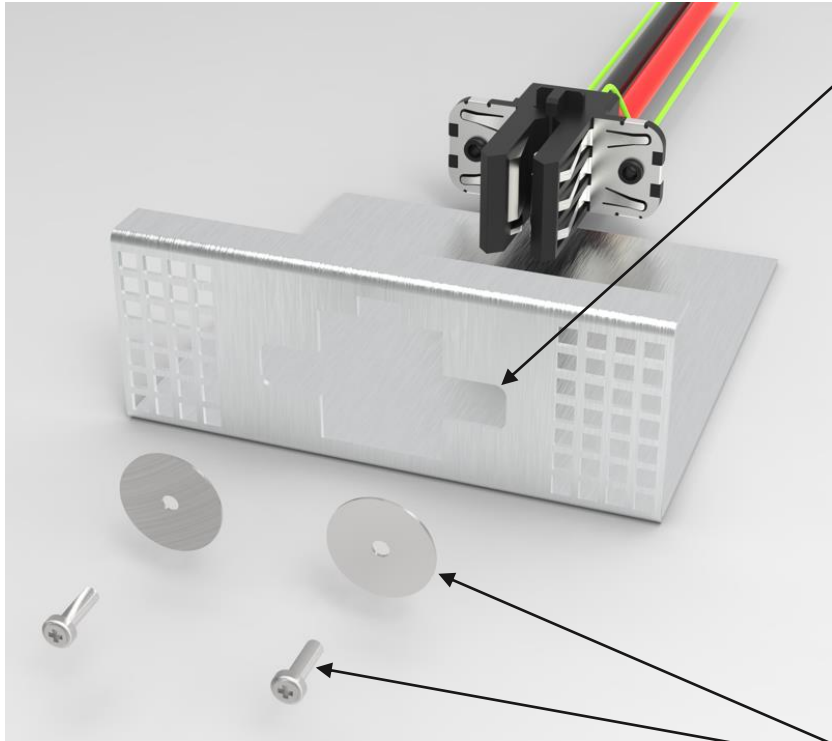
# IT Gear Connector

- Derived from existing OCP 48V Cable to Bus Bar IT Gear Connector
- Dedicated Chassis Ground Contact
  - Contact to Bus Bar Cage
  - Mate First – Break Last
  - Shall Conduct 2x Rated Current for 2 Minutes
- New Sense Contact
  - Mate Last – Break First
- Additional Horizontal Float
  - Was  $\pm 2.0\text{mm}$  Horizontally, now  $\pm 3.0\text{mm}$
- Increased Current Carrying Capacity
  - ORv2 was 75A max, ORv3 is now 100A max per contact

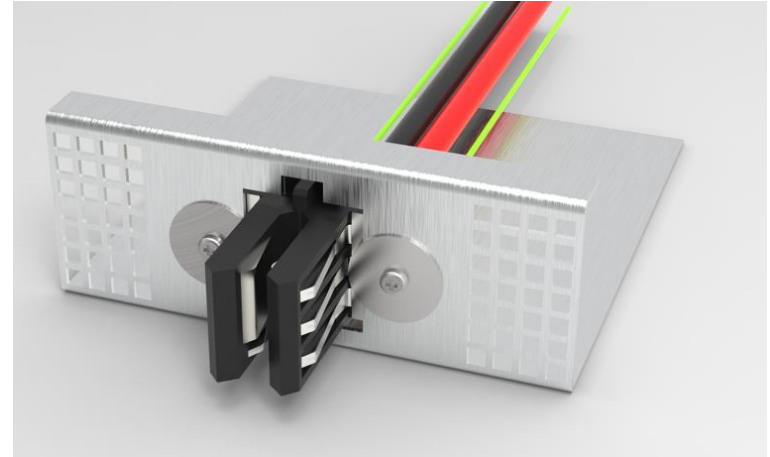


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# Screw Mounted IT Gear Connector



Panel cutout allows  $\pm 3.0\text{mm}$  horizontal and  $\pm 2.0\text{mm}$  vertical float



M3 Screws with 20mm diameter washers

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# Screw Mounted IT Gear Connector

