

Vertiv™ Liebert® FDC GUIDE SPECIFICATIONS

1.0 GENERAL

1.1 Summary

These specifications describe requirements for a freestanding rack power distribution center, supplying power to sensitive loads. It shall include all equipment to properly interface the AC power source to the intended load.

1.2 Standards

The specified system shall be designed, manufactured, tested and installed in compliance with:

- American National Standards Institute (ANSI)
- Canadian Standards Association (CSA)
- Federal Information Processing Standards Publication 94 (FIPS Pub 94)
- Institute of Electrical and Electronics Engineers (IEEE)
- ISO 9001
- National Electrical Code (NEC - NFPA 70)
- National Electrical Manufacturers Association (NEMA)
- National Fire Protection Association (NFPA 75)
- Underwriters Laboratories (UL)

Units shall be UL listed as a complete system under UL 60950 Standard for Information Technology and shall comply with EN and the European Low Voltage Directive and be CE marked.

The specified system shall comply with latest FCC Part 15 EMI emission limits for Class A computing devices and the emission and immunity limits of EN50081-2/EN55022 Class A and EN50082-2.

The system shall safely withstand without misoperation or damage:

- Transient voltage surges on the AC power input as defined by ANSI/IEEE C62.41 for Category B3 locations (industrial and commercial facilities with high surge exposure),
- Electrostatic discharges (ESD) up to 10 kV at any point on the exterior of the unit and
- Electromagnetic fields from portable transmitters within 3 ft. (1m) of the unit.

1.3 System Description

1.3.1 Electrical Requirements

Input-Output voltage shall be (480) (480/277) (415/240) (400/230) (380/220) (208/120) (_____) volts AC, (60) (50) Hz, three-phase, (four) (three)-wire-plus-ground.

1.3.2 Environmental Requirements

1. **Storage temperature range:** -67° to +185°F (-55° to +85°C).
2. **Operating temperature range:** +32° to 104°F (0° to 40°C).
3. **Relative humidity:** 0% to 95% without condensation
4. **Operating altitude:** Up to 6,600 ft. (2,000m) above Mean Sea Level. Derated for higher altitude applications.
5. **Storage/transport:** Up to 40,000 ft. (12,200m) above Mean Sea Level.
6. **Audible noise:** Under normal operation noise level shall not exceed 45 dBA measured 5 ft. (1.5m) from surface of the Vertiv™ Liebert® FDC.

1.4 Documentation

1.4.1 Drawings

Submittal drawings shall include:

- One-line wiring diagrams
- Outline drawings including weight, dimensions, heat dissipation and recommended service clearances
- Location and detailed layout of customer power and control connections
- Outline drawings of options if supplied

1.4.2 Equipment Manual

The manufacturer shall furnish an installation, operation and maintenance manual with installation, startup, operation and maintenance instructions for the specified system.

1.4.3 Spare Parts

A list of recommended spare parts shall be supplied at the customer's request.

1.4.4 User's List

An in-service user's list shall be furnished upon request.

1.5 Warranty

The manufacturer shall provide a one-year warranty against defects in material and workmanship for 12 months after initial startup or 18 months after ship date, whichever occurs first. (Refer to the Warranty Statement for details.)

1.6 Quality Assurance

The specified system shall be factory-tested before shipment. Testing shall include, but shall not be limited to: Quality Control Checks, "Hi Pot" Test, two times rated voltage plus 1000 volts, per UL requirements (and Metering Calibration Tests). The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

2.0 PRODUCT

2.1 Components

2.1.1 Frame Construction and Enclosure

The frame shall be constructed of painted steel and pop riveted to provide a strong substructure. The cabinet shall be a freestanding NEMA type 1 enclosure and meet IP10 requirements. The enclosure shall be mounted on four (4) heavy-duty swivel casters for portability and ease of installation and shall be provided with four permanent leveling feet for final installation. The unit shall have easily removable output cable trays with (84 (380-480V, 60Hz only)) (168) cable/conduit openings. All service shall be capable of being performed with access to the front, rear, [(side) units with side-mounted maintenance tie-breakers] and top. Retrofitting additional power distribution cables shall require access to the front or rear of the unit only. A tool shall be required to remove internal accent panels that access the hazardous voltage area of the unit.

The unit shall have lockable, hinged front and rear doors that are 16-gauge perforated sheet metal construction to maximize ventilation. A two-point latch with key lock is provided for security. Doors shall provide access to all output circuit breakers (and to the main panelboard circuit breaker(s)). Doors and side panels (if supplied) are finished in powder-coat black paint. Optional colors are available per the Standard Colors in the Liebert Color Selector.

