# ARTESYN 50 V, 33 KW, 1OU OPEN RACK HPR POWER SHELF

33 kW, 27.5 kW (N + 1) or 16.5 kW (N + N)



Advanced Energy's Artesyn introduces the 33 kW, 1OU, ORv3 HPR power shelf that converts incoming three phase AC supply voltage into a 50 VDC output with a total power capability of 33 kW continuous output power. It accommodates 6x5.5 kW hot-swappable single phase PSU modules. The power shelf inputs are universal 7 pin connectors which accept wye (5-wire 3PH+N+PE) connection. It includes a slot for a hot-pluggable shelf communications module, supporting 3 different options for communications and control:  Power Managment Interface (PMI), Power Managment Controller (PMC) or Power Management Module (PMM). Multiple shelves can be operated in parallel, typically enabling applications such as accelerated computing racks requiring 100 kW or more of highly regulated 50VDC power.

## AT A GLANCE

### Total Output Power

Dual Whip Shelf: 33 kW (N + 0)
27.5 kW (N + 1) or 16.5 kW (N + N)
Single Whip Shelf: 33 kW (N + 0)
27.5 kW (N + 1)

### Input Voltage

Nominal Ranges:
346 to 480 VAC 3 phase 5 wire
Wye (3ph + N + E)

### Output Voltage

50 to 49 VDC ( 0 to 100%)

### Mechanical Dimensions

720 x 537 x 46 mm (L x W x H)

### Operating Temperature

-5 to +45°C

## KEY FEATURES

- 33 kW at 50 V with N + 0 redundancy
  27.5 kW at 50 V with N + 1 redundancy
  16.5 kW at 50V with N + N redundancy
- Highly accurate shelf droop and/or active current sharing capability
- Houses 6 x 5500 W power modules and a removable shelf control module
- Very high efficiency

## COMPLIANCE

- EN 61000-4-2 for surges
- EN 61000-3-12 for harmonics
- EN55022, FCC Part 15, CISPR 22, Class-A for EMC

## SAFETY

- EN 62368-1
- UL 62368-1
- IEC 62368-1

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## ELECTRICAL SPECIFICATIONS

| INPUT | | | | |
|---|---|---|---|---|
| | MIN | NOM | MAX | UNIT |
| Input Voltage (3 phase Wye 5 wire) | - | 346 to 480 | - | VAC |
| **OUTPUT** | | | | |
| | MIN | NOM | MAX | UNIT |
| Regulation and Droop Characteristics[1] | 49 | - | 50 | VDC |
| Output Current | - | - | 674 | A |
| Ripple & Noise (@ 20 MHz BW)[2] | - | - | 500 | mVpp |

Note 1- The rectifier droop voltage (0% to 100%) is 1 V by default (with the tolerance of ±0.125 V). That means output voltage is 49 V at 100% load and 50 V at no-load. The droop extends linearly to 150% (it means at 150%, the droop is 1.5 V, and voltage is 48.5 V).

Note 2- Measured with a 0.1 mF capacitor connected to the probe tip.

## POWER SHELF INPUT CONFIGURATION

The following section explains the input configuration of the power shelf:

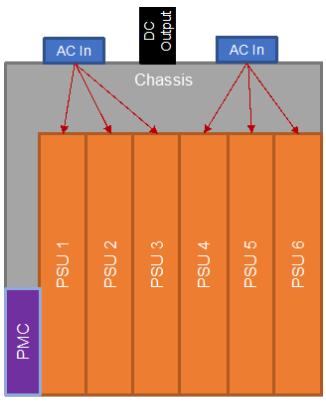
### 2AC: ORv3 HPR 1OU Power Shelf for 6 x 5.5 kW ORv3 5.5 kW HPR PSU with dual cord (2 x 30A NEC or 32A IEC breaker upstream)

1OU shelf with two AC power input
6 x 5.5 kW rectifier slots
Output power: 33 kW with N+0 or 27.5 kW with N+1 or 16.5kW N+N with both input connector powered

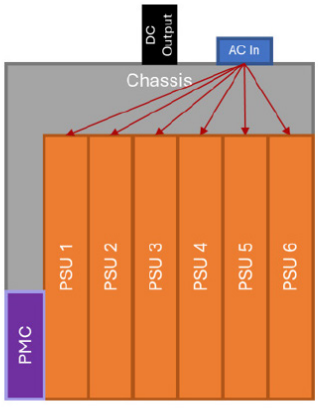
Direct connect to tap-boxes/facility – no intermediate PDU.

### 1AC: ORv3 HPR 1OU Power Shelf for 6 x 5.5 kW ORv3 5.5 kW HPR PSU with single cord (60A IEC breaker upstream)

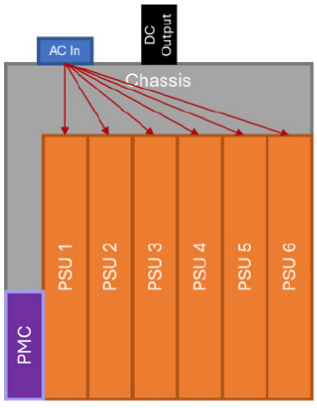
1OU shelf with one AC power input
6 x 5.5 kW rectifier slots
Output power: 33 kW with N+0 or 27.5 kW with N+1 or 16.5 kW N+N with one input connector powered
Direct connect to tap-boxes/facility – no intermediate PDU.




