Product Specifications

Guide Specification for FirstLine® P
65kVA, 80kVA, 100kVA, and 125kVA

Three-Phase, On-Line
Uninterruptible Power Supply

1-1-2011E

301 Gaddis Blvd, Dayton, OH 45403, USA
Telephone: (866) 261-1191, (937) 253-1191 Fax: (937) 253-1723

SECTION 1.0
SCOPE

1.1 Summary

A. This Specification defines the electrical and mechanical characteristics and requirements for the FirstLine P Series UPS as manufactured by Staco Energy Products Co. located in Dayton, OH.

B. The UPS shall a continuous duty; three-phase, uninterruptible power system, hereafter referred to as the UPS designed to operate with the building supply to provide conditioned power as well as power back up for the critical loads.

1.2 Qualifications

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.

1.3 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. 107.3
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
9. Seismic Withstand Certification (IBC Site Specific A – F)

1.4 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. Input Isolation switch (SWIN)
6. Output Isolation switch (SWOUT)
7. Maintenance Isolation switch (SWMB)
8. Bypass Isolation switch (SWBY)
9. DSP Control and Monitoring Panel with Graphic display
10. Line up and Match Battery Cabinets with varying back up times and integral DC Circuit Breaker.

SECTION 2.0
MODES OF OPERATION

2.1 Modes of Operation

A. The UPS shall always starts on Bypass and transfers to inverter after the rectifier and inverter have started. This means that the bypass source must be qualified (voltage, frequency, phase sequence) in order to start the UPS. The rectifier input must be qualified (voltage, frequency, phase sequence) in order to start the rectifier.

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

1. **On-Line (Normal)**
   The load shall always powered by the inverter, with stabilized voltage and frequency, using the energy from the mains power supply (INPUT). If there is a fault in the INPUT, the UPS shall switch to the batteries in zero time and the batteries shall supply energy to the inverter to keep the load powered (for the backup time of the batteries). When the INPUT is restored the batteries shall be automatically recharged by the rectifier.

2. **Stand-By or Smart Active**
   The load shall be powered from the by-pass line (if the power supply line is within the specified limits); if there is a fault on the power supply line, the load shall switch automatically onto the inverter, powered by the battery.

   In Stand-By- On mode, the rectifier remains powered and keeps the batteries charged. If the by-pass line voltage or the frequency moves out of the specified limit, the load shall be automatically switched onto the inverter output. With Stand-By On operation, the energy dissipated by the system shall be reduced, leading to considerable savings.

   In Smart-Active mode, the UPS autonomously activates On-Line or Stand-By-On operation according to the quality of the power supply. When in Smart-Active mode, the switch from inverter to by-pass line shall be immediate. For the switch to take place, the by-pass line is required to remain within the specified limits for the time set. When Smart-Active mode is activated, the power supply shall be monitored, after which, if the voltage has remained within the pre-set values, the output shall be then switched onto the by-pass line; otherwise the load remains powered by the inverter. After this time, provided there has been no interference, the load shall switch onto the by-pass line; otherwise the logic starts monitoring again, providing for improved efficiency, which is greater than 98%.

3. **Stand-By Off**
   Standby-Off the load shall not be powered. In the event of an input mains failure the UPS shall be powered from the inverter using the energy stored in the batteries.

4. **Battery System**
   Configurations with one (1) battery system for <u>each</u> UPS
   Each unit shall draw the energy from its own battery. At the end of its backup time each UPS shall shutdown. The load shall then remain unpowered if the duration of the power source outage is greater than the backup time of the connected battery system. When the power source is restored the system shall restart automatically. Each UPS shall recharge its own battery system.

Configurations with one (1) battery system for multiple UPS units
Each unit shall draw the energy from the common battery system. At the end of the backup time, the UPS systems shall shutdown. The load shall remain unpowered if the duration of the power source outage is greater than the backup time of the connected battery system. When the power source is restored the system shall restart automatically. Each UPS shall recharge the common battery.

5. **Overload**
   If the load condition to the system is not reduced, the UPS system shall switch onto the by-pass line. When the overload is removed, the UPS shall automatically return to normal operation. If the overload is continuous, this shall trigger the external protection devices located at the UPS input on the by-pass line. In this case the load shall remain unpowered.

