Stationary Power Distribution Unit (SPDU)  
3-phase, 75-300 kVA

Guide Specifications
PART 1 — GENERAL

1.1 SUMMARY

A. This technical specification describes the electrical characteristics and general requirements for a power conditioning and distribution system. This system shall henceforth be referred to as the Stationary Power Distribution Unit (SPDU).

B. The specified system will be used to distribute, monitor, and control computer-grade power to sensitive electronic equipment and other critical loads.

1.2 STANDARDS

A. Underwriters Laboratories Standard, UL 60950

B. National Electric Code (NFPA 70)

C. National Electrical Manufacturers Association (NEMA)

D. American National Standards Institute (ANSI)

E. National Fire Protection Association (NFPA)

F. Federal Information Processing Standards (FIPS)

G. FCC Part 15 EMI

H. ISO 9001

1.3 SYSTEM DESCRIPTION

A. Electrical Requirements

1. The SPDU must be able to satisfy the following requirements for continuous Output Capacity:
   a. 75 kVA
   b. 100 kVA
   c. 125 kVA
   d. 150 kVA
   e. 200 kVA
   f. 225 kVA
   g. 300 kVA
2. The SPDU must be able to satisfy the following requirements for Input Voltage, while operating at a frequency of 50 Hz or 60 Hz with either three or four wires plus ground:
   a. 208 V AC
   b. 240 V AC
   c. 380 V AC
   d. 400 V AC
   e. 480 V AC
   f. 600 V AC

B. Environmental Requirements

1. The SPDU must be designed for operation in the following conditions:
   a. Operating Temperature: 0°C to +40°C
   b. Storage: -40°C to +60°C
   c. Relative Humidity: 0% to 95%, non-condensing

2. The system’s Audible Noise must be less than the ANSI C89 Standard for transformers.

1.4 DOCUMENTATION

A. Equipment Manual: The SPDU manufacturer must furnish an installation manual that comprehensively covers installation, start-up, operation, and maintenance instructions for the specified system.

B. Drawings: The SPDU manufacturer must furnish a comprehensive array of system wiring diagrams, and detailed drawings of all system components.

C. Spare Parts: The SPDU manufacturer must provide a list of recommended spare parts upon request.

1.5 WARRANTY

A. The SPDU manufacturer must guarantee the entire system against defective materials and workmanship for a minimum period of one (1) year from date of delivery, and not to exceed eighteen (18) months from date of factory shipment.

B. In addition, manufacturer-provided start-up services and extended warranties must be made available as options.

1.6 QUALITY ASSURANCE

A. Factory testing must be performed on all SPDU equipment prior to shipment, and the manufacturer must be ISO 9001 certified.

B. Testing must include, though not necessarily be limited to, the following: Quality Control Checks, “Hi-Pot” and Ground Continuity Testing (per UL60950 requirements), and Meter Calibration Tests.
PART 2 — PRODUCT SPECIFICATION

2.1 COMPONENTS

A. The SPDU enclosure must be constructed of welded steel and be a free standing unit. The enclosure must be able to offer both mobility and stability, as the need arises. It should include four (4) 360° swivel casters to support movement and four (4) leveling jacks for stabilization at its final installation location. These component sets should be easily interchangeable.

B. The SPDU enclosure must be constructed in such a way that all servicing—including preventive maintenance, re-torque of all power connections, and (when required) compensation tap changes—can be performed via front access to the unit. Side or rear access should not be required for any of these purposes.

C. A tool must be provided for removing those panels providing access to exposed live parts. Grounding integrity, static protection, and EMI/RFI shielding must be ensured by grounding removable panels to the frame through the use of stranded copper wire.

D. All units must include provisions for properly accommodating both top and bottom cable entry and exit.

E. The SPDU must use natural convection for cooling purposes. Forced air (fan) cooling is expressly forbidden. The convection cooling must allow continuous full load operation without activating the internal over-temperature alarms. There must be no clearance required for cooling purposes in the rear and sides of the unit. Heat rejection must be provided through the protective top of the unit. The protective top must also prohibit entry of foreign material (per UL guidelines).