TOP VIEW




TOP VIEW (LEFT-SIDE)




TOP VIEW (RIGHT-SIDE)



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## MECHANICAL

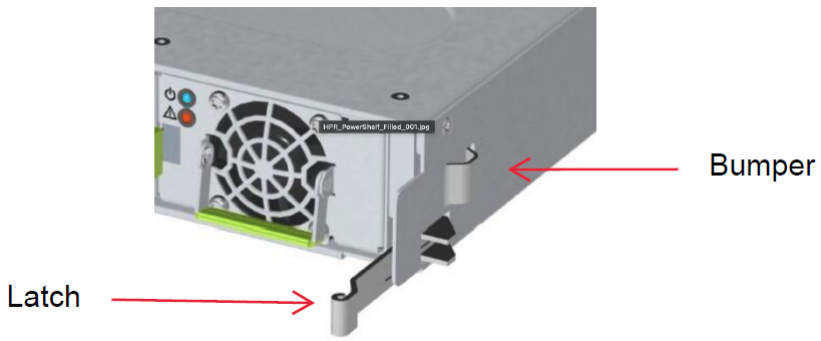
### ORv3 HPR Rack Mounting Features

These power shelves are designed for front mounting into Open Rack V3 racks on OU pitch rails (please refer to the Open Rack V3 specifications on more details for the design of these). The design of the 48 V output connector allows it to be placed in any location in the rack.

Rack mounting features are of particular importance in the power shelf design since they assist in constraining the power shelf in X, Y, and Z directions and promote solid electrical contact with the 48 V busbar.

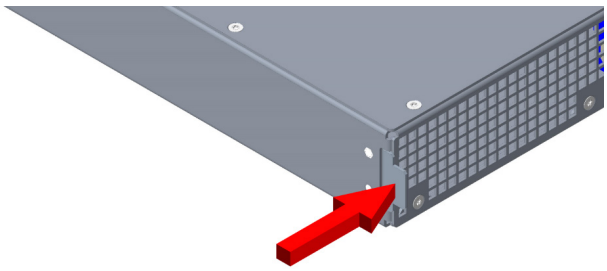
■ **Front Latch & Bumper**

Please refer to the mechanical CAD for the locations of the front latch and bumper. Note that these serve separate functions and should not be a single part.




■ **Rear Stop**

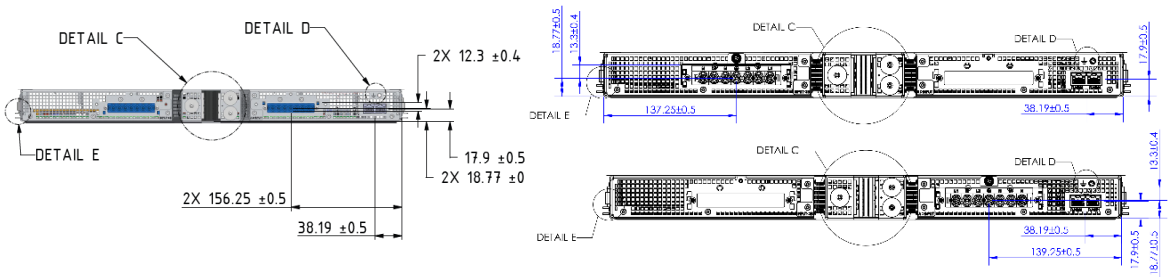
Please refer to the mechanical CAD for the geometry of the rear stop. This is required to interface properly with the ORv3 rack



### Connector Details

■ **AC Input Connector**

The power shelf has two AC input connectors left and right in the case of the dual whip shelf PN. 700-037148-0100, and one AC input connector in the case of the single whip shelf PN. 700-055500-0000 (Left-side) & 700-055600-000 (Right-side).






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## POWER SHELF IINPUT WHIP REQUIREMENTS

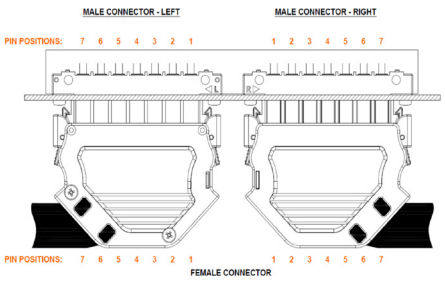
This section provides details about the input connector specification and configuration to ensure proper wiring.

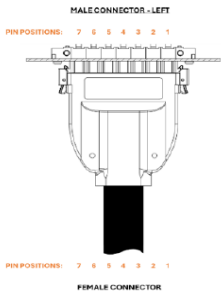
For 2AC (30A): Input Wire shall use Positronic SP10RSSS1F0W01/AA-2732 connector or equivalents to ensure proper fitting and operation. The connector will be rated for 30A (2AC) or higher.

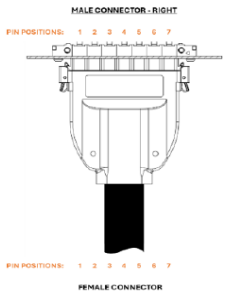
For 1AC (60A): Input Wire shall use Positronic SPH10PPPPPPP1F0001/AA connector or equivalents to ensure proper fitting and operation. The connector will be rated for 60A (1AC) or higher.

Power Shelf Side

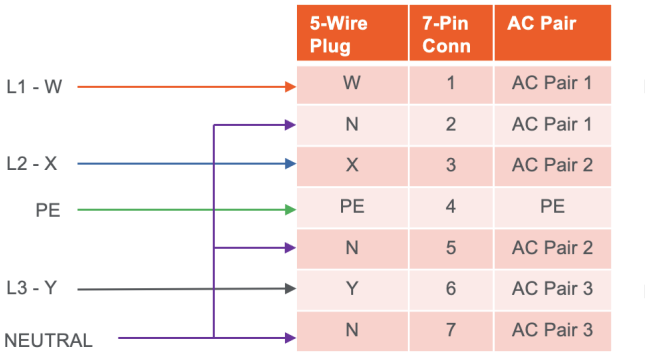
Input Whip Side




### AC Input Connector Wiring




| 5-Wire Plug | 7-Pin Conn | AC Pair |
|---|---|---|
| W | 1 | AC Pair 1 |
| N | 2 | AC Pair 1 |
| X | 3 | AC Pair 2 |
| PE | 4 | PE |
| N | 5 | AC Pair 2 |
| Y | 6 | AC Pair 3 |
| N | 7 | AC Pair 3 |



