CHLORIDE
POWER PROTECTION

Product Description and Specification

Guide Specification for Model CP3000 / 125-150 kVA Three Phase Uninterruptible Power Supply

916-219 Rev - 5/04

28430 North Ballard Drive, Lake Forest, IL 60045, USA
Telephone: (800) 239 2257, (847) 990-3228 Facsimile: (800) 833 6829, (847) 549-7917

PART 1 GENERAL

1.1 SUMMARY

A. This Specification defines the electrical and mechanical characteristics and requirements for a continuous duty; three-phase, uninterruptible power system, hereafter referred to as the UPS. The UPS shall operate with the building supply to provide conditioned power as well as power back up for the critical loads.

1.2 STANDARDS

A. The UPS shall be designed in accordance with the applicable sections of the current revision of the following documents. Where conflict arises between these documents and statements made herein, the statements in this specification shall prevail.

1. UL Standard 1778
2. CSA 22.2, No. 107.1
3. NEMA PE-1
4. FCC PT 15, Subpart J, Class A
5. National Electric Code
6. OSHA
7. IEEE C62.41-1991
8. ISO 9001

The UPS shall be listed to UL/cUL 1778 by UL.

1.3 SYSTEM DESCRIPTION

A. The UPS shall be a true double conversion, “On-Line” system consisting of the following major components:

1. Rectifier complete with power factor correction
2. Battery charger
3. PWM Inverter utilizing IGBT’s (Insulated Gate Bipolar Transistor)
4. Continuous duty rated Static Switch
5. Internal Maintenance Bypass
6. DSP Control and Monitoring
7. Available Options Including:
    a. Line up and Match Batteries with varying autonomy time with integral DC disconnects
    b. 7% THDi Input Filter
    c. LIFE2000 Monitoring Service
    d. SNMP Adaptor
    e. Remote alarm software

1.4 MODES OF OPERATION

A. The UPS shall be designed to operate as an on-line, reverse transfer system in the following modes:

1. Normal: The rectifier derives power from a utility AC source and supplies DC power to the inverter as needed. The input power factor shall operate at ~.92 while in normal operation. The battery charger automatically maintains the battery in a fully charged and optimal operational condition. The inverter converts the DC power into clean and regulated AC power that is then supplied to the critical load.

2. Emergency: Upon failure or degradation of the incoming AC power, either utility or generator, the critical AC load supplied by the inverter will draw its power from the batteries. There shall be no interruption of power switching from utility AC power to batteries or switching from batteries back to utility AC power upon its restoration.

3. Recharge: Upon restoration of utility AC power, even if the batteries are discharged below limits, the UPS will restart, the rectifier and charger shall assume the inverter and battery recharge loads. If the bypass source is within acceptable limits, the UPS will retransfer the critical load back to the inverter.

4. Bypass: When the inverter overload capacity is exceeded, the static transfer switch shall perform a transfer of the load from the inverter to the bypass source with no interruption in power to the critical load.

B. Future Expansion: Up to 8 modules can be paralleled as required to support future growth.

1.5 ENVIRONMENTAL REQUIREMENTS

A. The System shall withstand any combination of the following external environmental conditions without operational degradation.

1. Operating Temperature Range: 32ºF (0ºC) to 104ºF (40ºC) for the electronics, however the batteries should not be exposed to prolonged periods of temperature above 77ºF (25ºC). For every 15ºF (8ºC) above 77ºF battery life is cut in half, and may void the battery warranty.

2. Storage Temperature Range: -4ºF (-20ºC) to 122ºF (50ºC) however batteries should not be exposed to temperatures above 77ºF (25ºC).

For every 15ºF (8ºC) above 77ºF battery life is cut in half, and may void the battery warranty.

3. Relative Humidity: Continuous operation with a relative humidity up to 95% non-condensing at 77°F (25°C).

4. Altitude: Normal operation without de-rating is 0 to 5,000 feet (0 to 1,500 meters).

5. Audible Noise: Audible noise generated by the UPS shall not exceed 65 dBA when measured at 1 meter in front of the power converter using scale “A” of a standard ASA sound level-measuring device.

1.6 QUALIFICATIONS

A. The manufacturer shall have a minimum of 20 years experience in the design, manufacture, and testing of solid-state transistorized UPS systems of similar capacity.

1.7 WARRANTY

A. The UPS warranty shall be in effect for 12 months after initial start-up but no more than 18 months after shipment, whichever occurs first. The warranty shall cover all parts and labor for units commissioned by manufacturer’s approved service representative.