The unit shall be naturally convection-cooled. No fans for forced-air cooling system shall be used. The convection cooling method shall allow continuous full-load operation. Heat rejection shall be through a screened protective top that prohibits entry of foreign material.

The cabinet dimensions without side panels shall be a maximum of 23.5 in. wide by 78.5 in. high by 38 in. deep (597mm x 1994mm x 965mm). The distributed floor weight shall be less than 250 lb./sq.ft. (1225 kg/sq. m).

2.1.2 Cable Entry/Exit

The Vertiv™ Liebert® FDC shall be designed for (top) (bottom) cable entry/exit. (The unit shall have provisions for entrance and exit of all input and output cabling through the top of the unit.) (The unit shall have a screen top with provisions for entrance and exit of all input and output cabling through the bottom of the unit.)

2.1.3 Input Power Connections (For 208V, 380-415V, 50Hz units)

The Liebert® FDC shall have (one) (two) (four) input power feed(s). (All panelboards will be connected to the input power feed [one input]) (The front panelboard(s) will be connected to one input power feed with the rear panelboard(s) connected to the second input power feed) (Each panelboard shall be connected to an input power feed [four inputs]). Input power conductors shall connect to power blocks. Power blocks shall be provided for connection of the three phase conductors, a 173% rated neutral and a parity-sized insulated ground.

2.1.4 Input Power Connections (For 380-480V, 60Hz units)

The Liebert® FDC shall have (one) (two) input power feed(s). The front panelboard will be connected to the input power feed (and the rear panelboard connected to the second input power feed). Busbars shall be provided for connection of a 100% rated neutral and parity-sized insulated ground conductors.

2.1.5 Main Panelboard Circuit Breaker (For 208V, 380-415V, 50Hz units)

Each distribution panelboard shall be protected by a main panelboard circuit breaker. The breaker shall be UL listed and IEC rated for use at the system voltage. The main panelboard circuit breaker shall have a rating of 225 amperes with an overall short-circuit current rating of (22kA) (10kA [for GE Plug-in panelboards]) (Standard [no rating available for @ 380-415V]) RMS symmetrical amperes.

2.1.6 Main Panelboard Circuit Breaker (For 380-480V, 60Hz units)

Each distribution panelboard shall be protected by a main panelboard circuit breaker. The breaker shall be UL listed and IEC rated for use at the system voltage. The main panelboard circuit breaker shall have a rating of 400 amperes with an overall short-circuit current rating of (35kA) (65kA) RMS symmetrical amperes.

2.1.7 Distribution Panelboards (For 208V, 380-415V, 50Hz units)

The specified system shall contain (four) (three) (two) (one) vertically mounted (Square D) (GE [not available @ 380-415V]) (bolt-in) (plug-in) panelboard(s) for distribution to the intended loads. (Two panelboards) (One panelboard) shall be accessed from the front of the unit and (two panelboards) (one panelboard) shall be accessed from the rear of the unit. Each panelboard shall be totally enclosed with a hinged accent panel that provides access to that panelboard. The panelboard shall have a rating of 225 amperes, with an overall short-circuit current rating of (22kA) (10kA [for GE Plug-in panelboards]) (Standard [no rating available for @ 380-415V]) RMS symmetrical amperes. The panelboard(s) shall provide a total of (168) (126) (84) (42) single-pole branch circuit breaker positions. Each panelboard shall include separate isolated neutral and safety-ground busbars for the neutral and safety-ground connections for at least 42 output circuits. The neutral busbar and wiring shall be sized for at least 1.73 times the panelboard full load rating to accommodate high harmonic neutral currents associated with single-phase nonlinear loads.

Note: GE Panelboards cannot be used at 380-415V.

2.1.8 Distribution Panelboards (for 380-480V, 60Hz units)

The specified system shall contain (two) (one) vertically mounted (Square D) (GE) (bolt-in) (plug-in) panelboard(s) for distribution to the intended loads. A panelboard shall be accessed from the front of the unit (and a second panelboard shall be accessed from the rear of the unit). The panelboard shall be totally enclosed with a hinged accent panel that provides access to that panelboard without exposing other portions of the unit. The panelboard shall have a rating of 400A amperes, with an overall short-circuit current rating of (35kA) (65kA) RMS symmetrical amperes. The panelboard(s) shall provide a total of (84) (42) single-pole branch circuit breaker positions. Each panelboard shall include separate isolated neutral and safety-ground busbars for the neutral and safety-ground connections for at least 42 output circuits. The neutral busbar and wiring shall be sized for full load rating of the panelboard.