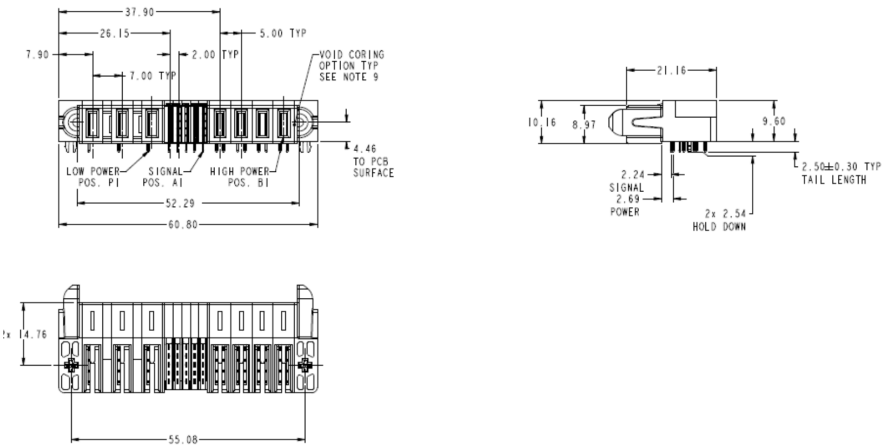
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## MECHANICAL

### Power Supply Connector

TThe shelf contains the 6 blind mate mating connectors for the 6 ORv3 PSUs. Amphenol 10127400-01U1520LF or equivalent. This is a R/A receptacle, PwrBlade ULTRA HD connector with 3 low power pins, 25 signal pins, and 4 high power pins.

Rectifiers plug into the power shelf directly, and they are hot swappable while the rack is powered. Please refer to "Advanced Energy 50 V 5.5kW OPEN RACK V3 PSU" datasheet for pinout details. Below is input connector drawing

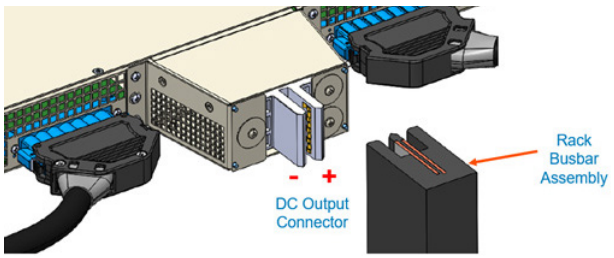



### DC Output Connector

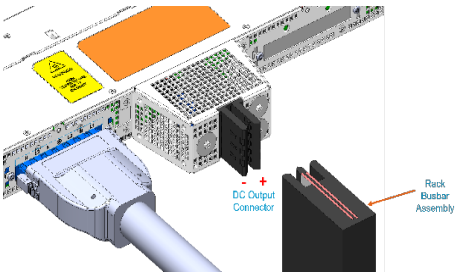
The shelf DC output connector is a floating blind mate connector that mates with ORv3 busbars in an ORv3 rack. This gives the flexibility for:

Placing power and battery shelves any desirable location on the rack

Increasing power and energy by adding more power and/or battery shelves in the rack



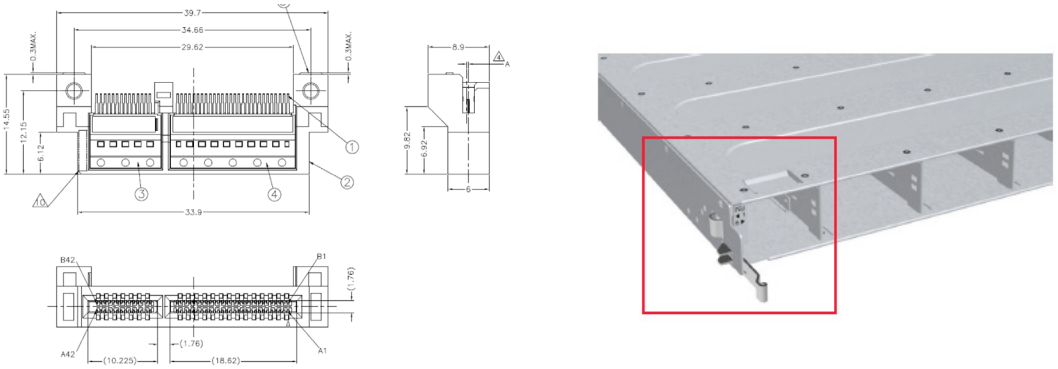

2AC DC Output Connector




1AC DC Output Connector

### PMC/PMI/PMM Connector

The PMC is a blind-mate module with a 2C card edge connector. The PMC plugs into the power shelf directly, and is hot swappable while the rack is powered. Please refer to "Advanced Energy ORv3 STANDARD HPR PMC" datasheet for pinout details.






