DISA Computing Services Division (CSD)
Facilities Engineering Team (GS452)

Minimum Technical Specifications and Planning/Installation Guidance For Remote Distribution Cabinets (RDCs)

This specification defines the electrical and mechanical characteristics and requirements for Remote Distribution Cabinets (RDCs) to be deployed at Computing Services datacenters. RDCs are subject to specific rigid specifications because products installed at DISA datacenters must meet the physical environment of our buildings. Products that do not meet these specifications are not acceptable and will not be ordered, purchased, accepted, or installed on DISA computer floors.

RDCs (also known as "PDU expansion cabinets," "sidecars," or "satellites" expand the 120/208V power distribution from a Power Distribution Unit (PDU) by providing additional circuit breaker panels. RDCs are fed from subfeed breakers in PDUs. They are similar in function to PDUs but do not contain a transformer – both the input and output power are 3-phase 120/208V. An RDC simply provides additional 42-space circuit breaker panels to allow additional power distribution to IT equipment. PDUs installed at Computing Services datacenters are generally rated for 100kVA or more, and generally only provide 2 to 4 panels (84 to 168 breaker spaces); the current distribution of power through these existing circuit breaker spaces only consumes a small fraction of the rated power capacity of the PDU. In order to optimize the usage of these expensive PDUs, we can (in many cases) use existing "subfeed breakers" to add RDCs.

An image of an RDC in shown to the right. The unit shown does not necessarily meet all specifications herein, and is only shown for illustrative purposes. This does not indicate any preference of vendor or manufacturer.

RDCs are deployed as near to the supported IT equipment load as possible, often supporting only one or two rows of server equipment in a zone (rather than the PDU, which supports a large amount of equipment that is distributed physically over a larger area). The use of RDCs at the IT equipment locations reduces costs and materials used to provide power to the IT equipment and reduces equipment congestion in the raised floor cooling air plenum. Planned RDC locations should employ the shortest output distribution cable runs consistent with logical equipment arrangement and allowances for future additions.

Because of the planned use of RDCs at the IT equipment location (rather than central to a larger "zone" of equipment as for a PDU, the RDCs must physically work with the Facilities Master Planning Guidance. Central to this guidance is the concept of pre-planned server farms that mesh with the other infrastructure systems, including the 24" raised floor grid. RDCs for use on Computing Services datacenter raised floors shall have the same footprint as an IT equipment rack so that they can be integrated into planned and existing server farms. This footprint is generally much smaller than that of a PDU, and requires a greatly reduced space for access and maintenance (even in non-rack zones).

1. SCOPE.

Scope: This specification covers the technical requirements for a power distribution center referred to as a Remote Distribution Cabinet (RDC) that provides distribution for electrical branch circuits supporting IT equipment.

RDCs are specified with four (4) internal subpanels to provide the maximum flexibility to the raised floor environment.

2. APPLICABLE STANDARDS.

The RDC will be designed, manufactured, tested, and installed in compliance with the following standards:

- National Fire Protection Association (NFPA) Code 70 - National Electrical Code (NEC)
- American National Standard for Electrical Power Systems and Equipment Voltage Ratings (60 Hz), ANSI C84.1

- Underwriters Laboratory (UL) Listed in accordance with UL 478, Standard for Electronic Data Processing Units and Systems, at date of manufacture.
- Fully CSA Listed at date of manufacture.
- Latest version of the DISA Facilities Standards CSI 360-95-3
- 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/EN550022 Class A and EN50082-2.

3. SYSTEM DESCRIPTION.

Electrical Requirements: Input/Output voltage shall be 208/120 volts AC, 60 Hz, three-phase, four-wire-plus-ground.

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. The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

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.

Environmental Requirements:
Storage temperature range: -55 to +85°C (-67 to +185°F).
Operating temperature range: 0 to 40°C (+32 to 104°F).
Relative humidity: 0% to 95% without condensation
Operating altitude: Up to 6,600 ft. (2,000m) above Mean Sea Level. Derated for higher altitude applications.
Storage/transport: Up to 40,000 ft. (12,200m) above Mean Sea Level.
Audible noise: Under normal operation noise level shall not exceed 45 dBA measured 5 ft. (1.5m) from surface of the RDC.
Cooling requirements: As with all electrical devices, the Remote Distribution Cabinet produces heat under normal operation. The maximum typical heat output is 1 ton, or approximately 3412 BTU/Hr (1 kWH). This heat output should be included when calculating the environmental conditions of the room. Cooling is conducted by direct convection through the bottom of the unit. Installation of the unit shall preserve static air pressure under the raised floor.