C. Paralleling - The UPS shall have expansion capabilities for up to 8 modules paralleled for capacity or redundancy in single module and group module configurations as required to support future growth. The UPS units shall be connected in parallel and shall share the connected load. (See Section 6.0)

Section 3.0
COMPONENTS

3.1 Components

3.1.1 Rectifier

The IGBT rectifier 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 and charge the batteries.

3.1.1.1 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.

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

3.1.1.3 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.

3.1.1.4 Power Walk-In
When the utility power is applied to the rectifier, the current shall be <25% of the full load current and shall gradually increase to full load rating within 10 seconds (adjustable 0-30 sec.).

3.1.1.5 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.

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

3.1.1.6.1 Charger Capacity

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

3.1.1.6.2 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.

3.2.1 Inverter

The inverter section of the power converter module shall utilize Insulated Gate Bipolar Transistors (IGBT's). This solid-state device that incorporates digital signal processing (DSP) pulse width modulation (PWM) technology 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.

3.2.1.1 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.

3.2.1.2 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.

3.2.1.3 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 bypass 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.

3.2.1.4 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.

3.2.3 Static Transfer Switch – 100% Rated, Continuous Duty

A 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 affect the operation of the UPS and the failure shall be shown on the LCD display.

3.2.3.1 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.

3.2.3.2 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.

3.2.4 Battery

A. General

The UPS module shall use a valve-regulated sealed lead acid (VRLA) heavy duty industrial battery, designed for auxiliary power service in an UPS application. The primary battery shall be furnished with impact-resistant plastic cases and housed in a line up and match cabinet(s) installed both adjacent to or stand alone versions.

B. Protection against Deep Discharge and Self-Discharge

The UPS shall be equipped with a device designed to protect the battery against deep discharge, depending on discharge conditions, with isolation of the battery by a circuit breaker. In particular, a monitoring device shall adjust the battery shutdown voltage as a function of a discharge coefficient to avoid excessive discharge at less than the rated output. A second device shall avoid self-discharge of the battery into the UPS control circuits during an extended shutdown of the UPS (over two hours).

C. Battery Self-Tests

1. The battery monitoring system shall be able to perform the following automatic functions:
    - Battery circuit checks every 12 hours.
    - Open circuit battery test once a month.
    - Partial discharge test every three months.

2. This self-test system shall signal faults via LEDs on the front panel or a message to remote supervision systems.

3.2.5 Manual 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.

Section 4.0
ELECTRICAL

4.1 Electrical Specifications

4.1.1 Ratings

4.1.1.2 The UPS shall be available in power ratings of (kVA/kW):

65kVA/58.5Kw 80kVA/72kW 100kVA/90kW 125kVA/112.5kW

4.1.1.3 Minimum Battery time with (1) Battery Cabinet @ Full Load shall be:

65kVA / 12 Minutes 80kVA / 6 Minutes 100kVA / 15 Minutes 125kVA / 10 Minutes

4.1.1.4 AC Input Characteristics

The UPS shall be capable of accepting power from two (2) sources as standard (Dual Input).

a. **Nominal Voltage**: 480Y/277 VAC, 3 Phase, 3 or 4-wire + ground (Standard Voltage)

or

208Y/120 VAC, 3 Phase, 3-wire + ground - with external line up and match transformer cabinet (Optional)

b. **Nominal Voltage Range:** +15/-10% from nominal voltage during battery recharge.

c. **Voltage Range on battery:** +15% / -40%

c. **Frequency Range:** 45 - 65 Hz)

d. **Power Factor:** > 0.99 at full load, nominal conditions.

e. **Current Harmonic Distortion (THDi):** < 3%

f. **Inrush current:** Less than nominal input current for less than one cycle

g. **Input Surge Protection:** UPS shall be equipped to withstand surges per ANSI/IEEE C62.41.

h. **Rectifier Walk-in:** Progressive from 0 to 30 seconds (adjustable)

i. **Rectifier Walk-in Delay Timer:** Progressive start of rectifier from 0 to 120 seconds (adjustable.

