

Vertiv™ PowerBoard Flex UL Switchboard GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Related Documents

Drawings and general provisions of the contract, including general and supplementary conditions and division [XX] specification sections, apply to this section.

1.2 Summary

- Vertiv™ PowerBoard Flex UL Switchboard (hereafter referred to as the switchboard) is a fully customizable, low-voltage switchboard solution designed to improve operational efficiency, optimize space utilization, and enhance operator safety.
- The system uses design principles based on IEC standards. The system is fully tested, ETL-certified, and complies with UL 891 switchboard design and safety requirements. All solutions are custom-built using a modular design that can be configured to suit project requirements. In-house metalwork fabrication, busbar forming, plating, and paintwork facilities provide a high-quality, efficient solution for any specification.
- Designed, built, and tested with a focus on performance, reliability, and safety of the switchboard, which incorporates internal segregation in accordance with IEC 61439-2 to reduce operator risk, limit internal arc-fault propagation, and preserve uptime during maintenance and upgrade activities.
- The flexible, component-agnostic architecture allows customers to select preferred components from a wide range of approved manufacturers, enabling customization to meet demanding specifications and site-specific requirements while maximizing space and performance.

1.3 Applications

The switchboard is intended for use in the following applications:

- Commercial facilities
- Industrial facilities
- Hospitals and healthcare facilities
- Universities and educational institutions
- Warehouses and distribution centers
- Data centers

1.4 Standards

This switchboard shall be manufactured in a certified management system environment where ISO 9001 (Quality), ISO 45001 (Occupational Health and Safety), and ISO 14001 (Environmental Management) standards are applied to all aspects of manufacturing and installation.

The switchboard shall be designed, tested, and certified to meet the requirements of applicable North American and international standards, including:

- UL 891 – Low Voltage Switchboards
- UL 489 – Molded Case Circuit Breakers (MCCB)
- UL 1066 – Draw-out air circuit breaker (ACB)
- IEC 61439-2 – Internal separation and safety concepts
- NEMA 1A / NEMA 3R – Enclosure requirements
- IBC 2021 / CBC 2019 – Seismic requirements
- UL 50 – Enclosures for Electrical Equipment, Non-Environmental Considerations
- C22.2 No. 244-05 – Safety Standard for Switchboards
- NMX-J-118/2-ANCE-2006 – Safety Standard for Switchboards
- NEMA, CSA, IEEE, ANSI, and IEC standards, as applicable

The switchboard shall be ETL certified to UL 891 and shall meet the safety and design requirements for low-voltage switchboards. All electrical components used in the manufacture of the switchboard shall be UL certified.

1.5 System Description

1.5.1 Environmental Conditions

The switchboard shall be suitable for operation under the following conditions:

- **Ambient temperature (operating):** 0 °C to 40 °C (32 °F to 104 °F)
- **Relative humidity:** Up to 50% non-condensing
- **Installation location:** Indoor or Outdoor (as specified)
- **Altitude:** Up to 1000 m above sea level

1.6 Electrical Specification / Performance Requirements

The switchboard shall perform as specified herein while supplying rated full-load current as indicated on the project drawings.

- **System Voltage:** The busbar/busway system shall be rated for voltages up to 600 V.
- **Insulation Voltage:** Rated insulation voltage (V_i) shall be 2.2 kV.
- **Operating Voltage:** Rated operating voltage (V_e) shall be up to 1000 V AC, where applicable.
- **Systems:** The system shall be available in the following configurations:
 - Three-phase, three-wire (3P3W)
 - Three-phase, four-wire (3P4W)
- **Frequency:** The system shall be rated for operation at 60 Hz.

- **Ampacity:** The busbar/busway system shall be available with continuous current ratings up to 6000 A.
- **Rated Current:** Rated current shall be up to 6000 A, depending on configuration.
- **Short-circuit Rating:** The busbar/busway system shall have a short-circuit withstand rating of:
 - Up to 100 kA at 600 V
 - Up to 10 kA at 1000 V
- **Transformer:** Close-coupled transformer connection option shall be available, where specified.

1.6.1 Seismic Compliance

The switchboard shall be independently certified to meet seismic requirements in accordance with:

- **IBC 2021** – International Building Code
- **CBC 2019** – California Building Code

Seismic performance shall be independently tested to AC156, providing seismic protection for installations in all seismic zones, including critical and nuclear facilities.

1.7 Submittals

The supplier shall submit the following for review and record:

- Product data sheets
- Overall dimensions and weights
- Single-line diagrams
- Installer/User guide

1.7.1 Installation and Operations

The **SL-71132_Vertiv™ PowerBoard Flex Switchboard Installer/User Guide** shall be provided.

