

PRODUCT SPECIFICATION FOR A 15 TO 150 kVA THREE PHASE POWER DISTRIBUTION SYSTEM WITH CONDITIONING, MONITORING AND REGULATION (Power-Pac)

1.0 General

This specification covers the electrical characteristics and general requirements for a Power Distribution System which provides isolation, distribution, control, monitoring, distribution, conditioning and regulation of AC power and shall properly interface with the building's AC power source with sensitive electronic loads. The specified equipment herein shall be referred to as a POWER-PAC. The POWER-PAC includes all components and systems required to install, operate and maintain the system. The POWER-PAC shall be tap switching regulator technology.

2.0 Applicable Documents

- 2.1 The National Electrical Code NFPA 1987 (Latest Edition)
- 2.2 American National Standards Institute Corp. and its Applicable standards C39.1, C80.1, C89, C84.1.
- 2.3 FCC Part 15, Sub-Part J, Class A.
- 2.4 IEC 435 International Electrotechnical Commission Recommendation "Safety of Data Processing Equipment".
- 2.5 VDE 0804/3.77 Verbauch Deutscher Elektotechiker standard. "Telecommunication and Electronic Data Processing Unit and Systems".
- 2.6 UL 50 Underwriters Laboratories Inc. Standard for Safety. Electrical Cabinets and Boxes.
- 2.7 UL 67 Underwriters Laboratories Inc. Standard for Safety. Electrical Panelboards.
- 2.8 UL 489 Underwriters Laboratories Inc. Standard for Safety. Molded Case Circuit Breakers and Circuit Breakers Enclosures.
- 2.9 UL 1950 Underwriters Laboratories Inc. Standard for Safety. Information Technology Equipment.
- 2.10 VDE 0806 Verbond Deutscher Electrotechniker Standard "Safety Design".
- 2.11 CSA 22.1 Canadian Standards Association, "Data processing Equipment".
- 2.12 NEMA National Electrical Manufactures Association and its applicable standards.
- 2.13 Local Inspection Authorities having jurisdiction over electrical equipment and its installation.
- 2.14 MIL-T-27B Dry Transformer Insulation.

3.0 Major Components

The Basic components of the POWER-PAC shall consist of: input power junction box, an input power cable, main input circuit breaker, cabinet, multi-shield isolation transformer, regulation electronics, internal wiring, single point ground output, 225 amp. secondary main breaker, secondary circuit breaker protection, distribution panelboard, system status panel, manual bypass switch and conduit landing bracket for output cables and optional features.

4.0 System Package and Construction

- 4.1 Agency approval.

The POWER-PAC shall be UL Listed under standard 1950.

- 4.2 Input Power Cable

The Input Power Cable shall be a 10' armored cable, type DP and be of liquid tight construction. Electrical conductors shall be sized to carry 125% of full load capability of the POWER-PAC and be UL Listed Cable.

The ground conductor shall be full sized and be equal to or greater than the phase conductor. Proper fittings shall be supplied to connect to an input junction box or to an optional Power Plug (Power Plug available on units rated under 200 Amps only).

4.3 Input Main Circuit Breaker (IMCB)

The POWER-PAC shall be equipped with a main input circuit breaker with a 24V shunt trip provided. The IMCB shall be rated for 125% of full load and be of thermal magnetic molded case construction. The IMCB shall have a minimum of 25,000 ampere interrupting capacity rating (AIC). Provision for higher interrupting capacity shall be incorporated into the design to accommodate this type of breaker if required. The IMCB shall be UL Listed.

4.4 Cabinet

The Cabinet shall consist of the following:

1. Frame

The Frame shall be of tubular construction of heavy gage metal and welded for maximum strength. Each frame shall be treated before paint is applied and be of "off-white" textured baked enamel. The base shall be supported by (6) movable casters. Four (4) leveling jacks shall be provided and be front accessible.

2. Internal Sheet Metal

Internal sheet metal not welded to the frame shall be plated with Gold Zinc Wash to ensure RFI, EMI susceptibility reduced to the absolute minimum.

3. Removable Access Panels

Removable side, front and rear panels shall be provided. Access to the IMCB and distribution panelboard circuit breakers shall be through a heavy metal door attached with a continuous hinge and held shut with a keyed door latch. A removable front access plate shall be provided for adding output cables to the POWER-PAC. All exposed access screws shall be bright nickel plated or black oxide plating.

4. Top Cover

A top screen shall be provided with a minimum of 3/32" holes on 1/8" centers to prevent metal objects from falling into the POWER-PAC.

4.5 Isolation Transformer

A multi shield, all copper wound, convection cooled, 3 phase, isolation transformer shall be provided. Construction of the transformer shall separate the Primary connections and the Secondary connections. The output terminals of the secondary shall be at opposite ends of the coil for the input terminals of the primary to minimize the possibility of transverse mode injection. A copper foil ground bus shall be provided to allow a large surface area for shunting RFI signals of the core to ground. The isolation transformer shall be mounted on rubber isolation pads to prevent 60 Hz Hum of the core from being transmitted to the frame. The Transformer core clamp shall be grounded to the frame through a 1" copper strap. The Transformer insulation system shall be 220° C. Full load taps shall be provided (2) FCAN and (4) FCBN for connection to the tap switching regulator module. Two (2) temperature monitors shall be provided: 140° C (alarm) and 160° C (shutdown). The transformer shall be 150° C temperature rise.