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## MECHANICAL

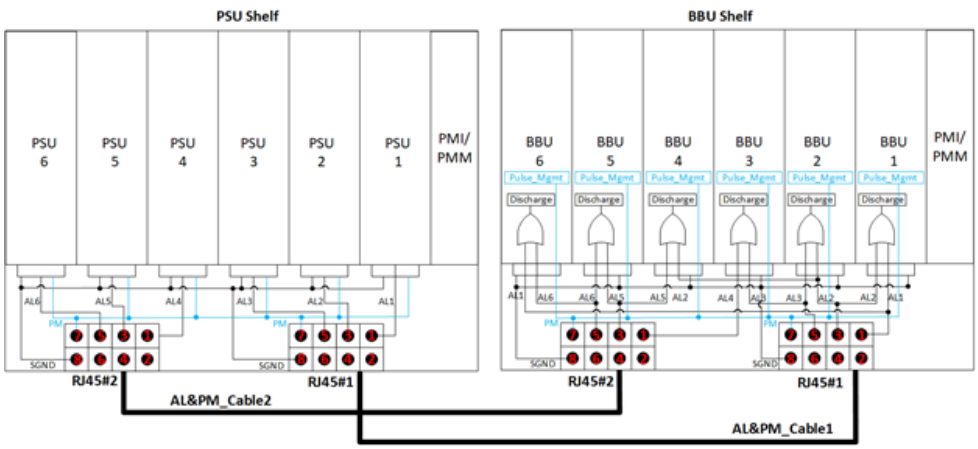
**PSU-BBU Operation in ORv3 HPR**

AC_LOSS_L and PULSE_MGMT signals have been added to ORv3 HPR PSU (Power Supply Unit) and BBU (Battery Backup Unit) design to enable control during Input loss events and repeated Power Surge. Each PSU has an output AC_LOSS_L and PULSE_MGMT signal, while each BBU has two input AC_LOSS_L signals and one PULSE_MGMT signal. These signals shall be routed to the rear of the Power or BBU Shelf to designated RJ45 connectors, as shown in below diagram.

PSU and BBU shelves AC_LOSS & PULSE_MGMT signal shall use standard Cat 5 or above cable to connect.

For detailed operation of AC_LOSS and PULSE_MGMT signal please refer to ORv3 HPR PSU specification.

**Diagram of ORV3 PSU/BBU AC_LOSS & PULSE_MGMT Signals for AC to BBU Transition**




| DEVICE | CONNECTOR | MATING CONNECTOR |
|---|---|---|
| 2AC Shelf | Input Connector:<br>POSITRONIC<br>SP10RSSS48RM220A1/AA-2731<br>SP10RSSS48M220A1/AA-2731 | POSITRONIC<br>SP10RSSS1F0W01/AA-2732 |
| | Output Connector:<br>FCI BarKlip BK600<br>10164745-1SF025LF | ORv3 Busbars |

| DEVICE | CONNECTOR | MATING CONNECTOR |
|---|---|---|
| 1AC Shelf | Input Connector:<br>Left-side Input Connector:<br>AMPHENOL, 10173750-07PL01(Blue)<br>POSITRONIC, SPH10PPPFPPP48RM330A1/AA (Black)<br>Right-side Input Connector:<br>AMPHENOL, 10173750-07PR01(Blue)<br>POSITRONIC, SPH10PPPFPPP48M330A1/AA (Black) | POSITRONIC<br>SPH10PPPPPPP1F0001/AA |
| | Output Connector:<br>AMPHENOL, 10164745-1SF053LF<br>TE, 2461760-3 | ORv3 Busbars |



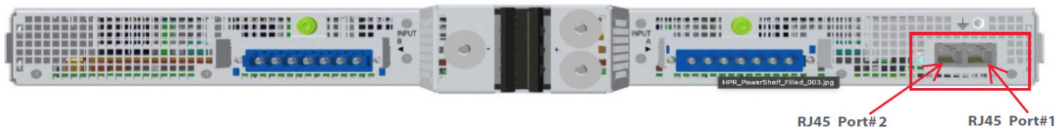
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## MECHANICAL

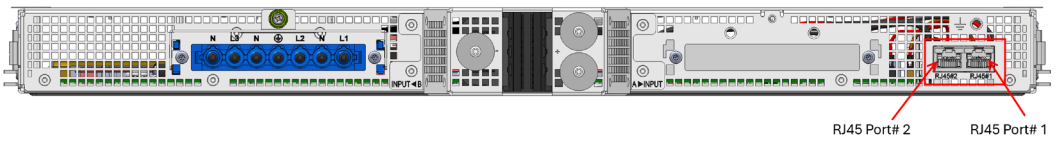
AC Loss Signal Connector

The shelf contains two RJ45 signal connectors on the rear of the power shelf to allow for an Input loss signal cable to be plugged between PSU & BBU shelf. For the interconnect a standard cat 5 or above cable is sufficient. Both RJ45 ports are daisy chained so shelves can be connected together. Please refer to below pin out:

2AC Loss Signal Connector




1AC Loss Signal Connector




RJ45 Port#1 Config

| Pin# | Wire Color | Signal Name | Function |
|---|---|---|---|
| 1 | White/Orange | AL1 | AC_LOSS signal from PSU 1 |
| 2 | Orange | RSVD | reserved |
| 3 | White/Green | AL2 | AC_LOSS signal from PSU 2 |
| 4 | Blue | RSVD | reserved |
| 5 | White/Blue | AL3 | AC_LOSS signal from PSU 3 |
| 6 | Green | RSVD | reserved |
| 7 | White/Brown | PM | Pulse_Mgmt signal from 6 PSUs |
| 8 | Brown | SGND | signal ground |

RJ45 Port#2 Config

| Pin# | Wire Color | Signal Name | Function |
|---|---|---|---|
| 1 | White/Orange | AL4 | AC_LOSS signal from PSU 4 |
| 2 | Orange | RSVD | reserved |
| 3 | White/Green | AL5 | AC_LOSS signal from PSU 5 |
| 4 | Blue | RSVD | reserved |
| 5 | White/Blue | AL6 | AC_LOSS signal from PSU 6 |
| 6 | Green | RSVD | reserved |
| 7 | White/Brown | PM | Pulse_Mgmt signal from 6 PSUs |
| 8 | Brown | SGND | signal ground |



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## MECHANICAL OUTLINE - POWER SHELF