Laminated Busbar with  
increased lead in-chamfer  
2.25mm x 45° per side

Bus Bar Frame with  
front lead in ground  
features



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Mounting Hardware (Screws  
and Washers) Not Shown

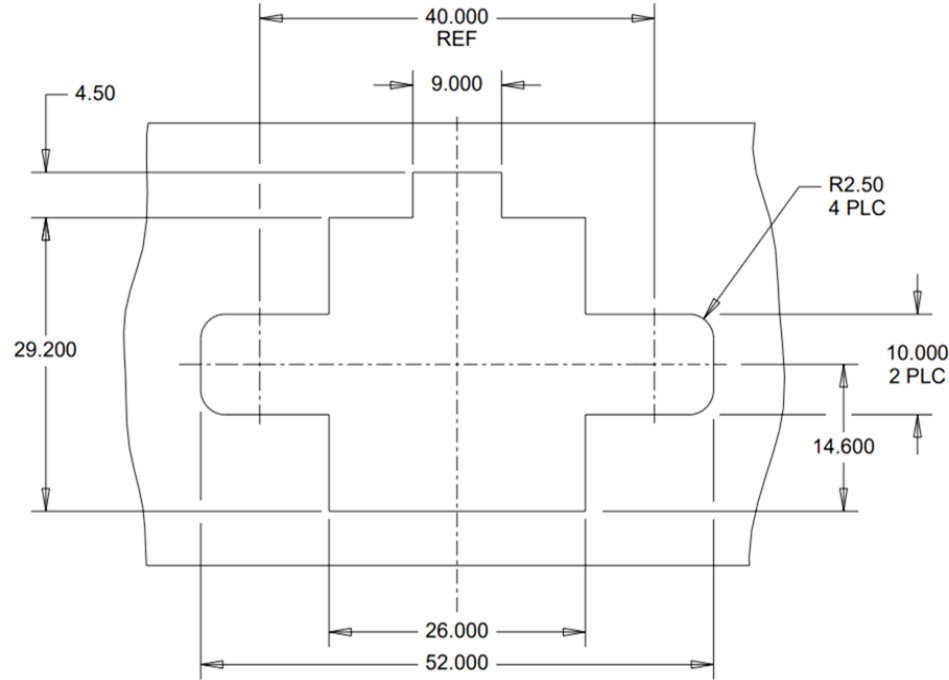


Supplemental Chassis  
Ground Contacts positively  
connect IT Gear Chassis to  
Busbar / Rack Frame