F. The SPDU enclosure must be designed so as to be able to accept at least four (4) distribution expansion sidecar enclosures. Each sidecar must not exceed 20 inches in width, while providing a minimum of 84 additional circuit breaker pole positions to the system. Each sidecar enclosure must be capable of becoming an integral part of the SPDU system via internal copper busbar power connections. The distribution panels contained in the SPDU and sidecars must face forward, such that additional workspace is not required on the sides of any of these units.
G. The maximum permitted dimensions for the SPDU and sidecar enclosures are as follows:

1. 75-225 kVA units
   a. SPDU
      1.) Height: 81.5”
      2.) Width: 36”
      3.) Depth: 32”
   b. Sidecar
      1.) Height: 81.5”
      2.) Width: 20”
      3.) Depth: 32”
2. 300 kVA units
   a. SPDU
      1.) Height: 81.5”
      2.) Width: 45”
      3.) Depth: 38.5”
   b. Sidecar
      1.) Height: 81.5”
      2.) Width: 20”
      3.) Depth: 38.5”

H. The SPDU’s main input power connections must terminate directly on its main input circuit breaker. These connections must be wholly accessible from the front of the unit, and the use of additional components or junction boxes to support top or bottom entry of the power cables is expressly forbidden.

I. A separate, low-voltage control wiring terminal strip must be provided for connecting Remote Emergency Power Off (REPO) and dry contact relay interfaces. The relay contacts must be rated 10 Amps at 240 VAC.

2.2 MAIN INPUT CIRCUIT BREAKER

A. The SPDU must include a main input circuit breaker that provides over-current protection, while also serving as the principle means for disconnecting primary power to the system. This main breaker must be a molded case circuit breaker (MCCB) having a minimum interrupting rating of 25,000 RMS symmetrical amps at 480 VAC.

B. The main input MCCB must include a 24 VAC shunt trip mechanism and an alarm contact for remotely indicating status.
2.3 ISOLATION TRANSFORMER

A. The SPDU must contain an electrostatically shielded transformer for voltage step-down and isolation purposes. The transformer must be capable of accommodating the kVA, input voltage, and output voltage ratings described in Section 1.3.

B. The isolation transformer must carry either a K1, K13, or K20 rating and include all copper windings.


D. The isolation transformer must have the following electrical and constructional characteristics:
   1. Percent Impedance: 3.0 - 5.0%
   2. Full Load Efficiency: 96.5 - 98%
   3. Insulation Class: Class “H”
   4. Temperature Rise: 150°C

E. The isolation transformer must contain two (2) sets of overload protection devices for monitoring core temperature. The thermal sensors that trigger these devices should be located in each coil of the transformer’s windings. The first set of sensors must be calibrated at 180°C, and the second set at 200°C. In the event of a 180°C core temperature condition, the first overload protection device will initiate local audible and visual alarms and energize the Summary Alarm Relay to signal this status to remote devices. In the event of a 200°C core temperature condition, the second overload protection device will close a set of contacts and initiate an automatic shutdown event.

F. The isolation transformer must be cooled by natural convection.

2.4 MANUAL RESTART OPTION

A. The SPDU must include a manual restart circuit that allows an orderly restart of the system when input power is lost. This circuit will automatically energize the shunt trip mechanism in the main input circuit breaker.

B. A methodology for field deactivation of this feature must be provided.

2.5 EMERGENCY POWER OFF (EPO)

A. The local EPO must include a fully guarded push button labeled “Emergency Power Off.” This button, when pressed, will activate the shunt trip mechanism in the main input circuit breaker.

B. An interface must also be provided for connecting one or more normally open (NO) or normally closed (NC) REPO dry contacts to the EPO circuit.
2.6 COMPUTER-GRADE GROUND

A. The SPDU must include a computer-grade, single-point ground that complies with electronic equipment manufacturer’s requirements IEEE 1100-1998.

B. A further requirement is that the neutral point be solidly bonded.

2.7 OUTPUT DISTRIBUTION PANEL BOARDS

A. The SPDU enclosure must be capable of accommodating two 42-pole, 225 amp, 240V, three-phase distribution panel boards. The unit must also be capable of accommodating up to seven 225 amp frame (AF), 3-pole, molded case circuit breakers (MCCBs) in place of one of the 42-pole panel boards, and up to eleven 225 AF MCCBs in place of both 42-pole panel boards.

