

TECHNICAL SPECIFICATION FOR A 15-100 KVA TRANSISTORIZED THREE PHASE UNINTERRUPTIBLE POWER SYSTEM (UPS Industrial Grade 3000)

1.0 General

This specification covers the electrical characteristics and general requirements for a Three Phase Transistorized Uninterruptible Power System. The specified equipment herein shall be referred to as an Uninterruptible Power System (UPS) or “UPS Industrial Grade 3000”. The UPS includes all components and systems required to install, operate and maintain the system. The UPS shall be all transistor inverter technology.

2.0 Applicable Documents

- A. The National Electrical Code NFPA 70 (Latest Edition)
- B. American National Standards Institute Corp. and its applicable standards C39.1, C80.1, C89, C84.1.
- C. FCC Part 15, Sub-Part J, Class A.
- D. IEC 435 International Electrotechnical Commission Recommendation "Safety of Data Processing Equipment".
- E. VDE 0804/3.77 Verbond Deutscher Elektrotechniker standard. "Telecommunication and Electronic Data Processing Unit and Systems".
- F. U.L. 1778 Underwriters Laboratories Inc. Standard for Safety. Uninterruptible Power Supplies.
- G. VDE 0806 Verbond Deutscher Elektrotechniker Standard “Safety Design”.
- H. CSA 22.1 Canadian Standards Association, "Data Processing Equipment".
- I. NEMA National Electrical Manufacturers Association and its applicable standards.
- J. Local Inspection Authorities having jurisdiction over electrical equipment and its installation.
- K. MIL-T-27B Dry Transformer Insulation.

3.0 Major Components

The Basic components of the UPS shall consist of a cabinet, input main circuit breaker, utility bypass circuit breaker, manual maintenance bypass switch, input isolation transformer, charger/rectifier, inverter, output summing transformer, internal wiring, static bypass switch, control electronics and system status panel.

4.0 System Package and Construction

- A. Agency approval

The UPS shall be U.L. Listed under standard 1778.

- B. 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 tan textured baked enamel. The base shall be supported by (6) movable

casters - the (2) rear casters shall be the locking type. Two leveling jacks shall be provided and be front accessible. Each leveling jack shall be provided with a lock nut to keep the jack in place.

2. Internal Sheet Metal

Internal sheet metal not welded to the frame shall be plated with Gold Zinc Wash to insure 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 bypass circuit breaker shall be through a heavy metal door attached with a continuous hinge and held shut with a lock attached to the door with a lockwasher and nut. A removable access plate shall be provided for adding output cables to the UPS. All exposed access screws shall be bright nickel plated or black oxide plating.

4. Top Cover

A top cover shall be provided with an area of sufficient width to accommodate the input and output conduits. The top cover shall contain the cooling fans. Up to four fans shall be provided with one redundant. The fans shall be guarded with a suitable grill or screen to protect the operator from injury and be protected individually with overcurrent devices.

C. Input Main Circuit Breaker (IMCB)

The UPS shall be equipped with an input main circuit breaker with a 24V shunt trip provided. The IMCB shall be rated for 150% of full load and be of thermal magnetic molded case construction. The IMCB shall have a minimum of 22,000 AIC rating. Provision for higher interrupting capacity shall be incorporated into the design to accommodate this type of breaker if required. The IMCB shall be U.L. Listed.

D. Utility Bypass Circuit Breaker (UBCB)

The UPS shall be equipped with a Utility Bypass Circuit Breaker with a 24V shunt trip provided. The UBCB shall be rated for 125% of full load and be of thermal magnetic molded case construction. The UBCB shall have a minimum of 22,000 AIC rating. Provision for higher interrupting capacity shall be incorporated into the design to accommodate this type of breaker if required. The UBCB shall be U.L. Listed.

E. Manual Maintenance Bypass Switch

The UPS shall be equipped with a manual switch to electrically isolate the UPS from the utility for the purposes of maintenance work inside of the cabinet. Access to the switch shall be through the top access door in the front for the UPS.

F. Charger/Rectifier

A solid-state, SCR controlled battery charger shall be provided with constant current supply to the battery during recharge to allow the recharge of the battery in ten times discharge. The rectifier shall be rated to carry the current load of the inverter at 125% while supporting the recharge of the battery at a maximum of 50 amps charging current. The rectifier shall be designed to limit current inrush by providing current limit ramp up to full power. The DC capacitor deck shall provide the proper source impedance to the inverter for optimum operation.