# Screw Mounted IT Gear Connector

## Screw Mount Connector Panel Opening Detail

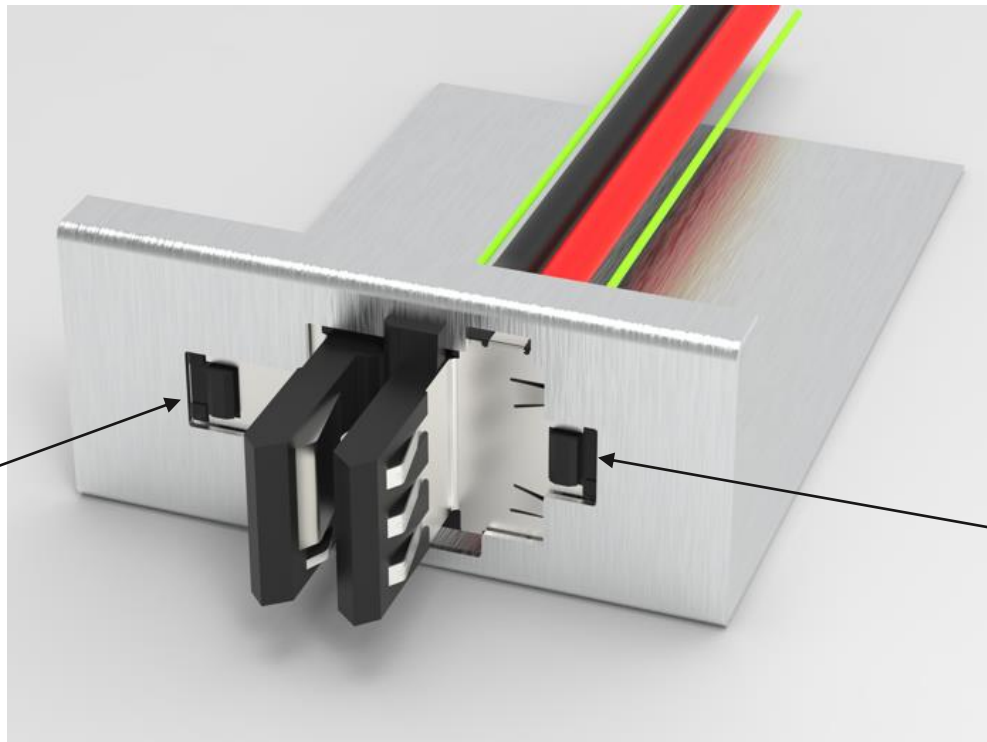


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# Toolless Mounted IT Gear Connector

Panel cutout  
allows  $\pm 3.0\text{mm}$   
horizontal and  
 $\pm 2.0\text{mm}$  vertical  
float

Anti-  
Rotation  
Feature



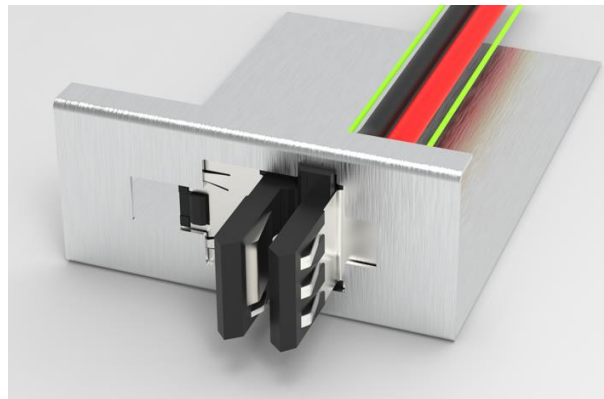
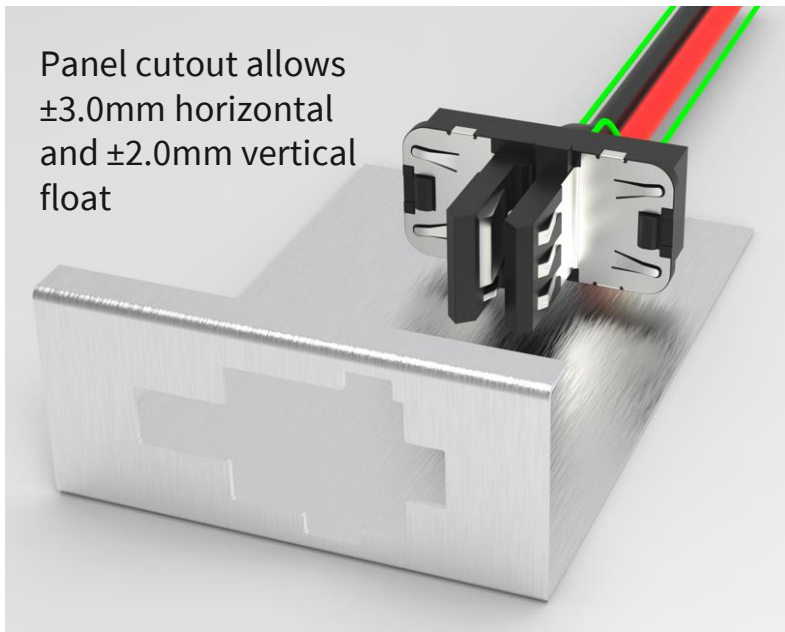
Anti-Rotation /  
Locking  
Feature

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# Toolless Mounted IT Gear Connector

## Assembly Steps

Panel cutout allows  
 $\pm 3.0\text{mm}$  horizontal  
and  $\pm 2.0\text{mm}$  vertical  
float