### Dual Whip Shelf

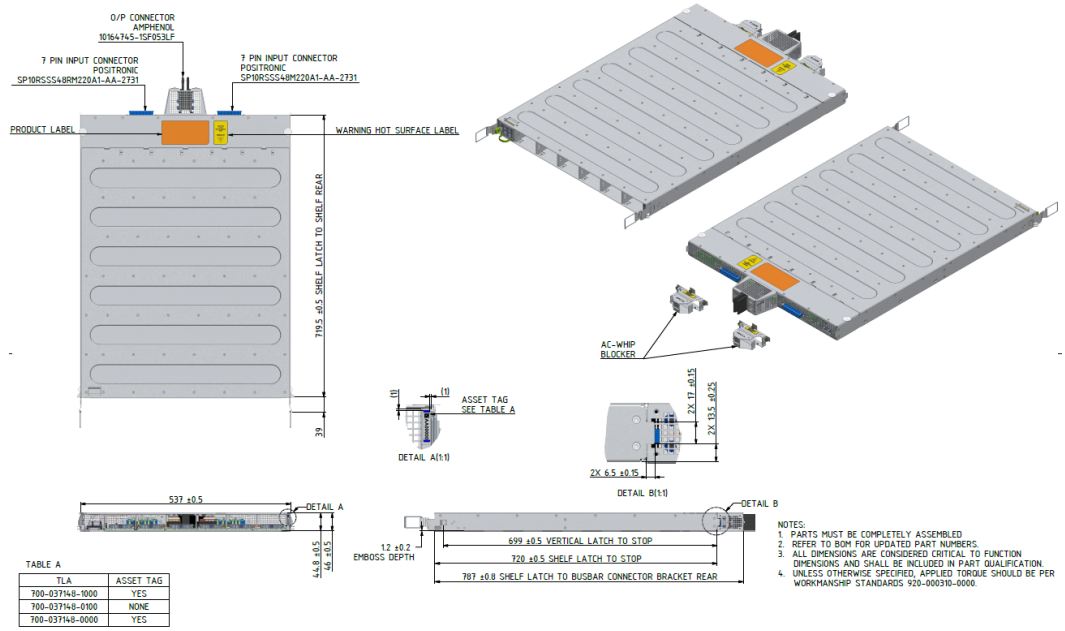
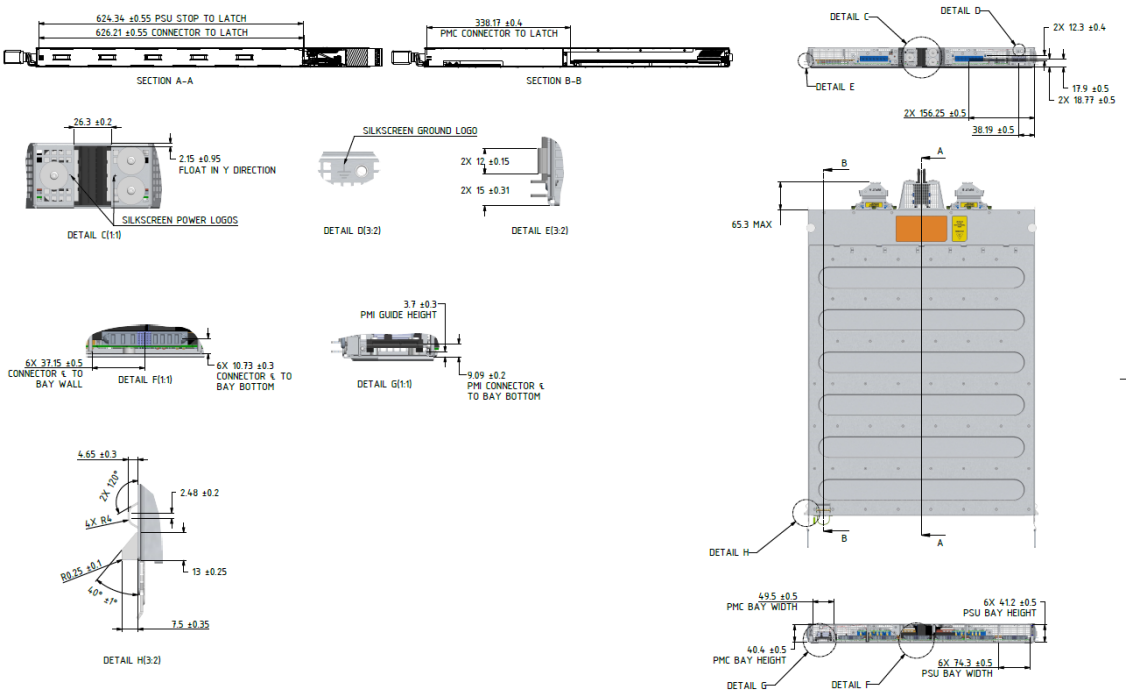