G. Input Isolation Transformer

A multi-shield, convection cooled, delta-to-delta, three phase, isolation transformer shall be provided. Construction of the transformer shall separate the primary connections and the secondary connections by placing them on opposite sides of the core. In addition, the output terminals of the secondary shall be at opposite ends of the coil for the A, B, C 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 or the core to ground. The isolation transformer shall be mounted on rubber isolation pads to prevent 60Hz 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 220C. Full load taps shall be provided (2) FLAN and (4) FLBN for connection of the line voltage to provide nominal voltage to the charger/rectifier. Two temperature monitors shall be provided @ 140 degrees C and 160 degrees C. The transformer shall be so constructed to suppress the harmonics produced by the rectifier to a level acceptable to the requirements of the FCC and the utility company. The first measurable harmonic shall be the 11th. Additional electrical filtering for transients and surges shall be provided on the primary of the transformer.

H. Inverter

The inverter shall be all transistor inverter. It shall be of a pulsed, step-wave design. The transistors shall be rated for 300% load conditions and when operating at that level shall be operating at 60% of their maximum capability. The inverter shall be a three phase "H" bridge design with vector summing through the output transformer to provide a well regulated output voltage. Base drive to the transistors shall be fused and shall be transformer isolated from the DC bus. DC bus fuses shall be provided for additional protection. Each transistor in the inverter shall have its own control and drive logic. The control electronics shall keep the output of the inverter in sync with the utility and during utility outages the inverter shall operate on an internal oscillator which shall keep the inverter within the specified tolerance for frequency.

I. Output Summing Transformer

The output of the inverter shall be summed in the output transformer. This transformer shall be so designed to reduce the effects of the impedance mismatch between the load and the inverter output. The summing transformer shall be multi-shielded and provide the necessary filtering of the output wave form to conform to the requirements of the output harmonics.

J. Internal Wiring

All internal wiring shall be U.L. Listed appliance wire or power wiring of multi stranded construction. secondary and primary power wiring from transformer, 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.

K. Static Bypass Switch (SBS)

The output of the summing transformer shall be connected to the critical load through the Static Bypass Switch. The SBS shall be a double through triple pole construction. The utility bypass circuit shall constitute one side of the switch and the inverter the other. The electronics shall ensure the inverter output and the utility are in synchronism as long as the utility is within the proper operating tolerances. The inverter control circuit shall ensure that the inverter will bypass to the utility during momentary overload conditions. The inverter side of the SBS shall contain the inverter overcurrent devices which shall be in the form of fuses, rated at 200% of the inverter output capability.

L. Control Electronics

The control electronics shall be of such a design to operate the functions of the UPS in a fully automatic mode of operation. The control electronics shall protect the UPS from abnormal operation by causing the inverter and associated circuitry to shut-down. This operation shall not cause any adverse problems for the UPS. Restarting automatically when the abnormal condition has been corrected.

M. System Status Panel (SSP)

The SSP shall provide a electrical flow diagram on the front which shall mimic the current operating status of the UPS. It shall provide the following controls, indicators and meters:

Indicators

1. Neon indicators for :
 - a. Three Phases of Input Voltage
 - b. Three Phases of Bypass Voltage
 - c. Three Phases of Maint. Bypass Voltage
2. LED indicators for:
 - a. ON Inverter
 - b. ON Utility
 - c. Rectifier ON
 - d. Inverter ON
 - e. Battery Charging
 - f. Battery Discharging
 - g. Low Battery
 - h. ON Maintenance Bypass
 - i. ON Automatic Operation
 - j. Battery Circuit Breaker Open

k. Battery Circuit Breaker Closed

3. Analog Meters for:
 - a. Input Voltage
 - b. Output Voltage (Inverter)
 - c. Output Voltage (Bypass)
 - d. Output Current
 - e. DC Bus Voltage
 - f. DC Bus Current (Inverter)
4. Control Switches for:
 - a. Input Voltage, Three Phases
 - b. Output Voltage Inverter
 - c. Output Voltage Bypass
 - d. Output Current
 - e. Emergency Power Off Guarded Push-button

N. System Ground Reference (SGR)

A system ground reference shall be provided and shall be of copper construction. Minimum thickness shall be 1/4" X 1" and be silver plated for the lowest possible resistance connections of all ground wires secured to the SRG. The following shall be grounded to the SRG:

1. Equipment ground bus(es).
2. Neutral (star of isolation transformer).
3. Core of the transformer.
4. Primary and secondary shields.
5. Frame.
6. Input ground conductor from the branch circuit.
7. System monitoring electronics.
8. All output conduits through the output conduit landing plate.
9. Cores of all inductors and transformers.