Install the switchboard on a smooth, solid, and level foundation with a maximum variation of ± 0.125 in. (3.175 mm) per 3 ft. (914.4 mm).

The altitude of the installation site shall be less than or equal to 3280.8 ft. (1000 m) above sea level.

An uneven floor may result in misalignment of sections, units, doors, and other components and shall be corrected prior to installation.

Determine the switchboard layout in advance and verify that the available space and location meet the minimum clearances required for working space in accordance with NEC requirements.

The Pre-Site Visit / Site Readiness Checklist – Installing Contractor (CS-980000-00) shall be used to provide additional guidance to the installation team and ensure readiness for a successful installation.

1.7.2 Warranty

The standard warranty shall be 18 months from the date of shipment against defects in materials and workmanship. Supplementary and extended warranty options shall be available upon request.

2.0 PRODUCT

2.1 Manufacturers

This specification is based on the Vertiv™ PowerBoard Flex UL Switchboard manufactured by Vertiv.

Substitutions are not permitted unless approved by the Engineer.

2.2 General Construction

The switchboard shall be a low-voltage, dead-front, floor-standing assembly with modular construction.

The switchboard shall be:

- Floor-standing
- Dead-front construction
- Modular and sectional
- Front access, rear access, or front-and-rear access, as specified

The switchboard shall be shipped in sections for ease of transportation and installation.

2.3 Key Features

The switchboard shall include the following features:

- Fully customizable, modular switchboard design engineered to meet project-specific and site-specific requirements.
- Type-tested tin-plated copper busbar systems designed for reliable high-current power distribution.
- Switchboard ampacity ratings up to 6000 A, depending on configuration.
- Internal segregation available up to Form 4 Type 7, providing enhanced operator safety and equipment protection.
- Support for UL 489 molded case circuit breakers (MCCB) and UL 1066 air circuit breakers (ACB) from major approved breaker manufacturers.
- Configurable breaker mounting options, including individual and group-mounted constructions
- Available with NEMA 1 (indoor) and NEMA 3R (outdoor) enclosures.
- Flexible architecture supporting front, rear, or front-and-rear access, based on project requirements.
- Standard shallow depth of 30.2 in. (767.08 mm), depending on configuration.
- Integration capability for transient voltage surge suppressor (TVSS) or surge protective device (SPD), power quality meters (PQM), protective relays, and control devices to meet site-specific operational needs.
- Customizable layout and component selection enabling high power density while optimizing floor space utilization.

2.4 Enclosures

2.4.1 Enclosure Type

Select one of the following enclosure types:

- **Indoor:** NEMA 1 / Type 1
- **Outdoor:** NEMA 3R / Type 3R

2.4.2 Paint Finish

- Standard - RAL 7035 (Custom colors are available)

2.5 Busbar Systems

2.5.1 Busbar Material

- Tin-plated copper

2.5.2 Neutral Bus

In a balanced system, the phase voltages shall be approximately equal in magnitude and equally spaced in phase relative to the neutral.

- A neutral bus shall be provided for 3P4W systems.

2.5.3 Ground Bus

- A continuous ground bus shall be provided throughout the switchboard lineup.
- The ground bus shall include taps along the lineup to accommodate equipment and field grounding connections.

2.5.4 Mimic Bus

Where specified, the switchboard shall be provided with a mimic bus to visually represent the one-line diagram.

Mimic bus options shall include:

- Option A – Mimic tape
- Option B – Phenolic adhesive tape
- Option C – Phenolic adhesive with fasteners

2.6 Circuit Breakers

2.6.1 General

Molded case circuit breakers (MCCB), listed to UL 489, and air circuit breakers (ACB), listed to UL 1066, are available in both fixed-mounted and draw-out configurations, with a wide selection from major manufacturers.

2.6.2 Approved Breaker Manufacturers

- ABB
- Schneider

Other Breaker Manufacturers may be approved upon request.

2.6.3 Feeder Breaker Ratings

Table 2.1: Feeder Breaker Ratings by manufacturer and configuration

MCCB Dimensions (X,Y)	Brand	Rating
2 MOD X 1 MOD 2 MOD X 1.5 MOD (with integral meter)	ABB	125A
		225A
	Schneider	150A
		250A
2 MOD X 3 MOD	Schneider	1200A
3 MOD X 1 MOD	ABB	125A
		225A
		250A
		400A
	Schneider	150A
		400A
3 MOD X 1.5 MOD	ABB	250A
		400A
	Schneider	600A
3 MOD X 2 MOD	ABB	800A
3 MOD X 3 MOD	Schneider	1200A

Note: Intermediate current requirements may be achieved by selecting the next higher standard breaker frame size.