TABLE A

| TLA | ASSET TAG |
|---|---|
| 700-037148-1000 | YES |
| 700-037148-0100 | NONE |
| 700-037148-0000 | YES |

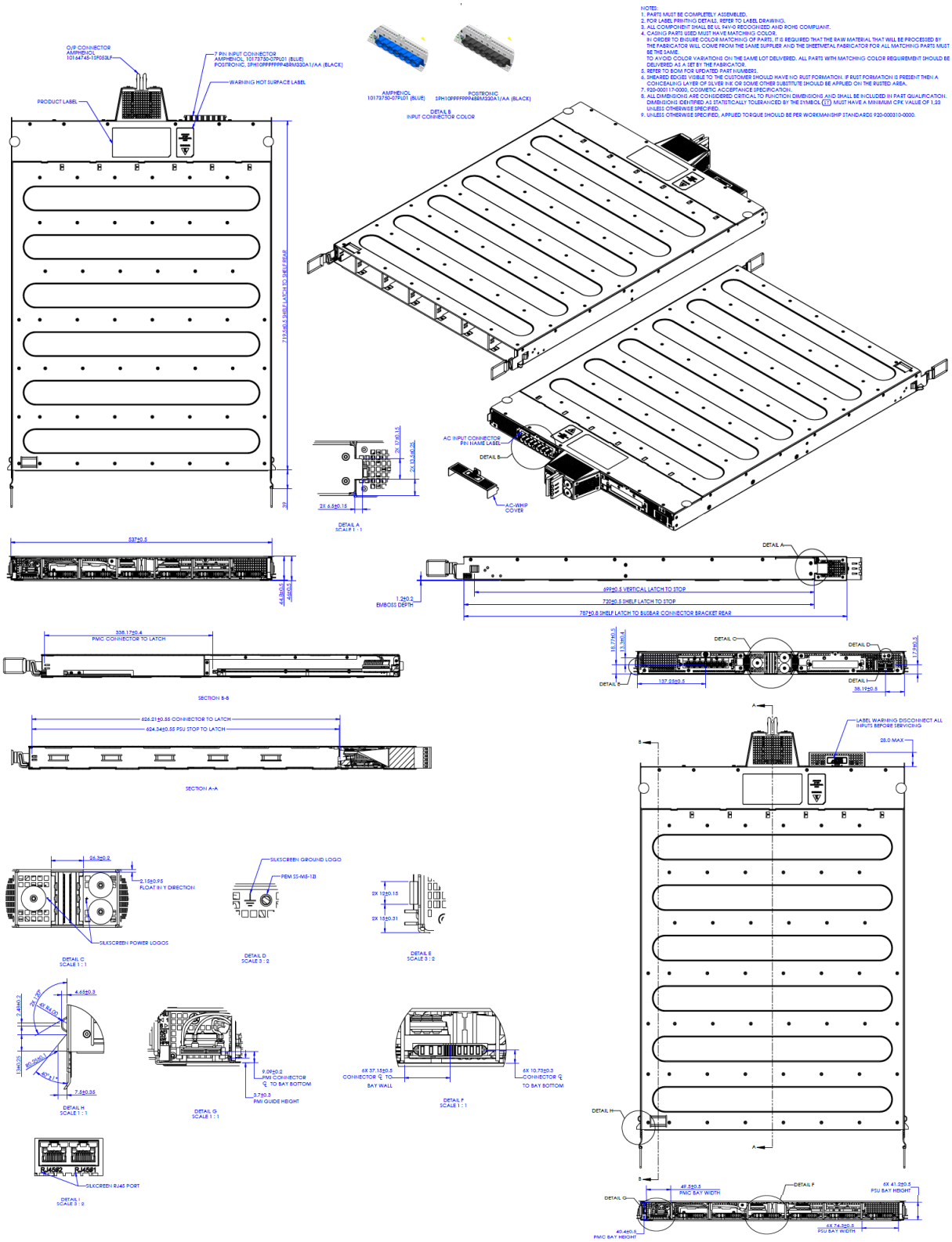





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## MECHANICAL OUTLINE - POWER SHELF

### Single Left-side Whip Shelf

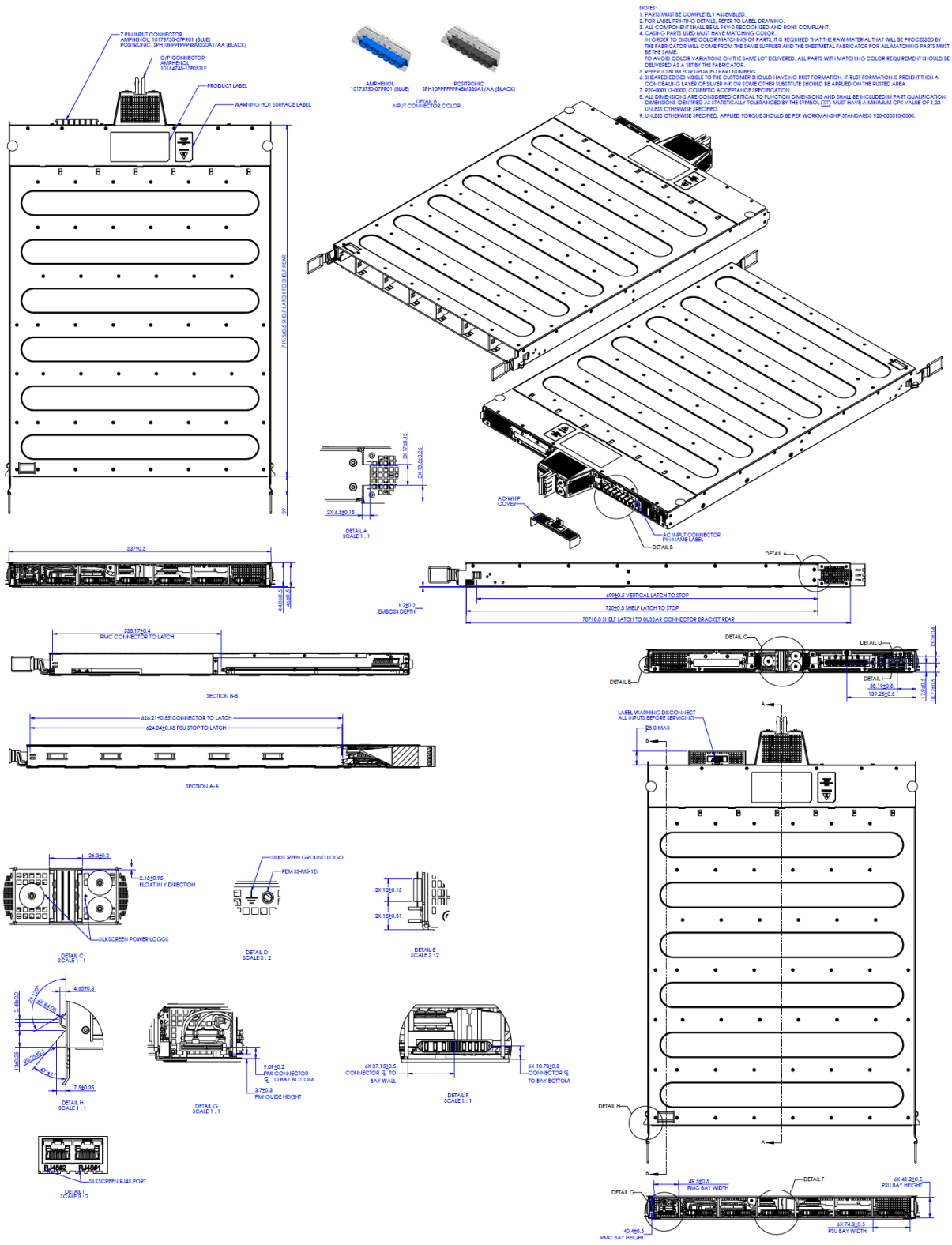





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## MECHANICAL OUTLINE - POWER SHELF