Connector inserted  
though panel  
opening



Connector moved  
toward the center  
and locking latch  
engaged which  
prevented  
connector from  
moving such that it  
can be removed

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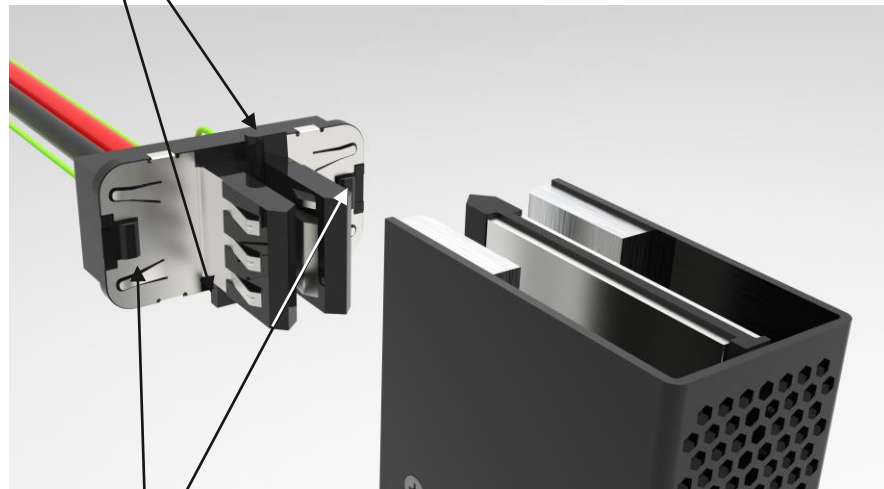
# Toolless Mounted IT Gear Connector

Laminated Busbar with  
increased lead in-chamfer  
2.25mm x 45° per side

Bus Bar Frame with  
front lead in ground  
features



Mounting Flanges Retain Connector  
to the panel (not shown)



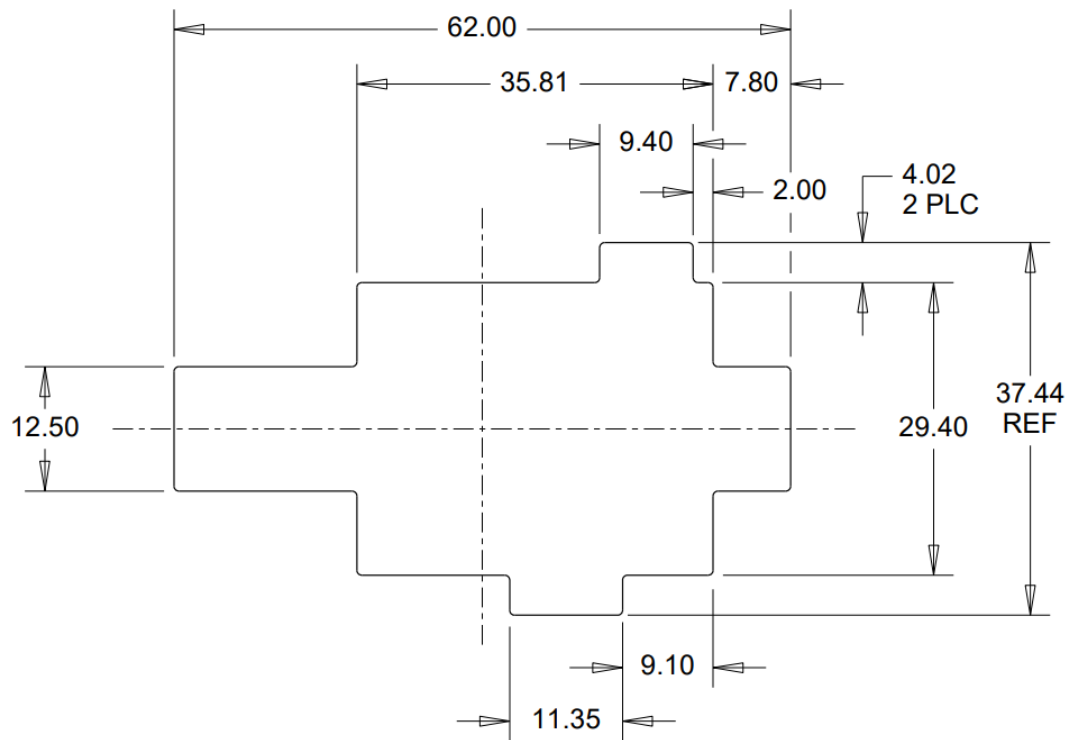
Anti-Rotation  
Feature or left, anti-  
rotation/locking  
feature on left