4.6 Regulation Electronics

A solid state, electronic, zero current crossing, tap-switching regulation system shall be provided. This technology shall use SCR's (Silicon Control Rectifiers) technology in its construction and shall be rated at 200% above worst case ratings (26% below nominal) without any adverse effects. The regulation system shall respond to a change in the input voltage within one (1) cycle.

4.7 Bypass Switch (Regulation Only)

A manually operated Bypass switch shall be provided in the event that the regulation electronic control circuit fails. The bypass switch shall select the Nominal Tap (100%) of the primary winding to provide voltage to the load. The bypass switch shall be accessible by the operator by unlatching and lowering the SSP panel to activate. The bypass switch is a "break-before-make" switch.

4.8 Internal Wiring

All internal wiring shall be UL Listed appliance wire or Power wiring of multi stranded construction. All wiring shall be clearly marked using wiring markers. Circuit boards shall utilize ribbon cable to the extent practical for ease of removal and replacement. All logic and control connections shall be routed away from power runs for noise suppression. Primary & Secondary Power wiring from transformer shall not pass through the same access holes in the transformer shield. When in close proximity, Secondary and Primary wiring shall cross at a 90 degree angle to minimize the injection of transient electrical noise between the two circuits.

4.9 Single Point Ground (SPG)

A single point ground bus shall be provided and shall be of copper construction. Minimum thickness shall be 1/4" X 1" and be silver plated to provide connection of the lowest possible resistance of all ground wires secured to the SPG. The following shall be grounded to the SPG:

1. Equipment ground bus(es).
2. Neutral (star of isolation transformer).
3. Core of the Transformer.
4. Primary and Secondary shields.
5. Frame.
6. Equipment grounding conductor from the branch circuit(s).
7. System monitoring electronics.
8. All output conduits through the output conduit landing plate.
9. The input conduit through the input conduit landing plate.

4.10 Output panelboard(s)

One or more output panelboards or secondary circuit breaker protection shall be provided. The POWER-PAC shall be so constructed to accommodate plug-in or bolt-on circuit breakers. These breakers shall be of high industrial quality grade. Each panelboard(s) shall accommodate 42 circuit breaker pole positions with separate equipment copper ground bus and copper neutral bus rated for 200% of nominal phase current for each panelboard. The equipment ground bus shall not be shared between panelboards.

4.11 Metering: (Standard)

The standard Monitor panel shall offer up to 49 highly accurate, real-time, true RMS readings. Max/Min demand values are available for every instantaneous reading. Metering capabilities shall include but not limited to the following features for monitoring and alarm detection:

1. Metering:

Volts: phase to phase and phase to neutral
Amps: Each phase and neutral
Power: Each phase, KVA
Frequency: Total

2. Alarms:

Over / Under voltage phase to phase and phase to neutral
Voltage phase reversals
Input phase loss
Input phase rotation
1st stage Xfmr over temperature warning
2nd stage Xfmr over temperature shutdown
Emergency power off tripped
Ground amp

3. Input Metering (Optional):

An additional meter to monitor input.

4. Functions:

Reset: Turns off any alarm LEDs after problem has been corrected.
Alarm Silence: Silences the audible alarm.
Audible Alarm: 70 dBA at 3'
Local Emergency
Power Off (LEPO): A guarded, red push button shall be provided to shunt trip the IMCB.

5. External Alarm Interface (Optional):

Up to 8 external alarm interface channels shall be provided - each channel shall have its own LED to indicate which channel(s) are in an alarm state.

6. Digital communications, ModBus ASCII/RTU or DNP3.0 RS232 or RS485 (Optional)

7. Remote Emergency Power Off Interface (REPO):

Provisions shall be made to interface a REPO to the POWER PAL to provide EPO capability - a terminal block shall be provided and well marked.

8. All metering panel alarms shall have the option of being able to shunt trip the POWER PAL. This option shall be field selectable through monitor panel menu requiring an access password.

4.12 Output Cable Conduit Landing Plate

A Zinc Wash Plated tiered output conduit landing plate shall be provided. Access to the landing plate shall be made from the front of the POWER-PAC. The output flexible cables shall be permitted to be attached without threading the wires through a knock out hole. The KO shall be slotted to provide easy installation and removal by a qualified technician.

4.13 Input Transient Noise Filter

The Input Transient Noise Filter consist of a resistor/capacitor network, installed on the primary, which acts as a large snubber circuit to eliminate high frequency impulses from entering the power system.

4.14 Output Transient Noise Filter (OPTION)

The Output Filter consist of a capacitor network installed on the secondary. This capacitor network, when coupled with the primary filter, virtually eliminates most electronic noise from reaching the applied load or being fed back to the unit from noise generating loads.