2.1.9 Branch Circuit Breakers

Each load shall be protected by an individual branch circuit breaker. Single-pole, two-pole and three-pole (plug-in) (bolt-on) type branch breakers up through 100 amperes shall be utilized. Each branch circuit breaker shall provide overcurrent protection and shall clearly indicate the ON, OFF and TRIPPED positions. All branch circuit breakers shall have a minimum interrupting capacity of [(10kA) (22kA) @ 208V] [6kA @ 380-415V, 50Hz] [(18kA) (35kA) (65kA) @ 380-480V, 60Hz] RMS symmetrical amperes at (208/120) (380/220) (400/230) (415/240) (480/277) VAC. Each branch circuit breaker shall be sized in accordance with the NEC and shall be UL/CSA listed. Branch circuit breakers shall have an associated directory label identifying the branch circuit number and the equipment being served.

2.1.10 Output Distribution Cables

The cable supplying each load shall consist of UL/ULC listed liquid-tight, flexible metal conduit containing the required THHN copper insulated power, neutral and parity-sized ground conductors. The flexible conduit shall be liquid-tight, insulated and shielded to minimize electrical or mechanical disturbances to the conductors. The length of each cable and the type of receptacle/termination shall be as specified on the detailed cable schedule. Each output distribution cable shall be permanently labeled at each end of the cable with the assigned circuit number and receptacle type, equipment identification and cable length. Each cable shall be thoroughly factory-checked and factory-tested. Tests shall include continuity, phase rotation and a Hi Pot test at twice-rated circuit voltage plus 1000 volts. Each cable shall be a UL listed assembly.

2.2 Accessories (Optional Components)

2.2.1 Current Monitoring Panel

The Current Monitoring Panel shall consist of a four-digit high-visibility Liquid Crystal Display (LCD) to monitor current parameters. Front and rear LCDs shall be provided with push-button switches for operator interface. The three-phase and neutral currents for each panelboard shall be displayed. The display and switches shall be accessible without opening the door. All currents shall be monitored using true RMS measurements for accurate representation of non-sinusoidal waveforms typical of computers and other sensitive loads.

2.2.2 Current Plus Monitoring With Display

The Current Plus Monitoring (CPM) shall monitor the current and voltage of the panelboard main circuit breaker and include a monochrome Liquid Crystal Display (LCD) with oval bezel that includes power and alarm LEDs, an audible alarm and an alarm silence push button. The CPM shall display the power parameters and alarms listed below for each panelboard main. A display shall be mounted on the front and rear doors, the display and switches are accessible without opening the door.

The following metering parameters shall be displayed:

- Voltage
 - Line-to-line
 - Line-to-neutral
- Neutral Current
- Ground Current
- kVA
- Power Factor
- Voltage Total Harmonic Distortion (THD)
- Current Total Harmonic Distortion (THD)
- Crest Factor

Circuit identification and status of each breaker shall be displayed.

The CPM shall detect and annunciate by alarm message the following conditions:

- Overvoltage
- Undervoltage
- Neutral Overcurrent
- Ground Overcurrent
- Phase Overcurrent
- Phase Overcurrent Warning
- Summary Alarm

All alarm thresholds for monitored parameters shall be adjustable by way of the service port to match site requirements. The factory setpoints for the alarms shall be as follows:

- **Overvoltage** - at least one of the line-to-line voltages exceeds +6% of nominal

- **Undervoltage** - at least one of the line-to-line or line-to-neutral voltages falls below -13% of nominal
- **Phase Overcurrent Warning** - current exceeds 75% of breaker amps
- **Phase Overcurrent** - current exceeds 80% of breaker amps
- **Neutral Current** - current exceeds 95% of breaker amps
- **Ground Current** - current exceeds 5 amps

Summary Alarm

- **Summary Alarm** - shall detect and annunciate upon occurrence of any alarm

Summary Alarm Contacts

- The CPM shall have form C (1 NO and 1 NC) summary alarm contact for remote alarm status. The contacts are rated at 24VAC @ 1A. The contacts shall change state upon occurrence of any alarm including warnings and shall reset when the alarm is cleared.