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# Toolless Mounted IT Gear Connector

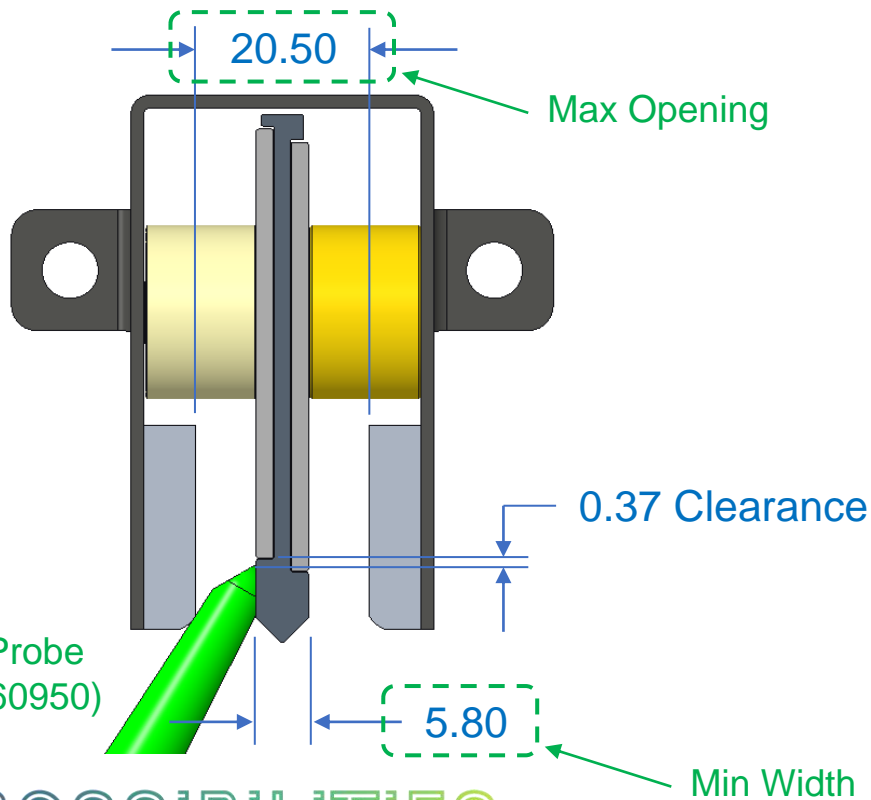
Toolless Mount  
Connector Panel  
Opening Detail



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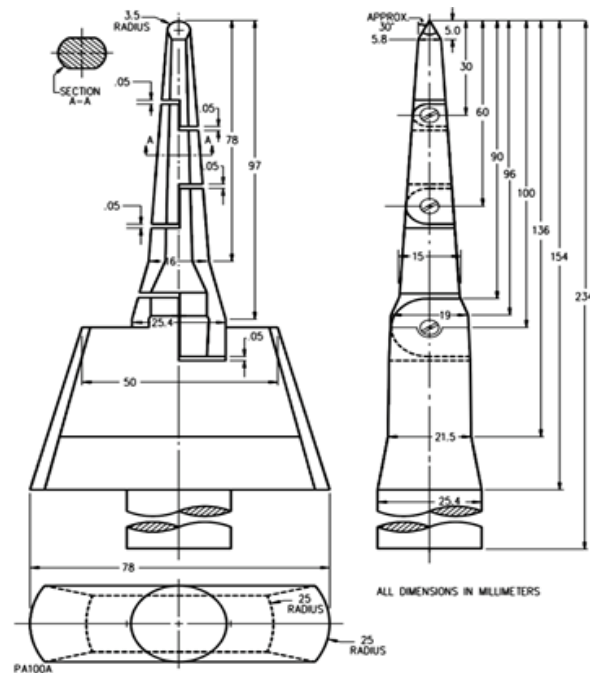