4.15 Secondary Surge Suppression (SSS) (OPTION)

A transient suppression network shall be located on the secondary side of the isolation and regulation transformer. The SSS shall suppress load induced noise to reduce the sensitivity of one load from another load. The SSS shall have the following characteristics:

1. Parallel (Shut) Protection
2. Response time of < 5 ns
3. Repetitive transients up to 5000/sec
4. Clamping Voltage:
 - 160 VAC line to neutral
 - 274 VAC line to line (208Y/120)
5. Peak Pulse Power Rating:
 - 27 KW line to neutral
 - 13.5 KW line to line
6. Each device shall be fused for circuit protection. Visual service indicators (one for each phase) shall be provided to indicate that the SSS is no longer providing protection.

4.16 Output Interconnect Cables (OPTION)

Construction of the optional output cables shall be armored cable type DP. Output cable shall be UL Listed as a field installed option and shall contain a parity ground for noise reduction. I.G. receptacles shall be grounded with a separate ground wire that shall be green with a yellow stripe. A separate ground bus shall be provided for the I.G. ground and shall be grounded to the single point ground bus in the POWER-PAC. The output cable shall be of liquid tight construction and be labeled as to circuit number, type, rating and length at each end.

4.17 Manual Restart (OPTIONAL)

The manual restart option will trip the IMCB when a power outage occurs. This will require the operator to manually reset the IMCB when power is restored. This will allow for an orderly start-up of the applied load, preventing possible data loss or tripping of the environmental safety system.

4.18 Ground Integrity Monitor (OPTIONAL)

The Ground Integrity Monitor is utilized to determine the impedance of the ground connection from the PDU back to the service entry. A connection from the PDU to the input power J-box is provided. Customer to provide a sense wire from J-box back to the desired ground connection point.

5.0 Electrical Characteristics

5.1 60 HZ Frequency Units:

1. Output Rating KVA: 15, 30, 50, 75, 100, 125 and 150
2. Input Voltage: 208 VAC or 480 VAC
3. Output Voltage: 208Y/120
4. Input Frequency Tolerance: 60 Hz \pm 3 Hz

5.2 50 Hz Frequency Units:

1. Output Rating KVA: 15, 30, 50, 75, 100, 125 and 150
2. Input Voltage: 380 VAC or 415 VAC
3. Output Voltage: 380Y/220 or 415Y/240
4. Input Frequency Tolerance: 50 Hz \pm 3 Hz

5.3 Transformer

1. Type: Dry, isolation, multi-shield, all copper, three phase, computer grade, delta-wye
2. Impedance: 3% to 5 % maximum
3. Efficiency: >96 %
4. Load Power Factor: Unity to 0.3 leading or lagging
5. Harmonic distortion: < 1% maximum added
6. Waveform distortion at Tap switching: < 1% added
7. Noise rejection: (typical):
Common Mode: - 120 dB (0.5Hz to 5MHz)
Normal Mode: - 40 dB/decade (2KHz start)

5.4 Audible Noise: Meets or exceeds NEMA standards.

5.5 Input voltage regulation range: +10 to -26 % of nominal

5.6 Output voltage regulation: \pm 3% typical, \pm 4% maximum for all load and line conditions

5.7 Response time: 1 cycle typical

5.8 Load rating: Continuous regardless of line/load conditions

- 5.9 Over load inrush rating: 200% of full load for 10 seconds
1000% of full load for 1 cycle
- 5.10 Meter accuracy: $\pm 1\%$

6.0 Physical characteristics

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|-----|-------------|---------|---------|----------|-----------|
| 6.1 | Dimensions: | 42 POLE | 84 POLE | 168 POLE | 252 POLES |
| | Height: | 42.0" | 42.0" | 42.0" | 42.0" |
| | Width: | 34.0" | 34.0" | 45.0" | 56.0" |
| | Depth: | 35.5" | 35.5" | 35.5" | 35.5" |
- 6.2 Floor loading weight: Not to exceed 250 lbs. per sq/ft

7.0 Operating Environment

- 7.1 Temperature: 32° F to 122° F (0° C to 50° C)
- 7.2 Humidity: 10% to 90% Relative Humidity
- 7.3 Altitude: 0 to 7000 Ft.

8.0 Storage Environment

- 8.1 Temperature: 0° F to 140° F (-17° C to 60° C)
- 8.2 Humidity: 0% to 95% Relative Humidity

9.0 Warranty

The manufacturer shall warrant the POWER-PAC to be free from defects in both material and workmanship for a period of 24 months from the time of installation or 30 months after shipment which ever occurs first.

10.0 Manufacturer's Qualifications

The unit shall be furnished by a qualified manufacturer who specializes in the manufacturing of Power Distribution Units and has been in business for at least 15 documented years, and with a nation wide service organization. The manufacturer shall be an ISO9001 certified company.

11.0 Qualified Systems.

The unit shall be a POWER-PAC manufactured by:

OnLine Power, Inc.
5701 Smithway Street
City of Commerce, CA 90040