2.6.4 Air Circuit Breaker (ACB) Dimensional Configurations

Table 2.2: Front Access Single Stack

Amperage (A)	Maximum System	Switchboard Approximate Dimensions		
		Minimum width (in.)	Depth (in.)	Height (in.)
800 - 2000	3P4W	30.24	60.47	90.83
2500 - 3200	3P4W	30.24	60.47	90.83
4000- 6000	3P4W	37.8	60.47	90.83
4000- 5000	3P4W	45.35	60.47	90.83

Note: Consult the factory for the 6000A Vertiv™ PowerBoard Flex UL Switchboard.

Table 2.3: Rear Access Double Stack

Amperage (A)	Maximum System	Switchboard Approximate Dimensions		
		Minimum width (in.)	Depth (in.)	Height (in.)
800 - 2000	3P4W	30.24	60.47	94.7
2500 - 3200	3P4W	30.24	60.47	94.7

Table 2.4: Rear Access Single Stack

Amperage (A)	Maximum System	Switchboard Approximate Dimensions		
		Minimum width (in.)	Depth (in.)	Height (in.)
800 - 2000	3P4W	30.24	30.24	94.7
2500 - 3200	3P4W	30.24	30.24	94.7
4000- 6000	3P4W	37.8	30.24	94.7
4000- 5000	3P4W	45.35	30.24	94.7

Note: Consult the factory for the 6000A Vertiv™ PowerBoard Flex UL Switchboard.

2.6.5 Switchboard Segregation

The switchboards incorporate a modular design based on IEC 61439 construction standards and are designed to meet UL 891 and CSA standards. Internal segregation is implemented to improve operator safety and equipment protection by restricting access to live components and minimizing the effects of internal faults.

The flexible, modular architecture supports configurable levels of segregation to meet application-specific safety, protection, and customization requirements for the North American market.

2.6.6 Forms of Separation

A high level of protection and operational safety is achieved by separating components into clearly defined modular compartments within the switchboard.

Table 2.5: Classification of Switchboard Internal Separation Types

Form	Main Criteria	Sub-criteria	Type of Construction
4a	Separation of busbars from the functional units and separation of all functional units from one another, including the terminal for external conductors which are an integral part of the functional unit	Terminals for external conductors in the same compartment as the circuit breaker	Type 1 – Busbar separation is by an insulated covering. Cables may be connected elsewhere.
			Type 2 – Busbar separation is by metallic or non-metallic rigid barriers or partitions. Cables may be glanded elsewhere.
			Type 3 – Busbar separation is by metallic or non-metallic rigid barriers or partitions. The termination for each functional unit has its own integral glanding facility.
4b		Terminals for external conductors not in the same compartment as the circuit breaker, but in individual, separate, enclosed protected spaces or compartments	Type 4 – Busbar separation is by an insulated covering. Cables may be glanded elsewhere.
			Type 5 – Busbar separation is by metallic or non-metallic rigid barriers or partitions. Terminals may be separated by insulated coverings and glanded in common cabling chambers.
			Type 6 – All separation requirements are by metallic or nonmetallic rigid barriers or partitions. Cables are glanded in common cabling chamber(s).
			Type 7 – All separation requirements are by metallic or non-metallic rigid barriers or partitions. The termination for each functional unit has its own integral glanding facility.

The objectives of internal separation are as follows:

1. To protect personnel against direct contact with live parts.
2. To facilitate access to one part of the assembly while other parts remain energized, thereby supporting maintenance and upgrading activities.
3. To protect the switchboard against the ingress of solid foreign bodies.
4. To limit the risk of internal arc flash by separating busbars, connections, and functional equipment.

The required level of internal separation shall be agreed upon by the manufacturer and the user and is determined by factors including switchboard rating, required access level, and functional application.

Note: Vertiv strongly recommends that no work be performed on the switchboard, or any part of the switchboard, while it is energized.

2.6.7 Form 4 Type 7 – Maximum Internal Separation

Form 4 type 7 segregation provides the maximum level of internal separation within the switchboard. All separation requirements are achieved using metallic or non-metallic rigid barriers or partitions to isolate functional units, busbars, and terminals.

Each functional unit is provided with its own integral cable glanding facility, ensuring complete segregation of terminations and minimizing the risk of internal fault propagation.

Typical elements within the segregated arrangement include:

- Vertical bus
- Circuit breaker
- Cable termination

2.7 Optional Features

Optional features may include, but are not limited to:

- Surge Protective Devices (SPD)
- Power Quality Meters (PQM) for monitoring system electrical parameters and power quality conditions
- Protective relays to support system protection and coordination requirements
- Close-coupled transformer connections

2.8 Cable Entry

Select one of the following cable entry options:

- Top entry
- Bottom entry

2.9 Cable Exit

Select one of the following cable exit options:

- Top exit
- Bottom exit

2.10 Lifting and Handling

The switchboard shall include provisions for:

- Bottom lifting

Shipping sections shall include lifting instructions.