# ORv3 Busbar Touch Safe



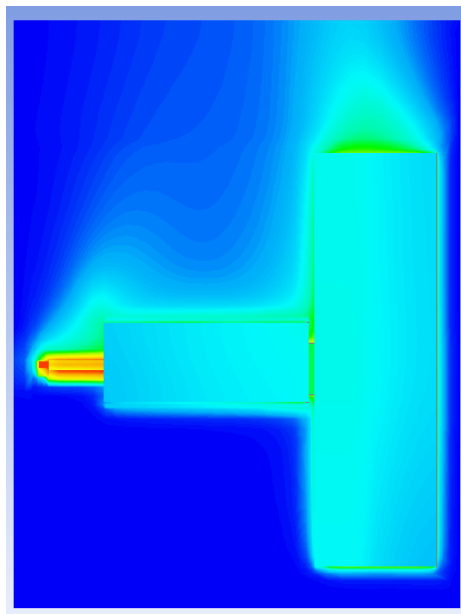
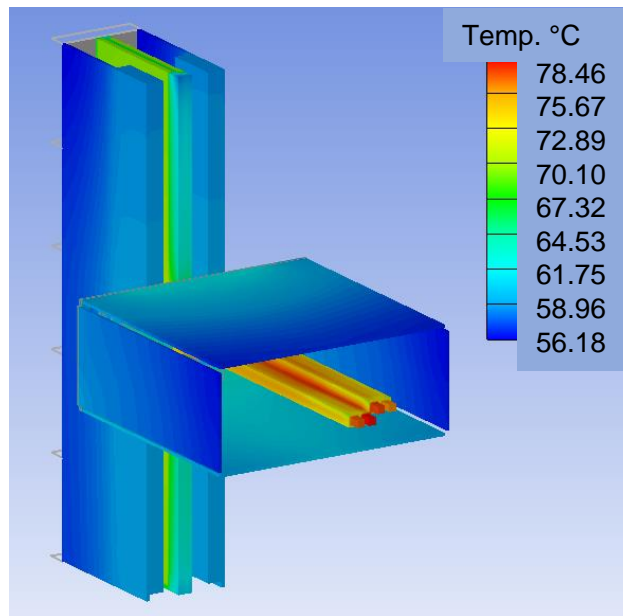
## UL 62368 Finger Probe (Thinner than UL 60950)

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# Power & Chassis Ground Contact Thermal Analysis

Simulation Conditions: Ambient temperature: 52°C, 100A on 48V power and return.  
64A on chassis ground contacts (32A each), No Airflow



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# Power Shelf 48V Output Connector