4. COMPONENTS.

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. All service shall be capable of being performed with access to the front, rear and top only. A tool shall be required to remove internal access panels that access the hazardous voltage area of the unit.

The unit shall be front- and rear-access only. In order to be utilized as planned, the unit must fit in the same footprint as a standard 24" width IT equipment rack and not require side access after installation. Retrofitting additional power distribution cables shall require access to the front or rear of the unit only.

The unit shall have lockable, removable, hinged front and rear doors that are 16-gauge perforated sheet metal construction to maximize ventilation. A two-point latch ("door handle") with key lock shall be provided for security. Doors shall provide access to the main panelboard circuit breakers and to all output circuit breakers. Doors and side panels are finished in electrostatic powder-coat ☐ **black** ☒ **cream** ☐ **white** ☐ **blue** ☐ **green** ☐ **gold** ☐ **pink**.

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 shall be a maximum of 24" width by 78.5" height by 42" depth (610mm x 1994 mm x 1067 mm) in order to fit on the 24 in. raised floor grid, to be installed through standard 2 meter doorways, to present a low enough profile to not interfere with fire suppression equipment, and to fit seamlessly into DISA's "server farm" master plan concept. This equipment is sized to both be freestanding and to fit into DISA "master plan" server farm floor layouts for maximum flexibility in placement and power distribution.

The distributed floor weight shall be less than 250 lb/ft^2 (1225 kg/m^2).

Minimum Service Clearances are 36” front and rear for access door swings. The clearances at the front and rear of the unit are required for service access by the National Electrical Code (NEC). No RDCs shall have mandatory or optional components requiring side access (thus the RDCs can be integrated into the middle of a row of IT equipment racks rather than being placed at the end of a row only). Clearance above the unit is required for cooling airflow (exhaust) and to meet fire code clearances relating to sprinkler systems.

Cable Entry
The RDC shall be designed for bottom cable entry. Bottom clearance is required for exit of output distribution cables/conduits and for cooling airflow. This clearance is automatically provided by a raised floor with a minimum height of 15" (381mm).

Input Power Connections
The RDC shall have one input power feed. All panelboards will be connected to the input power feed. 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.

Main Panelboard Circuit Breaker
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 breakers shall have a rating of 225 amperes (corresponding to the PDU subfeed output breaker 225A rating) with a minimum overall short-circuit current rating of 10kA RMS symmetrical amperes. The short circuit rating shall be consistent with NEC requirements.

Distribution Panelboards
The specified system shall contain four vertically mounted ☒ **Square D** ☐ **GE** panelboards with ☐ **plug-in** ☒ **bolt-in** circuit breakers for distribution to the intended loads. Two panelboards shall be accessed from the front of the unit and two panelboards shall be accessed from the rear of the unit. Each panelboard shall be totally enclosed with an individual hinged access panel that provides access to that panelboard without exposing other portions of the unit.
Each panelboard shall have a rating of 225 amperes, with a minimum overall short-circuit current rating of 10kA RMS symmetrical amperes. The four (4) panelboards shall provide a total of 168 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 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.
Each panelboard shall have an individual cover panel such that access to a single breaker panel requires removal of only that panel’s safety cover.

Branch Circuit Breakers
Each load shall be protected by an individual branch circuit breaker. Single-pole, two-pole and three-pole plug-in 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 10,000A RMS symmetrical amperes at 120/208 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.
Each panelboard shall be fully populated with one- and three-phase 20Acircuit breakers of the appropriate type, ½ of the spaces in each panel being 1ϕ 20A and ½ being 3ϕ 20A.

Output Distribution Cables
Output distribution cabling shall be installed to support individual IT equipment loads after installation and start-up of the RDC. Provision and installation of these “whips” are not a requirement of the RDC equipment provider. Output distribution cabling shall be landed through the bottom of the RDC (underfloor cabling distribution system).