B. The battery manufacturer's standard warranty shall be passed through to the end user provided the UPS is commissioned within six months of the ship date.

PART 2 PRODUCTS

2.1 FABRICATION

2.1.1 Cabinet

The UPS unit, comprised of the rectifier, charger, inverter, static transfer switch, and maintenance bypass shall be housed in a single, free standing NEMA type 1 enclosure. Cabinet doors and covers shall be removable for expedient servicing, adjustments, and installation. The UPS cabinet shall be structurally adequate, have casters for ease of maintenance and installation, and have provisions for forklift handling. The cabinet shall be front access only for service.

2.1.2 Material

All materials and components making up the UPS shall be new, of current manufacture, and shall not have been in prior service except as required during factory testing. All bus bars shall be copper.

2.1.3 Thermal Design

Redundant, forced air-cooling shall be provided to ensure that all components are operated within specification with air entry at the front and exit at the top. Optional external battery cabinets will be convection cooled.

2.1.4 Serviceability

The UPS shall be constructed of replaceable subassemblies. Printed circuit assemblies shall be plug-in. The main control printed circuit and boards shall be interchangeable across the entire product range.

2.2 COMPONENTS

2.2.1 Rectifier

The rectifier section shall be a six-pulse, solid-state device. It shall be capable of receiving utility input and rectifying it to produce Direct Current (DC) power at levels sufficient enough to supply the load via the inverter.

2.2.1.1 Input Protection: The rectifier shall include protection against primary power surges, (except for lightning transients) and under or over voltage conditions. This protection is provided via fuses, Circuit Breakers, and Microprocessor Control of the rectifier.

2.2.1.2 Filtering: Sufficient filtering of the rectifier/charger output shall be provided to prevent damage to the battery. Ripple voltage shall not exceed 1% RMS.

2.2.1.3 In-Rush Limiting: When the primary power is applied to the rectifier, the current surge shall be limited to no more than nominal input current when the UPS is operating at 480VAC input. In configuration utilizing 208VAC input, the current surge shall be limited to no more than 8 times nominal input current.

2.2.1.4 Automatic Restart: Upon restoration of utility AC power after a power outage, the rectifier shall automatically restart and assume the inverter and battery recharge loads.

2.2.1.5 Charger

An intergral charging circuit shall be capable of recharging the batteries during normal operation to ensure maximum life from the battery system.

2.2.1.5.1 Charger Capacity: The charger shall have sufficient capacity to recharge a fully discharged battery to 90% capacity within ten times discharge time.

2.2.1.5.2 Battery Test: The UPS shall periodically check the battery system for an open cell. If the UPS detects an open cell, an alarm condition shall be displayed and an audible alarm shall sound.

2.2.2 Inverter

The inverter section of the power converter module shall utilize Insulated Gate Bipolar Transistors (IGBT's). This solid-state device that incorporates pulse width modulation (PWM) technology, is capable of accepting the output of the rectifier or the battery system voltage and delivering AC power within specified limits to the critical load bus. The inverter shall be microprocessor controlled and include all necessary timing logic and control circuits.

2.2.2.1 Inverter Start-Up: The inverter shall automatically startup when a start command is generated and shall be stable and ready to deliver power to the load within 2 seconds.

2.2.2.2 Inverter Protection: Inverter IGBT's shall be protected by current limiting circuits. The inverter shall be capable of running indefinitely with the batteries disconnected. For rapid removal of the inverter from the critical load, the inverter's control electronics shall instantaneously turn off the inverter when the inverter's capacity is exceeded. Simultaneously, the static transfer switch shall transfer the load to utility power without interruption to maintain continuous power to the critical load.

2.2.2.3 Inverter Oscillator: The inverter shall contain an oscillator capable of operating and maintaining the output frequency of the inverter within specified limits. The inverter oscillator shall be capable of frequency synchronization and phase locking to the utility power source frequency. When operating as a slave to the utility power and a failure occurs in the slaving signal, the inverter

oscillator shall automatically revert to a free running state and maintain the specified limits. The oscillator shall not drift more than 0.05% while operating at maximum rated operating temperature.

2.2.2.4 Phase Balance: Electronic controls shall be provided to regulate each phase so that an unbalanced load will not cause the output voltage to go outside of the specified voltage unbalance or phase displacement limits.

2.2.3 Static Transfer Switch

An internally mounted static transfer switch and bypass circuit shall be provided as an integral part of the UPS. The static switch shall be naturally commutated high speed devices rated to conduct full load current continuously while on bypass power. The static switch shall be designed to avoid back-feed into the utility supply. Failure of one device shall not effect the operation of the UPS and the failure shall be shown on the LCD display.