To facilitate troubleshooting, all alarms shall be stored in non-volatile memory to protect against erasure by a power outage. Alarms shall be manually reset after the alarm condition has been corrected.

Alarms shall be saved in an event log. The event log shall store 128 events using a first-in, first-out format (FIFO).

Communication

The CPM shall have 3 Vertiv™ Liebert® IntelliSlot ports; up to 3 Liebert® IntelliSlot cards can be added for customer connection to a Building Management System (BMS). (The CPM shall communicate with a Vertiv™ Liebert® SiteScan™ System using RS485.

2.2.3 Vertiv™ Liebert® Distribution Monitoring (LDMF)

The Liebert® LDMF shall be capable of receiving input from branch current sensor modules. The system shall monitor (one) (two) (three) (four) 42 pole panelboard(s). Each Sensor Module shall contain twenty-one 100A current transformers (CT) capsulated in an epoxy filled plastic enclosure designed to mount next to the panelboard. No individual current transformers mounted on a printed circuit board shall be used. Sensor Module shall be designed to work with (Square D) (GE) panelboards.

In addition to monitoring the branch circuit breakers, the Liebert® LDMF shall monitor the current and voltage of the panelboard main circuit breaker. These measurements are used for reporting the average RMS current, power and other parameters.

The Liebert® LDMF reports alarm and status conditions for each branch circuit breaker and the panelboard main circuit breaker.

The Liebert® LDMF shall monitor and display the following parameters for each branch circuit breaker:

- Phase Current
- Percent Load
- kW
- kW-Hours

In addition, the Vertiv™ Liebert® LDMF shall monitor and display the following parameters for the panelboard main circuit breaker:

- Voltage
- Line-to-line
- Line-to-neutral
- Neutral Current
- Ground Current
- kVA
- Power Factor
- Voltage Total Harmonic Distortion (THD)
- Current Total Harmonic Distortion (THD)
- Crest Factor

Circuit identification and status of each breaker shall be displayed. Parameters shall be updated every 500msec.

The Liebert® LDMF shall detect and annunciate by alarm message the following conditions:

- **Overvoltage** - panelboard main breaker
- **Undervoltage** - panelboard main breaker
- **Neutral Overcurrent** - panelboard main breaker
- **Ground Overcurrent** - panelboard main breaker
- **Phase Overcurrent** - panelboard main breaker and branch breakers
- **Phase Overcurrent Warning** - panelboard main breaker and branch breakers
- **Phase Low Current Warning** - branch breakers
- **Summary Alarm**

All alarm thresholds for monitored parameters shall be adjustable by way of the service port to match site requirements. The factory setpoints for the alarms shall be as follows:

Panelboard Main Breaker

- **Overvoltage** - at least one of the line-to-line voltages exceeds +6% of nominal
- **Undervoltage** - at least one of the line-to-line or line-to-neutral voltages falls below -13% of nominal
- **Phase Overcurrent Warning** - current exceeds 75% of breaker amps
- **Phase Overcurrent** - current exceeds 80% of breaker amps
- **Neutral Current** - current exceeds 95% of breaker amps
- **Ground Current** - current exceeds 5 amps

Branch Breakers

- **Overcurrent Warning** - current exceeds 75% of breaker amps

- **Phase Overcurrent** - current exceeds 80% of breaker amps
- **Low Current Warning** - minimum current level of a branch breaker

Summary Alarm

- **Summary Alarm** - shall detect and annunciate upon occurrence of any alarm

Summary Alarm Contacts

- The Vertiv™ Liebert® LDMF shall have form C (1 NO and 1 NC) summary alarm contact for remote alarm status. The contacts are rated at 24VAC @ 1A. The contacts shall change state upon occurrence of any alarm including warnings and shall reset when the alarm is cleared.

To facilitate troubleshooting, all alarms shall be stored in non-volatile memory to protect against erasure by a power outage. Alarms shall be manually reset after the alarm condition has been corrected.

Alarms shall be saved in an event log. The event log shall store 128 events using a first-in, first-out format (FIFO).

Communication

The Liebert® LDMF shall have 3 Vertiv™ Liebert® IntelliSlot ports; up to 3 Liebert® IntelliSlot cards can be added for customer connection to a Building Management System (BMS).) (The Liebert® LDMF shall communicate with a Vertiv™ Liebert® SiteScan™ System using the Liebert® SiteScan™ Monitoring Interface option.)