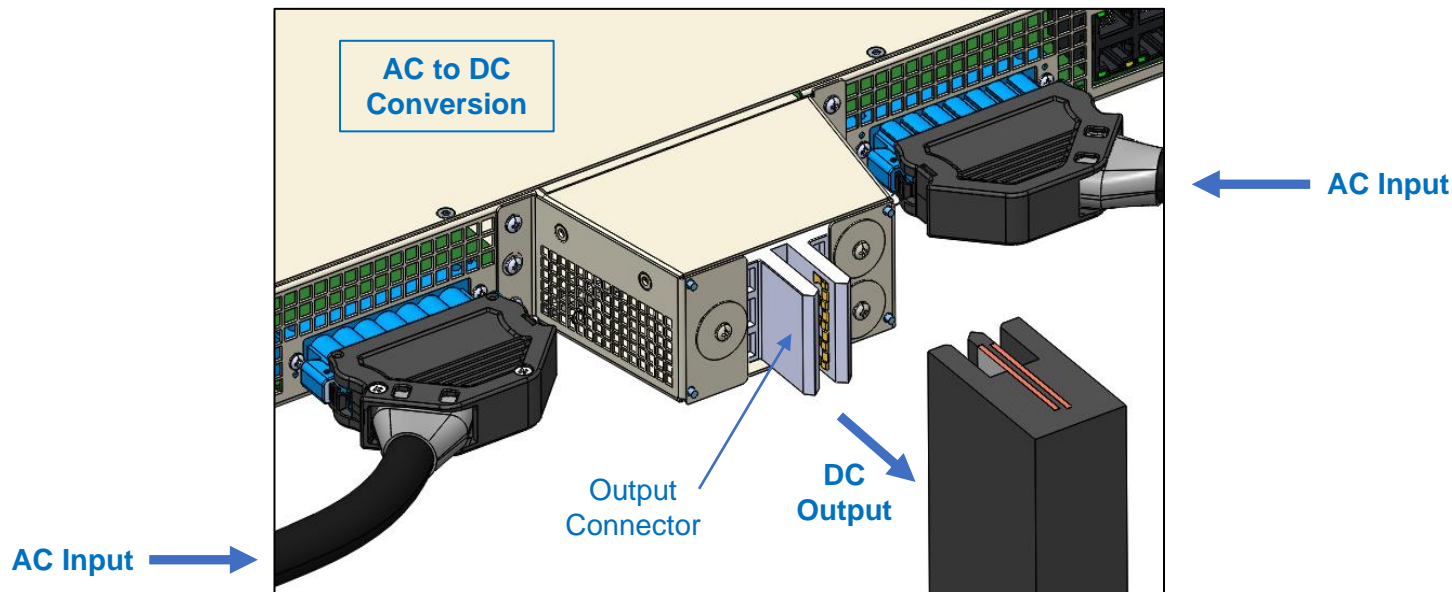
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# Power Shelf 48V Output Connector

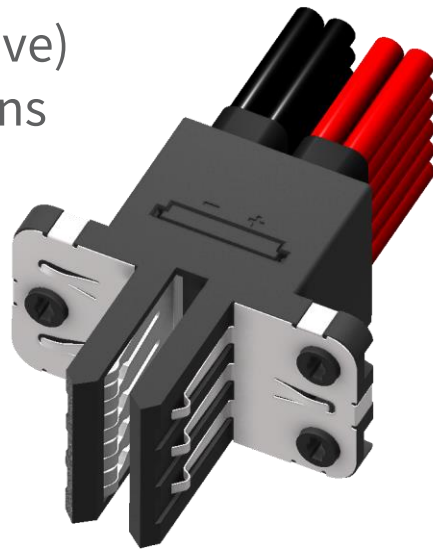
- Interface between Power Shelves and Busbar