5. ACCESSORIES (OPTIONAL COMPONENTS).

☒ **Inside Delivery**
Inside delivery is specified for all RDC units purchased.

☐ **Current Monitoring Panel** (not typically required on RDC)
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.
DISA typically monitors current parameters at the PDU, not at the RDC.

☐ **Enhanced Monitoring Panel** (not typically required on RDC)
The enhanced monitoring panel shall consist of a bright, easy to read, 12-digit (three lines of four digits each), 3/4-in. high, LED display to monitor voltage, current and power parameters. Front and rear displays shall be provided, each with a toggle switch to allow an operator to view data for each panelboard. The displays and switches shall be accessible without opening the door. The following metering parameters shall be displayed:

Voltage line-to-neutral for each phase	Current demand, for each phase and average
Voltage line-to-line for each phase	Peak current demand, for each phase and average
Voltage line-to-neutral average	Frequency
Voltage line-to-line average	Total Power Factor
Current for each phase	Total kW
Neutral current	Peak kW
Current average	kWH

All voltages and currents shall be measured using true RMS techniques for accurate representation of non-sinusoidal waveforms associated with computers and other sensitive electronic loads. The metering parameters shall have a full-scale accuracy of ±0.5%.
For remote monitoring, a RS-485 port that includes Modbus RTU protocol is provided for each panelboard.
DISA typically monitors current parameters at the PDU, not at the RDC.

☒ **View Doors** (DISA standard option)
The enclosure shall be provided with lockable, hinged removable doors with a clear acrylic scratch- and impact-resistant Plexiglas insert to allow for external viewing of the branch breakers without opening the door.

☐ **Solid Sheet Metal Doors** (not typically required on RDC)
The enclosure shall be provided with lockable, hinged removable solid sheet metal doors with air circulation vents at the door top and bottom.

☒ **Plug-In Main Breakers** (DISA standard option)
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.

☐ **Maintenance Tie-Breakers** (not typically allowed for DISA configurations)
Tie-breakers shall be provided to allow connection of the panelboards within the RDC to different inputs. The inputs must be fed from the same source so they can be safely tied together. Breakers are located behind a lockable, hinged door on the ride side of the unit. Side access is required with this option.
This option is used to connect a single RDC to two PDUs on a single UPS bus. There are no options currently available to support a single RDC powered by two separated UPS busses.

☒ **Isolated Ground Busbar** (DISA standard option)
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.

☒ **22kAIC Main Panelboard Circuit Breaker** (DISA standard option)
The main panelboard circuit breaker shall have an overall short-circuit current rating of 22kA RMS symmetrical amperes.

☐ **Branch Circuit Monitoring System** (not typically required on RDC)
The Branch Circuit Monitoring System (BCMS) shall monitor the individual branch circuits of a 42-pole panelboard. The BCMS provides current and alarm conditions for each branch circuit. There shall be two user-adjustable alarm levels that provide both a warning alarm and a critical alarm. Sensor strip current transformers (CT) shall have a current range of 0-50A with an accuracy of ±5%. The warning alarm shall be adjustable from 0-100% and factory-set at 60%. The critical alarm shall be adjustable from 0-100% and factory-set at 70%. The BCMS shall have an RS-485 Modbus RTU communication port for configuration and remote data access. Up to 32 BCMSs can be daisy-chained using a 2-wire or 4-wire Modbus network. Side access is required with this option.

DISA typically monitors current parameters at the PDU, not at the RDC. IT equipment rack specifications include individually metered 3ϕ modular power distribution units ("power strips") that will provide branch circuit monitoring at the rack level.

☒ **Side Panels** (DISA standard option)
Unit shall be supplied with 18-gauge sheet metal (right) (right and left) side panel(s). A tool shall be required to remove the exterior panels that access the hazardous voltage area of the unit.

☐ **Export Crating** (not typically required on RDC)
Heavy-duty solid wood crating shall be provided to meet international requirements regarding package strength and special markings for overseas shipments.

6. WARRANTY
The manufacturer shall provide a one-year warranty against defects in material and workmanship for 12 months after ship date. 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. DISA requires a 48-hour onsite diagnostic response to warranty issues within the warranty period. The manufacturer shall provide necessary repairs or replacement components for failed equipment within 72 hours of the arrival of the onsite diagnostic response at no additional cost to the Government.