4.1.1.5 AC Output Characteristics

a. **Voltage:** 480Y/277 VAC, ± 1% steady state variation phase-to-phase voltage volts AC, three-phase, 3 wire plus ground (Standard Voltage).

or

208Y/120 VAC, 3 Phase, 3-wire + ground - with external line up and match transformer cabinet (Optional)

b. **Frequency:** 60Hz, + 2%, 60Hz, + .05% when free running.

c. **Voltage regulation:** ±1% for balanced load, ±3% for 100% unbalanced load.

d. **Voltage Distortion:** Maximum 2% total (THD).

e. **Voltage Transient (Step Load) Response:** + 5% for 100% step load change.
f. **Voltage Recovery Time:** Return to within 1% of nominal value within 20 milliseconds.

g. **Phase Angle Displacement:** 120 degrees + 1º for balanced load; 120º, + 1º for 100% unbalanced load.

h. **Non-Linear Load Capability:** Output voltage total harmonic distortion shall be less than 2% when connected to a 100% non-linear load with a crest factor not to exceed 3%.

i. **Slew Rate:** 1 hertz/second maximum.

j. **Power Factor:** 0.9 at the rated volt amperes (VA).

k. **Inverter Overload Capability:** 110% of rated load for 60 minutes, 150% of rated load for 1 minute.

l. **Bypass Overload Capability:** 110% for 60 minutes, 125% for 10 minutes,150% for 1 minute.

m. **Output Waveform:** Sinusoidal

n. **Efficiency:** (DC-AC): Minimum - 95% at Full Load, (AC-AC): Minimum – 93% at Full Load

4.1.2 Battery

a. **Battery Voltage:** 420 volts DC minimum before cutoff, 540 volts float.

b. **Maximum DC Current:** Maximum DC current at cutoff voltage shall be:
65kVA 159.5 Amps 80kVA -196 Amps 100kVA – 236 Amps 125kVA – 296 Amps

4.2 Mechanical Design and Ventilation

A. Enclosure: The UPS shall be housed in a freestanding NEMA 1 enclosure with dead front construction. The mechanical structure of the UPS shall be sufficiently strong and rigid to withstand handling and installation operations without risk and have provisions for forklift handling. The sheet metal elements in the structure shall be protected against corrosion by a suitable treatment, primed and powder coat painted black with a textured finish.

B. Redundant, forced air-cooling shall be provided to ensure that all components are operated within specification with air entry at the front, lower sides, and back with top air exit.

C. Cable Access: The standard UPS available shall accommodate bottom entry cables (top or side entry shall be optional).

D. Cabinet Dimensions: The width of the UPS shall be 31.5 inches (800 mm) Wide x 33.5 inches Deep (850 mm) x 75 inches High (1,900 mm).

E. Cabinet Weights: The UPS shall have a maximum weight of 1,213 lbs. (550 kg) at 65kva and 80kVA, 1,433 lbs. (650 kg) at 100kVA and 1,544 lbs. (700 kg) at 125kVA.

F. Ventilation and Heat Rejection: The UPS shall be designed for forced air cooling. Air inlets shall be provided from the front and bottom of the UPS enclosure. Air exhaust shall be from the top portion of the unit. Full load heat rejection shall be 15,033 BTU's/Hr at 65kVA, 18,500 BTU's/Hr at 80kVA, 23,120 BTU's/Hr at 100kVA and 28,900 BTU's/Hr at 125kVA.

4.3 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: -25ºF (-32ºC) to 122ºF (50ºC) however batteries should not be exposed to temperatures above 77ºF (25ºC). For every 15ºF (9.5ºC) 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 90% non-condensing at 77°F (25°C).

4. Altitude: Normal operation without de-rating is 3,281 feet.

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.

Section 5.0
DISPLAY & CONTROLS

5.1 System Controls and indicators

The UPS unit shall incorporate the necessary controls, instruments and indicators to allow the operator to monitor the system status and performance, as well as take any appropriate action. The UPS shall meet, at a minimum the following requirements:

5.1.1 Panel Functions

5.1.1.1 LED Control Panel Functions

- Menu Selections
- Mimic Screen
- Function Indicator LED’s
- Function Selection Keys
- EPO Button

5.1.1.2 Graphic Display

A graphic display shall be on the UPS door, which provides the user to have a close-up, detailed overview in real time of the status of the UPS. The user shall be able to switch the UPS on and off, consult electrical mains, output, battery measurements and perform the main UPS settings. The display shall be divided into four main areas, each with its own specific role.