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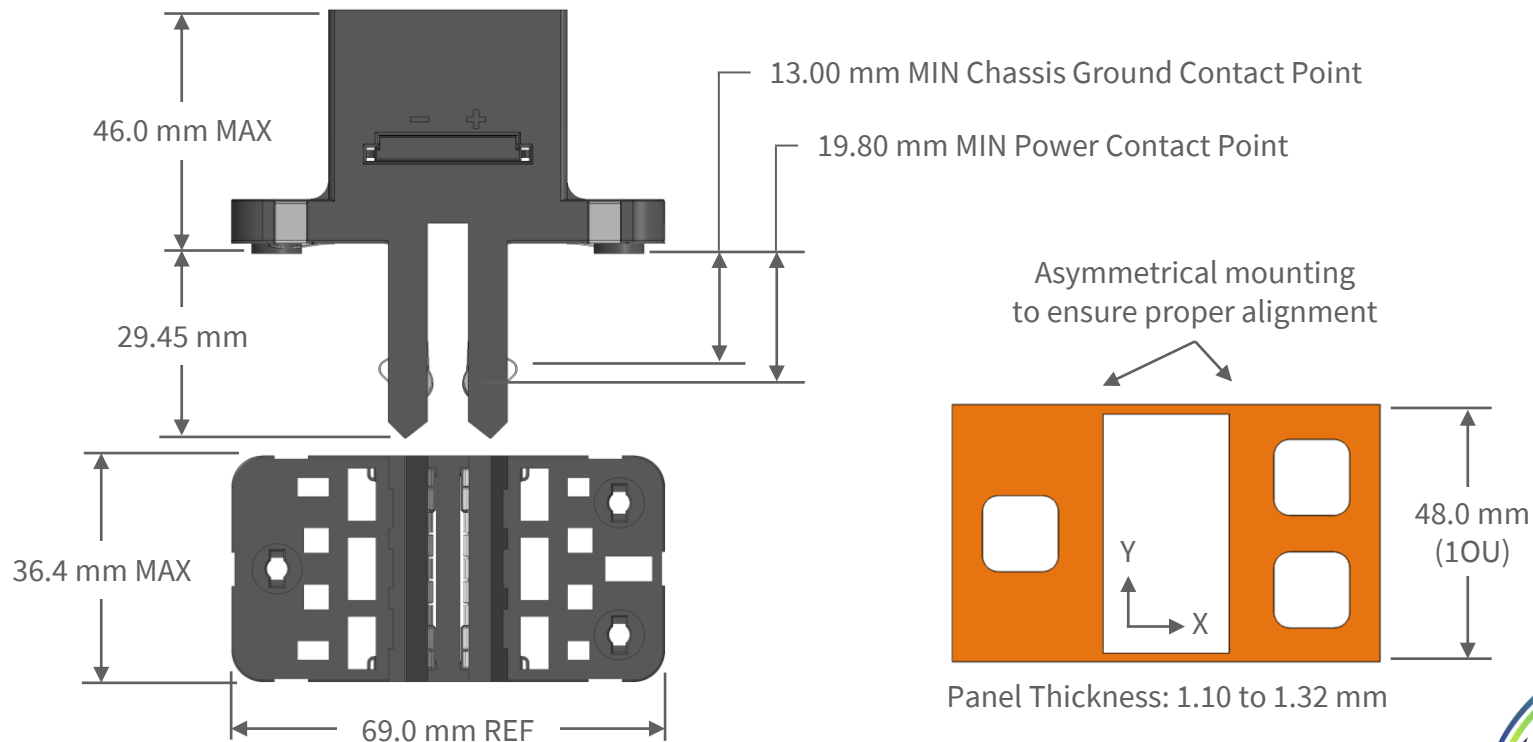
# Power Shelf 48V Output Connector

- 360A Load + 360A Return (30°C t-rise, still air)
- 500A Load + 500A Return (45°C 300 LFM airflow)
- Maximum voltage drop: 14mV @ 360A; 20mV @ 500A
- Chassis Ground Contact
  - 64A total for 2 minutes (32A/contact)
- Panel Thickness: 1.10 – 1.32 mm (inclusive)
- Panel Float:  $\pm 3.0$  mm in X and Y-directions



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# Power Shelf 48V Output Connector



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# Call to Action

## Contacts:

- TE Connectors: Kelli Bretz ([ksbretz@te.com](mailto:ksbretz@te.com))
- TE Power Cable Assemblies: Pat DiPaola ([pat.dipaola@te.com](mailto:pat.dipaola@te.com))
- TE Busbars: Lily Zhang ([lily\\_zhang@te.com](mailto:lily_zhang@te.com))
- Amphenol Connectors: Carmelo Cruz ([carmelo.cruz@amphenol-icc.com](mailto:carmelo.cruz@amphenol-icc.com))
- Amphenol Busbars: Mike Wingard ([mike.wingard@amphenol-gis.com](mailto:mike.wingard@amphenol-gis.com))
- Where to find additional Information:
  - Rack & Power Project Wiki:  
[https://www.opencompute.org/wiki/Rack\\_& Power](https://www.opencompute.org/wiki/Rack_& Power)
  - Rack and Power Specifications and Designs:  
[https://www.opencompute.org/wiki/Open\\_Rack/SpecsAndDesigns](https://www.opencompute.org/wiki/Open_Rack/SpecsAndDesigns)
  - Mailing List: [OCP-RackandPower@OCP-All.groups.io](mailto:OCP-RackandPower@OCP-All.groups.io)

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# Open Discussion



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