B. Each distribution panel board must be individually protected by a main input circuit breaker having a short-circuit rating of 65,000 RMS symmetrical amperes at 240 VAC.

C. Each distribution panel board must be constructed with copper busbar, and be capable of accepting 1-pole, 2-pole, and 3-pole circuit breakers that are rated up to 100 amps.

D. Each distribution panel board must include isolated neutral and safety ground bars for terminating branch circuit wiring. These bars should ideally be located on either side of the distribution panel boards to facilitate installation.

2.8 BRANCH CIRCUIT BREAKERS

A. Each branch circuit breaker must provide over-current protection.

B. Each branch circuit breaker must be equipped with three (3) toggle positions: ON, OFF, and TRIPPED.

C. All branch circuit breakers must be 1-pole, 2-pole, and 3-pole types and rated 15 amps through 100 amps.

D. All branch circuit breakers must have a minimum rating of 10,000 RMS symmetrical amperes at 120/240 VAC.

2.9 OUTPUT POWER CABLES

A. The SPDU enclosure must accommodate up to 84 output power cables per 84 pole positions.

B. All output power cables must be able to exit the SPDU at either the top or the bottom of the enclosure.
2.10 MONITORING SYSTEM

A. The SPDU must offer the option of selecting between Basic, Advanced, or Premium-level monitoring systems.

B. Basic Monitoring Parameters

1. The Basic-level monitoring system must continuously monitor the temperature of the electrostatically shielded isolation transformer, the status of the main input circuit breaker, and the status of a remote alarm contact.
2. The monitor will initiate local audible and visual alarms and energize the Summary Alarm Relay (to signal status to remote devices) under the following conditions:
   a. A 180°C transformer core temperature condition.
   b. A 200°C transformer core temperature condition.
   c. Main input circuit breaker tripped.
   d. Remote alarm contact closed.
3. An Alarm Indicator/Reset push button must be located on the front of the SPDU. This push button will be capable of disabling any active audible alarms. The Alarm Indicator and Summary Alarm Relay should not reset until the fault condition has been cleared.

C. Advanced Monitoring Parameters

1. The Advanced-level monitoring system must utilize a microprocessor-based power module that has the capability to sense, process, and display the following:
   a. Output Voltages: Line-to-line for all three phases
   b. Output Voltages: Line-to-neutral for all three phases
   c. Output Current: All three phases
   d. Output Frequency
   e. Output Power: kVA, kW, power factor
   f. Min and Max values: All monitored values

D. Premium Monitoring Parameters

1. The Premium-level monitoring system must utilize a microprocessor-based power monitor that has the capability to sense, process, and display the following:
   a. Output Voltages: Line-to-line for all three phases, plus average
   b. Output Voltages: Line-to-neutral for all three phases, plus average
   c. Output Voltages THD: Line-to-line for all three phases
   d. Output Voltages THD: Line-to-neutral for all three phases
   e. Output Current: All three phases, plus average
   f. Output Current: Neutral
   g. Output Current: Ground
   h. Output Current THD: All three phases and neutral
   i. Output Frequency
   j. Output Power: kVA, kW, power factor
   k. Min and Max values: All above monitored values
1. K Factor
m. Crest Factor
n. Discrete Input and Output Status
o. Analog Input Reading
p. Custom: User programmable display of any combination of up to seven metered values

2. All three phases of three-phase parameters must be displayed simultaneously. All voltage and current parameters must be monitored using true RMS measurements.

E. Premium-level Alarm Annunciation

1. The Premium-level monitoring system must also supervise and annunciate the following:
   a. Output Over Voltage: Line-to-line for all three phases
   b. Output Over Voltage: Line-to-neutral for all three phases
   c. Output Under Voltage: Line-to-line for all three phases
   d. Output Under Voltage: Line-to-neutral for all three phases
   e. Maximum Thresholds:
      1.) Current: All three phases, neutral and ground
      2.) Voltage: Neutral to ground
      3.) System Power: Watts, kVA
      4.) Frequency
      5.) % THD
   f. Minimum Thresholds:
      1.) Current: All three phases
      2.) System Power: Watts, kVA
      3.) Frequency
   g. Voltage Phase Unbalance: Line-to-line for all three phases
   h. Voltage Phase Unbalance: Line-to-neutral for all three phases
   i. Current Phase Unbalance: All three phases
   j. Discrete Input Energized: All discrete inputs
   k. Reverse Sequence Error