2.2.3.1 Bypass Transfer: The static switch shall automatically and successfully transfer the critical load from the inverter to the bypass source under the following conditions:

- DC voltage out-of-limits
- Inverter failure
- Critical load current exceeds inverter overload rating
- Over-temperature develops within the inverter
- Manual command is given

Transfer shall be automatically inhibited whenever bypass source parameters are outside predetermined (adjustable) limits, or UPS output and bypass are not synchronized and phase locked.

2.2.3.2 Retransfer: The static switch shall automatically and successfully retransfer the critical load from the bypass source to the inverter under the following conditions:

- Inverter output voltage returns to within specified limits.
- Critical load current reduces to within inverter limits.

2.2.4 BATTERY

The UPS shall be designed to utilize Valve Regulated Lead-Acid (VRLA) batteries with a nominal voltage of 480VDC.

2.2.5 MAINTENANCE BYPASS

Bypass switching shall allow the critical load to be fed from the bypass power source, while providing isolation of the static switch during maintenance. Provision for testing of the UPS operation without affecting or disconnecting the critical load shall be provided.

2.3 ELECTRICAL SPECIFICATIONS

2.3.1 Rectifier and Charger

Input:

a. Nominal Voltage 480 VAC, 3 Phase, 4-wire (plus ground), or 480 VAC, 3 Phase, 3-wire (plus ground)

b. Voltage Limit: ±15% from nominal voltage during battery recharge; +15/-20% with fully charged battery

c. Frequency: ±5% (57 - 63 Hz)

d. Power Factor: 0.92 minimum at full load, nominal conditions

Output:

a. Nominal Battery Voltage: 480 VDC
"Float " Operation: 2.27 VDC per cell @ 77^{o}F

b. Regulation: ± 5% maximum for input voltage and DC variations

c. Temperature Compensation: 0.11% float volts per cell per °C

d. Ripple Voltage: Less than 1% RMS voltage, with inverter fully loaded and battery disconnected

e. Battery AC current ripple: <1% nominal

f. Protection: Electronic current limiting, input breaker and fuses.

2.3.2 Static Transistorized (IGBT) Inverter

2.3.2.1 Power Rating: UPS output ratings are shown at 0.9 pf lagging. Other power factor loads can be supported.

2.3.2.2 Input: Shall operate within specification over the nominal rectifier output range and minimum battery voltage of 1.65 volts per cell.

2.3.2.3 Output Voltage: 480/277 or 208/120 VAC, 60HZ, 3 Phase, 4-wire (plus ground)

2.3.2.4 Output Regulation:

Balanced Loads: ±1% balanced load - Phase Angle 120^{o} $\pm 1^{o}$
Unbalanced Loads: ±3% 100% unbalanced load - Phase Angle 120^{o} $\pm 3^{o}$

2.3.2.5 Output Waveform: Sinusoidal

2.3.2.6 Frequency Stability: Normally synchronized to utility line over frequency range of ± 1.5% or optionally ±.75%, ±2.5%, ±6%; free running ±0.1%. Slew rate ≤1.0 Hz/Sec

2.3.2.7 Output Response: <± 8% maximum deviation for less than one cycle.

2.3.2.8 Overload Rating: 150% for 1 minute
125% for 10 minutes

2.3.2.9 Short Circuit Rating: 200% for 10ms
150% for 300ms

2.3.2.10 Harmonic Content: Linear loads: Max. Voltage THD < 3%

2.3.2.11 Efficiency (AC-AC): Minimum: 93% at Full Load for 480VAC output configurations

2.3.3 Static Transfer Switch

2.3.3.1 Power Rating: Static switch is continuous duty power rated.

2.3.3.2 Transfer Characteristics:

Transfer time from inverter: Less than 0.5ms to or from utility power when both sources are in phase lock.

Transfer time from inverter to utility when both sources are not in phase lock: 20 ms (To prevent damage by phase reversal to the load.)

2.3.3.3 Voltage Limits: ±10% of nominal input voltage

2.3.3.3 Frequency Tolerance: Tolerance shall be set for a frequency range of ± 1.5% or optionally ±.75%, ±2.5%, ±6%

2.4 CONTROLS and MONITORING

2.4.1 Front Panel Display

The UPS shall incorporate a Front Panel Display consisting of a backlit LCD Display of 8 lines by 21 characters. This LCD shall display UPS and Battery status, metering, and active alarms. This LCD shall also show a mimic diagram highlighting the current operating status of the UPS.