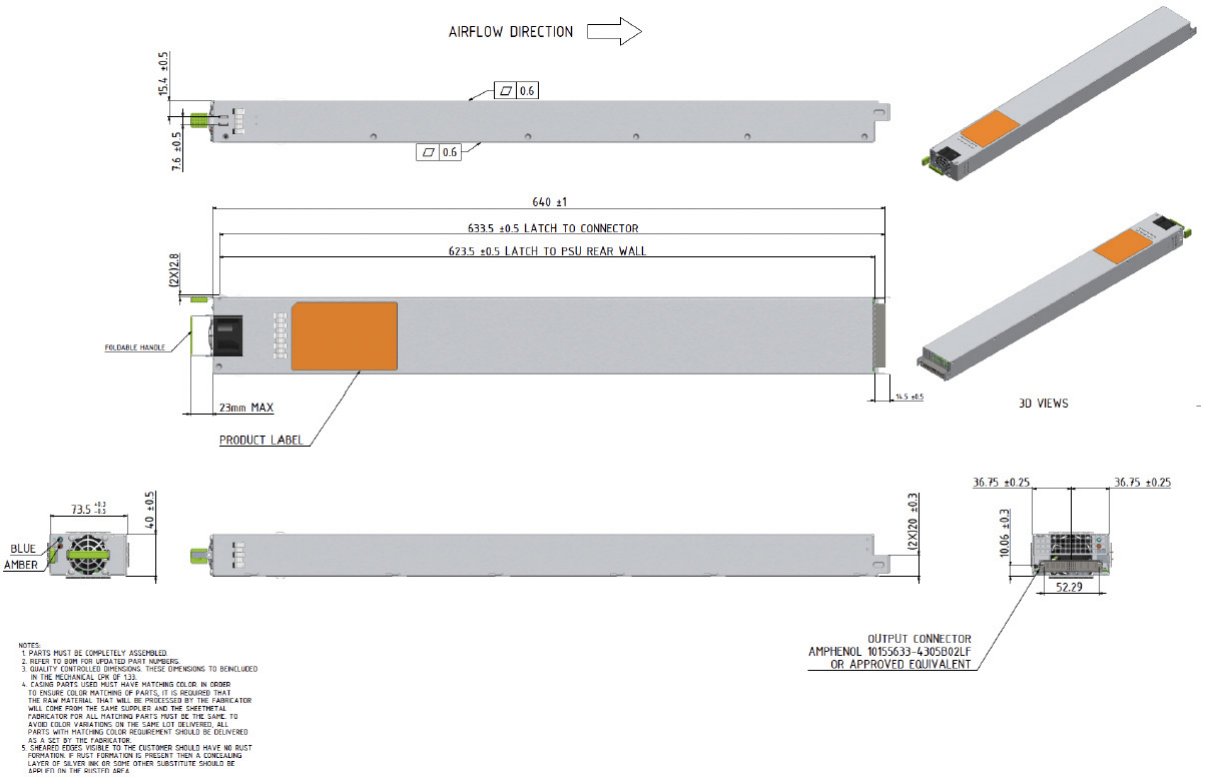
### Single Right-side Whip Shelf






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## MECHANICAL OUTLINE - PSU




Unit: mm



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## THERMAL DESIGN

- Bus-bar power or DC output connection assembly: Cables external to the shelf as well as the clip/connector (to the rack bus-bar) mounting at the rear panel are designed to ensure adequate cooling for compliance requirements (temperature difference as a function of current draw).

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## ENVIRONMENTAL COMPLIANCE

- Gaseous contamination: Severity Level G1 per ANSI/ISA 71.04-1985
- Ambient operating temperature range: -5°C to +45°C
- Operating and storage relative humidity: 10% to 90% (non-condensing)
- Storage temperature range: -40°C to +70°C
- Transportation temperature range: -55°C to +85°C (short-term storage)
- Operating altitude with no de-ratings: 3,050 m (10,000 feet)
- Acoustic noise: Target sound pressure should not exceed 85 dBA when fan modules are running at full speed and operating within the defined environmental envelope

### Vibration and Shock (Non-packaged)

The “power shelf with PSUs inside” meet vibration and shock test per EN 60068-2-6 and 60068-2-27, respectively, for both non-operating and operating condition, with the specifications listed below.

During operating vibration and shock tests, the PSU will exhibit full compliance to the specification without any electrical discontinuities.

During the non-operating tests, no damages of any kinds (included physical damages) should occur and they should not corrupt the functionalities of the PSU per the specifications.

**Vibration Non-Operating:**

| | |
|---|---|
| Excitation Mode: | Sinusoidal |
| Test Frequency: | 5 to 500 Hz<br>(5 to 9 Hz) 6 mm peak to peak<br>(9 to 500 Hz) 1 g |
| Amplitude: | 1 g |
| Frequency Change Rate: | 1 octave / min |
| Test Directions: | 3 directions in space (x, y, z) |
| Duration: | 10 sweep cycles for each direction (2 hours 13 minutes) |
| Test Temperature: | Room temperature |
| Electrical Work: | None |

**Shock Non-Operating:**

| | |
|---|---|
| Shock Pulse: | Half sinusoidal |
| Shock Duration: | 11 ms |
| Shock Amplitude: | 12 g |
| Test Directions: | 6 directions |
| Number of Shocks: | 60 (10 per each direction) |
| Test Temperature: | Room temperature |
| Electrical Work: | None |