2. All Alarms must be stored in non-volatile memory until manually reset.

F. Premium-level Custom Alarm Annunciation

1. The Premium-level monitoring system must also be capable of providing up to four (4) Form C (NO/NC) relay contact enclosure outputs.
2. These relays must be independently programmable to actuate one event condition and/or a combination of metered event conditions.
G. Display

1. The Advanced and Premium-level monitoring systems must also utilize a high visibility, liquid crystal display (LCD) to allow viewing of all monitored parameters and alarms.
2. This LCD must sit within a decorative bezel and be located on the front of the SPDU.

H. Autoscan

1. The Advanced and Premium-level monitoring systems must also include an Autoscan mode, in which the meter continuously displays all monitored parameters and active alarm messages in sequential order.
2. The Autoscan mode must further allow manual interruption so that selected parameters can be displayed.

I. Communications

1. The Premium-level monitoring system must also offer the option of adding a communications interface module.
2. The communications interface module shall be, at a minimum, made available in the following protocols/interfaces:
   a. Ethernet
   b. N2
   c. Web

2.11 OPTIONS

A. Sub-feed Output Circuit Breakers

1. The SPDU must be capable of accommodating up to seven 225 amp frame (AF) 3-pole molded case circuit breakers (MCCBs) in place of one of the 42-pole panel boards, and up to eleven 225 AF MCCBs in place of both 42-pole panel boards.
2. These circuit breakers must be powered ahead of any and all SPDU panel board main breakers, and have a minimum rating of 18,000 RMS symmetrical amperes at 240 V AC.

B. Manual Restart

1. A manual restart circuit must be available that allows for an orderly manual restart of the SPDU in the event input power is lost. This circuit would automatically energize the shunt trip mechanism in the main input circuit breaker.
2. A methodology for field deactivation of this feature must also be made available.

C. Floor Jacks

1. A set of four (4) floor jacks must be available for enclosure leveling, and as a means of providing load relief in raised floor applications.
2. The floor jacks would individually mount to the bottom corners of the SPDU (and the sidecars, if used), and be offered in heights of up to 18 inches with an adjustable range of +/- 3 inches.
D. Full-frame Floor Stand

1. A full-frame floor stand must be available for enclosure leveling, and as a means of providing bottom cable access independent of a raised floor application.
2. The floor stand must be constructed of welded steel, and be offered in heights of up to 32 inches with an adjustable range of +/- 3 inches.

E. Input Surge Arrestor

1. A multi-stage suppression circuit device must be available as a means of arresting input surge. This device would utilize fast-acting 40 mm Metal Oxide Varistors (MOV’s) and be connected in a high-energy, parallel design for Category A, B, and C3 applications. Each mode of protection would be individually fused, and contain a thermal cutout to ensure safe operation during severe over-voltages and high fault-current conditions. The device must have an interrupting rating of 100,000 RMS symmetrical amperes, and be capable of withstanding 5,000 Category C3 impulses with less than 10% drift.
2. The suppression circuit device must also have an AC tracking filter to provide wave shapes smoothing. It must further provide a high level of EMI/RFI noise attenuation, as well as electrical noise attenuation of up to -50 db from 100 kHz to 100 MHz. The device must be installed with a minimum conductor length in order to achieve maximum performance.
3. For Basic and Advanced-level monitoring systems, this device should offer a remote monitor that is mounted on the front panel of the SPDU as an added option. For the Premium-level monitoring system, this device should offer an alarm contact that connects with the monitor to annunciate suppression device failures as an added option.

PART 3 — EXECUTION

3.1 SERVICE

A. Factory start-up and user training, preventive maintenance service, and full service for the above-specified system must be included upon request. The manufacturer must also employ an international service organization that consists of factory-trained field service personnel who are dedicated to the start-up, maintenance, and repair of all provided power equipment.

B. The manufacturer must further maintain a full-time (24 hours per day, 365 days per year) call center to provide readily available technical support to end users and to facilitate emergency service dispatching.

End of Section 16460