O. Optional Output Panel Boards

One or two output panel boards with secondary circuit breaker protection shall be provided - the UPS shall be so constructed to accommodate either plug in or bolt on circuit breakers. These breakers shall be of industrial grade such as Square "D" or equivalent. Each panel board shall be capable of 42 pole position with separate equipment ground bus and neutral bus for each panel board. The equipment ground bus shall not be shared between panel boards. The UPS shall be capable of a maximum of 42 pole positions.

P. 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 Side-car. 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.

Q. Output Interconnect Cables

Construction of the optional output cables shall be armored cable type DP, output cable shall be U.L. 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 TUPSS. The output cable shall be of liquid tight construction and be labeled as to type, rating and length at each end.

R. Remote Emergency Power Off Interface (REPO)

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

5.0 Electrical Characteristics

A.	Frequency	60 Hz (Optional 50 Hz)
	Output Rating kVA	15, 20, 25, 30, 37.5, 50, 75, 100
	Input Voltage	208Y/120 – 480Y/277
	Output Voltage	208Y/120 – 480Y/277
B.	Input Frequency Range	60Hz \pm 5%
	Output Frequency	Controlled to within \pm .1Hz
C.	Input Voltage Regulation Range	+10 to -15 % of nominal
D.	Inverter Walk in	20% to 100% in 15 sec.
E.	Input Magnetizing Inrush	5-8 X full load current
F.	Input Current Limit	100-125% of nominal full load current (adjustable)
G.	Input Protection	Molded Case Circuit Breakers
H.	Output Voltage Regulation	+ 0.5% typical + 5% maximum at 50% unbalance
I.	System Response Time	To within 1% of output voltage within 50 milliseconds
J.	Load Rating	Continuous regardless of line/load conditions
K.	Load Power Factor	0.7 lag to 0.9 lead
L.	Overload at Nominal Voltage	30 second 150% 10 minutes 125%
M.	Meter Accuracy	+ 1% (Optional \pm .5% available)
N.	Harmonic Distortion	Total 5% RMS Max. Single 3% RMS Max.
	1. Reflected Harmonics to the Input Bus	5%
O.	Phase Balance	Balanced Load 120 + 1 Deg. 50 % Imbalance 120 + 3 Deg.
P.	Output Current Limit	150% Full load current at reduced voltage
Q.	Fault Clearing	300-400% Sub-cycle
R.	Transient Response	\pm 1% for loss or return of input power \pm 4% for 20% stepload on a manual transport of a 100% load \pm 5% for 30% stepload or \pm 8% for 50% stepload
S.	Output Wave Form	Sinewave
T.	Clamping Voltage Level	198 VAC (peak)

U.	Bypass Phase Lock with Slew Rate Inhibit	Within 5 degrees of utility if in tolerance. 2 Hz per second More than + 10% and 3 Hz
V.	DC Bus	220 VDC
W.	Battery End Voltage	155 VDC
X.	Low Battery Indication	30% reserve
Y.	Efficiency	92%

6.0 Physical Characteristics

Dimensions:

Height	76"
Width	31.5"
Length	31.5"
Floor Loading Weight	Not to exceed 250 lbs. per sq/ft

7.0 Operating Environment

Temperature	32 degrees to 104 degrees F (0 degree - 40 degrees C)
Humidity	5 to 95 % RH non-condensing
Altitude	0 to 7000 ft.

8.0 Storage environment

Temperature	20 degrees to 70 degrees C
Humidity	5 to 95 % RH non-condensing
Altitude	0-10,000 ft.

9.0 Warranty

The manufacturer shall warrant the UPS to be free from defects in both material and workmanship for a period of 60 months from the time of installation or 62 months after shipment which ever occurs first.

10.0 Qualified Systems

The UPS shall be an "OnLine Power Inc." UPS manufactured by:

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