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## ENVIRONMENTAL COMPLIANCE

**Vibration Operating**

| | |
|---|---|
| Excitation Mode | Sinusoidal |
| Test Frequency | 5 to 500 Hz<br>(5 to 9 Hz) 6 mm peak to peak<br>(9 to 500 Hz) 1 g |
| Amplitude | 0.5 g |
| Frequency Change Rate | 1 octave / min |
| Test Directions | 3 directions in space (x, y, z) |
| Duration | 10 sweep cycles for each direction (2 hours 13 minutes) |
| Test Temperature | Room temperature |
| Electrical Work | Power supply in operation |

**Shock Operating:**

| | |
|---|---|
| Shock Pulse | Half sinusoidal |
| Shock Duration | 11 ms |
| Shock Amplitude | 6 g |
| Test Directions | 6 directions |
| Number of Shocks | 30 (5 per each direction) |
| Test Temperature | Room temperature |
| Electrical Work | Power supply in operation |

### Package Vibration, Drop and Compression

The power shelves (without PSUs) in their shipping package meet the following requirements:

| | | |
|---|---|---|
| Package Vibration | 1.146 g, 2 to 200 to 2 Hz, all three axes, random vibe | ISTA 3E 06-06 |
| Package Drop | 8-inch drop | ISTA 3E 06-06 |
| Package Compression | Maximum compression loading on a bulk pack | ASTM D 642-94 |



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## EMC, SAFETY AND ENVIRONMENTAL COMPLIANCE

The power supply shelf is designed for compliance to allow worldwide deployment.

### Safety Standards

The product is to be designed to comply with the latest edition, revision, and amendment of the following standards. The product is designed such that the end user could obtain the safety certifications: UL 62368-1, IEC 62368-1 and EN 62368-1; hazard-based performance standard for Audio video, IT & Communication Technology Equipment

- UL or an equivalent NRTL for the US with follow-up service (e.g. UL or CSA)
- CB certificate and test report issued by CSA, UL, VDE, TUV or DEMKO
- CE marking for EU

### Component Safety Requirements

Following are the safety compliances for major components:

- All fans have the minimum certifications: UL and TUV or VDE.
- All current limiting devices have UL and TUV or VDE certifications and are suitable rated for the application where the device in its application complies with IEC/UL 62368-1.
- All printed wiring boards are rated UL94V-0 and sourced from a UL approved printed wiring board manufacturer.
- All connectors are UL recognized and have a UL flame rating of UL94V-0.
- All wiring harnesses are sourced from a UL approved wiring harness manufacturer. SELV cable to be rated minimum 80 V, 130°C.
- Product safety label will be printed on UL approved label stock and printer ribbon. Alternatively, labels can be purchased from a UL approved label manufacturer.
- The product will be marked with the correct regulatory markings to support the certifications that are specified in this document.

### EMC Requirements

The power shelf meets the following requirements in the latest edition of standards when operating under typical load conditions and with all ports fully loaded.

The Power supply integrated into the shelf is called the component power supply.

The power shelf will have minimum 6dB margin from the Class A limit for the radiated and conducted emissions.

The following EMC Standards (the latest version) are applicable to the product:

- FCC /ICES-003
- CISPR 32/EN55032
- CISPR 35/EN55035 - Immunity
- EN61000-3-12 - Harmonics
- EN61000-3-11 - Voltage flicker
- KS C 9832 and KS C 9835

Each individual basic standard for immunity test has the following minimum passing requirement. Higher level of passing criteria may be applied depending on the system manufacturer's design goals and business needs.

- EN61000-4-2 Electrostatic Discharge immunity
  Contact discharge: > 5.6 kV
  Air discharge: > 11.2 kV
- EN61000-4-3 Radiated immunity
  > 3 V/m
- EN61000-4-4 Electrical Fast Transient immunity
  AC power line: > 1 kV
  Signal line: > 0.5 kV
- EN61000-4-5 Surge
  AC power line: > 2 kV (Line-to-line), > 4 kV (Line-to-earth)
  Signal port: > 1 kV



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## EMC, SAFETY AND ENVIRONMENTAL COMPLIANCE

- EN61000-4-6 Immunity to conducted disturbances
  DC power line: > 3 Vrms
- EN61000-4-8 Power frequency magnetic field immunity, when applicable
  > 1 A/m
- EN61000-4-34 Voltage dip and sag

### Environmental Compliance

The power shelf (including all components inside) complies with the following minimum environmental requirements:

- RoHS Directive (2011/65/EU and 2015/863/EU)
- REACH Regulation (EC) No 1907/2006;
- Halogen Free: IEC 61249-2-21, Definition of Halogen Free, 900 ppm for Br or Cl, or 1500ppm combined
- US SEC conflict mineral regulation to source mineral materials from socially responsible countries, if applicable
- Waste Electrical and Electronic Equipment ("WEEE") Directive (2012/19/EU) if applicable;
- Product does not contain any substances regulated by EPA 40 CFR751

## ORDERING INFORMATION

| Model | Description |
|---|---|
| 700-037148-0100 | Standard ORv3 HPR Power Shelf - Dual Whip |
| 700-055500-0000 | Standard ORv3 HPR Power Shelf - Single Left-side Whip |
| 700-055600-0000 | Standard ORv3 HPR Power Shelf - Single Right-side Whip |

| Model | Description |
|---|---|
| 700-037147-0100 | Standard ORv3 HPR 5.5 kW PSU |
| 700-055176-0000 | Standard ORv3 HPR PMC |
| 700-037149-0100 | Standard ORv3 HPR PMI |
| 700-043397-0100 | ORv3 HPR PMM |



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## ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than four decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

Our products enable customer innovation in complex applications for a wide range of industries including semiconductor equipment, industrial, manufacturing, telecommunications, data center computing, and medical. With deep applications know-how and responsive service and support across the globe, we build collaborative partnerships to meet rapid technological developments, propel growth for our customers, and innovate the future of power.

PRECISION | POWER | PERFORMANCE | TRUST

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