2.2.4 Liebert® LDMF Display

A monochrome Liquid Crystal Display (LCD) with power and alarm LEDs, an audible alarm and an alarm silence push button. It will display all the Liebert® LDMF power parameters and alarms listed in Section 2.2.3 for the panelboard mains and branch breakers. A display shall be mounted on the front and rear door, the display and switches are accessible without opening the door.

2.2.5 Liebert® LDMF and Liebert® SiteScan™ Monitoring Interface

Monitoring interface module allows Liebert® Distribution Monitoring (LDMF) to communicate to Liebert® SiteScan™ Web 4.0 or later. Includes software and graphics that support up to 168 branch breakers using an Ethernet connection.

2.2.6 Liebert® IntelliSlot IS-UNITY-DP Card

The Vertiv™ Liebert® FDC shall be supplied with an IS-UNITY-DP Card for remote communication using two of the following protocols: HTTP/HTTPS, Emerson Protocol, Email, SMS, SNMP v1/v2c/v3, BACnet IP/MSTP and Vertiv™ Liebert® Modbus TCP/RTU output. A serial RS-485 two wire connector shall be supplied.

NOTE: Two of the 3rd party protocols (SNMP, Modbus or BACnet) may be configured and used simultaneously. Liebert® Modbus RTU and BACnet MSTP cannot both be enabled simultaneously.

2.2.7 EZ-View Doors

The enclosure shall be provided with lockable, hinged removable doors with a clear acrylic scratch-resistant and impact-resistant Plexiglas insert to allow for external viewing of the branch breakers without opening the door.

2.2.8 Solid Sheet Metal Doors

The enclosure shall be provided with lockable, hinged removable solid sheet metal doors with air circulation vents at the door top and bottom.

2.2.9 Plug-In Main Breakers (for 208V, 380-415V, 50Hz units)

Plug-in main panelboard circuit breakers shall be provided to allow easy replacement. The plug-in feature of the breaker shall include interlock, which prevents the breaker from being unplugged without being in the Off (open) position.

2.2.10 Maintenance Tie-Breakers (for 208V, 380-415V, 50Hz units)

Plug-in tie-breakers shall be provided to connect two panelboards to a common panelboard main circuit breaker within the Vertiv™ Liebert® FDC. This allows the tie-breakers and plug-in panelboard mains to be removed for testing or replacement without interrupting power to the load. The inputs must be fed from the same source so they can be safely tied together. Breakers shall be located behind a side-access lockable hinged door.

NOTE: Maintenance tie-breakers require side access for installation and maintenance.

2.2.11 Isolated Ground Busbar (for 208V, 380-415V, 50 Hz units)

An isolated ground busbar shall be provided for each panelboard to connect the output cable isolated ground conductor. The isolated ground busbar is in addition to the standard equipment ground busbar.

2.2.12 65kAIC Main Panelboard Circuit Breaker (for 380-480V, 60Hz units)

The main panelboard circuit breaker shall have an overall short-circuit current rating of 65kA RMS symmetrical amperes.

2.2.13 Main Panelboard Circuit Breaker Deduct (for 380-480V, 60Hz units)

Deduct the main panelboard circuit breaker. Panelboard shall be provided without main breaker.

2.2.14 Side Panels

Unit shall be supplied with 20-gauge sheet metal (right side) (left and right side) panel(s). A tool shall be required to remove the exterior panels that access the hazardous voltage area of the unit.

2.2.15 Floor Stands

Floor Stand shall be furnished to support and level the unit and to provide bottom cabling access without relying on a raised floor for support. The nominal height of the floor pedestals shall be [18 in. (483mm)] [24 in. (610mm)] [30 in. (762mm)] [36 in. (914mm)] with adjustment for ±1.25 in. (32mm).

2.2.16 Factory Witness Test

A pre-scheduled demonstration of the standard factory test procedures performed on the customer's unit at Emerson Network Power's manufacturing facility.

2.2.17 Certified Test Report

A certified copy of the factory test report shall be provided for each unit.

2.2.18 Export Crating

Heavy-duty solid wood crating shall be provided to meet international requirements regarding package strength and special markings for overseas shipments.

3.0 EXECUTION

Factory startup, preventive maintenance and full service for the specified system shall be available and included upon request. The manufacturer shall directly employ a service organization of factory-trained field service personnel dedicated to the startup, maintenance and repair of the manufacturer's power equipment. The manufacturer shall maintain a dispatch center 24 hours per day, 365 days per year, to minimize service response time and to maximize availability of qualified service personnel.