2.11 Instrumentation and Monitoring (Optional)

Where specified, the switchboard may be provided with factory-installed instrumentation for system monitoring.

Optional instrumentation may include:

- Customer metering
- Power quality monitoring
- Status indication devices
- Mimic bus (refer to Mimic Bus section 2.5.4)

2.12 Accessories

The primary accessory offered by Vertiv for the switchboard is the Overhead Lifting Device (OHL D).

- The OHL D is used to lift breakers from the floor or from a completely drawn-out cradle.
- An internal winch with wire rope is used to provide the power for lifting.
- The device can travel the complete width of the switchboard lineup.
- Rails come with the OHL D and are mounted on the top of the switchboard; these rails have holes that allow the OHL D to lock into place in the center of the section.
- The rails mount on the top of the device compartment to provide support to the entire lifting system.

For detailed installation, operation, and safety instructions, refer to the **SL-71132_Vertiv™ PowerBoard Flex Switchboard Installer/User Guide**.

2.13 Communication Interfaces (Optional)

Where specified, the switchboard may include communication interfaces to allow integration with external monitoring systems, such as building management or supervisory systems, as required by the project.

2.14 Safety and Interlocks

The switchboard shall include safety features intended to reduce the risk of unintended access to energized components.

Safety features may include:

- Door interlocks
- Barriers to limit access to busbars and terminals
- Warning labels identifying electrical hazards

The switchboard design should support front access for normal operation and maintenance only.

2.15 Control and Auxiliary Power Isolation

Where control or auxiliary power is provided, provisions shall be included to allow isolation of these circuits during maintenance operations.

Isolation shall reduce the risk of exposure to energized control wiring when the main incoming device is opened.

3.0 EXECUTION

3.1 Factory Testing

Each switchboard shall undergo factory production testing prior to shipment.

Factory testing shall include:

- Visual inspection
- Mechanical inspection
- Insulation resistance testing
- Hi-Pot (high potential) testing
- Continuity testing
- Electrical functional testing

Certified factory test reports shall be made available upon request.

3.1.1 Factory Acceptance Testing and Witness Testing

At the factory, the switchboard manufacturer shall perform tests on the switchboard.

- Verify the proper operation of each component.
- Demonstrate full compliance with the requirements of this specification.
- Provide a factory witness test for the owner's representatives.
- Simulate and demonstrate the successful operation of the equipment at the factory before shipment.

3.2 Examination

- Examine the installation areas to confirm that conditions are suitable for the installation of the switchboard.
- Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 Installation

Install the switchboard in accordance with:

- Manufacturer's written instructions
- Approved drawings
- Applicable codes and standards

Install the switchboard in the location and orientation shown on the drawings.

Ensure that required working clearances are maintained in accordance with applicable codes.

3.4 Field Quality Control

3.4.1 Site Inspection

Upon delivery to the site:

- Inspect the switchboard for shipping damage.
- Perform continuity checks of the main power circuit using a high-resolution resistance tester to record baseline measurements, as these results can be compared during each service interval, and any anomalies can be investigated.
- It is recommended to use authorized documentation for verifying the equipment configuration.

Note: Report any discrepancies or damage before installation.

3.4.2 System Acceptance Test

Where specified, the system acceptance test (SAT) shall be performed while the system is energized.

SAT may include:

- Verification of mechanical installation
- Verification of grounding connections
- Functional checks of circuit breakers
- Verification of labeling and identification

3.4.3 Manufacturer's Services

Where specified, manufacturer-authorized services shall be provided by factory-authorized technicians to support installation, startup, commissioning, testing, and ongoing maintenance of the switchboard.

Table 3.1: Service Level Table

Level	Service	Description
L1	Site arrival inspection	Equipment inspection and configuration verification
L2	Visual and mechanical inspection	Mechanical and electrical checks, pre-energized tests
L3	System acceptance test and startup	System controls, voltage verifications, and communications, post-energized tests
L4	Standby commissioning support	Commissioning service support availability
L5	Standby integrated system test	Integrated system test service support availability

3.5 Field Adjustments

Verify and adjust protective device settings in accordance with the approved coordination study prior to energization.

3.6 Cleaning

Remove debris and foreign materials from the switchboard interior prior to energization.

3.7 Closeout Activities

Provide the following documentation:

- As-built drawings
- Installer/User guide
- Final test documentation