2.4.2 Control Panel Indicators

A. Summary Alarm: This shall indicate that the UPS has detected an alarm condition that is currently active.

B. On By-Pass: This shall indicate that the load is supplied by the by-pass path.

C. On Battery: This shall indicate that the UPS Inverter is supplied by the battery system. This shall be indicated when the AC input (Utility or Generator) has failed or is outside of the operating parameters of the Rectifier.

2.4.3 Panel Controls

A. Inverter On/Off: The button shall allow the inverter to be turned either on or off.

B. Arrow Keys: Four arrow keys shall be provided to allow the user to scroll through the Front Panel Display.

C. Enter: Allows the user to access the menus on the Front Panel Display.

D. Escape/Home: Returns the user to the previous menu.

E. Cancel Audible Alarm: This key shall silence the current audible alarms. The audible alarm shall sound again the next time a new alarm state is detected.

F. EPO: This button shall allow a user to quickly shut down the UPS system.

2.5 OPTIONS and ACCESSORIES

2.5.1 Interface Cards

2.5.1.1 RS232 Card: This card shall allow communication with Chloride's MopUPS Monitoring and Shutdown software.

2.5.1.2 ManageUPSNET Interface Card: This card shall allow the UPS to be monitored over a network using TCP/IP protocol. Monitoring is accomplished using an NMS station using SNMP or a computer using a web browser.

2.5.1.3 AS/400 Interface Card: This card shall allow the UPS to interface with computer systems utilizing the IBM AS/400™ contact protocol.

2.5.1.4 Relay Driver Card: This card shall allow the UPS to interface with a Remote Alarm Unit (RAU). This shall also allow the use of an Industrial Contact Card.

2.5.1.5 Industrial Contact Card: This card shall provide up to five contacts rated at 120V, 2A and can be used either in a normally open or normally closed configuration.

2.5.1.6 LIFE2000 Interface Card: This card shall allow the UPS to be monitored via Chloride's LIFE2000 Factory Monitoring Service.

2.5.2 Input Harmonic Filter

The UPS system shall be provided with an optional input harmonic filter to reduce input total harmonic current distortion (THDi) to <7 % during normal operating condition.

2.5.3 External Maintenance Bypass

An external bypass shall be available to allow the entire UPS system to be bypassed for service without requiring the load to be shut down.

2.5.4 Remote Alarm Unit

A separate alarm unit shall be provided and shall include at least the following monitoring and alarm functions:

- System normal
- UPS alarm
- Shutdown imminent
- Mains failure
- Load on Reserve (Bypass)
- Inverter fault
- LED test
- Alarm mute

2.5.5 MopUPS Monitoring and Shutdown Software

A software package shall provide for safe system shutdown and useful power management. Available features shall include network shutdown, scheduled shutdown and restart, event messaging, event logging, data logging, real-time viewing, UPS diagnostics, and remote access. This option requires a costumer supplied computer and meet the following operating system requirements:

- Windows™
- All hardware requirements are OS specific
- Network or Modem connection (for email, paging, etc.)
- Dedicated serial communications port or, TCP/IP connection

2.5.6 Parallel Operation

Up to eight (8) modules of the UPS shall be capable of working together in parallel operation for either redundancy or capacity when a paralleling option board is installed in each module.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

The following procedures shall be performed by Chloride's Authorized Field Service Engineer during the Factory Start-Up Service:

1) Visual Inspection
   a. Inspect all wiring between the cabinets of the UPS system to ensure proper connections.

b. Examine all external wiring connections to the UPS system for proper connections.
c. Record environmental conditions and make any necessary recommendations to ensure proper operation of the UPS system.

2) Mechanical Inspection

a. Inspect all wire terminations for proper tightness.
b. Inspect all battery cable terminations for proper tightness.
c. Inspect all board and control wire terminations to ensure proper tightness and seating.

3) Electrical Inspection

a. Ensure all voltages are correct.
b. Ensure proper phase rotation has been used.
c. Ensure that the battery voltage is correct.

4) UPS Start-Up Inspection

a. Energize system and ensure correct AC and DC voltages.
b. Check for proper synchronization between Inverter and Bypass.
c. Verify that UPS operates in all modes of operation.
d. Verify that no alarms conditions are present and the UPS is operating “normal”.

3.2 FIELD SERVICE ORGANIZATION

The UPS manufacturer shall have available a nationwide field service organization staffed by factory trained Field Service Engineers dedicated to the start-up, maintenance and repair of UPS equipment. The manufacturer shall have a toll free service telephone number answered 24 hours a day / 365 days a year.