General Information: Area of the display where the set date and time and, according to the screen, UPS model or title of the menu which is active at that moment is displayed permanently.

Data Display/Menu Navigation: Main display area designed for displaying the UPS measurements (constantly updated in real time) and for consulting the various menus which the user shall select using the designated function keys.

UPS Status/Errors-Faults: Area where the UPS operating status is displayed. The first line shall always be active and constantly display the status of the UPS at that moment. The second only becomes active in the presence of an error and/or fault with the UPS and shall display the type of error/fault encountered.

Key Function: Area divided into four boxes, each relative to the function key below its area. According to the menu which is active at that moment, the display shall indicate the function belonging to the corresponding key in the appropriate box, access main menu, go back to previous menu or display, scroll, confirm selection and silence function keys.

5.1.1.3 Menu Display

- System Diagram
- Measures
- Waveforms
- Commands
  - Battery Test
  - Command
  - Bypass
  - System
  - Stand-By Mode ON
  - Smart Mode ON
- Customizing
  - Date/Time
  - Normal Output Voltage
  - Battery Capacity
- History
- Firmware
- Language

5.1.1.4 LED Status Indication

- Bypass Line
- Main Power
- On Battery
- Load on Bypass
- Normal Output
- Alarm for Internal Fault

5.1.1.5 Alarm Messages/Events

The Display Panel shall provide the following alarm and event messages.

Normal Operation
Disturbances on Bypass Line
Manual Bypass (SWMB) On
Bypass Line Volt, Failure
Main Line Voltage Failure
Pre-alarm, Low Battery Voltage
Low Battery Charge or Closed Disconnect
Low Input Voltage
Output Overload
Internal Fault
Temporary Bypass, Wait
Bypass for Output Overload
Bypass Command ON or OFF
Remote Bypass Command Active
Over-temperature or Fan Failure
Battery test ON
Parallel Cable Fault
Fuse Fault
Battery Discharge Fail
High Battery Temperature
Slave UPS OFF
Fan Fault
Parallel Redundant Lost: High Unit
Input Voltage Sequence not OK
Output Off
System Off Command ON or OFF
Remote System Command ON or OFF
Auto-shutdown Timer ON
System Off
Power
Parallel Redundant Lost: Unit OFF
Break Circuit Fail
Break Circuit Overload
Rectifier Switched Off by Remote Command
UPS Service Required
Battery Service Required
Input Switch Off
Insulation Loss-AC
Insulation Loss-DC
Over-temperature On Bypass
Line Transfer
Inverters Off

5.1.1.6 Configurable Alarms

The UPS shall have the following user configurable control functions accessible from the Display Panel.

A. Basic Functions

- Output Voltage – Selects the rated output voltage
- Operating Mode – Selects the operating Mode: On-Line, Stand-By ON, Smart Active
- Auto Off – If bypass line is present and the load is < of the set value than the load will be supplied from the bypass line. If the bypass line in not preset and the load is < of the set value than the load will not be supply (configurable 0 to 99%).
- Battery Low Warning – Estimated battery time remaining for low battery warning (configurable).
- Battery Capacity – Sets the Amp Hour Battery installed.

- Audible Alarm – Audible alarm operating mode: Enable/Disable
- Language – Selects area Language – English, Italian, German, French, Spanish, Polish or Turkish.

B. Advanced Functions

- Input Frequency Tolerance Range – Selects the acceptable range for the input frequency for switching to the bypass and for the synchronization of the output: +/- 1 to +/- 6 in !% stages.
- Bypass Voltage Thresholds – Selects the acceptable voltage range for switching to the bypass: +/- 5 to +/- 25 in 1% stages.
- Bypass Voltage Threshold for ECO – Selects the acceptable voltage range for operation in ECO Mode: +/- 5 to +/- 25 in 1% stages.
- Switch-On Delay – Waiting time for automatic power-on after the return of power source voltage:
- Disable or configurable 1 to 255 in 1 second stages.
- Power Walk-In – Activates the gradual return to power source mode: Activated or Deactivate.
- Power walk-In Duration – Sets the duration of the gradual return to power source voltage (only if Power Walk-In is activated: Minimum 0 seconds to maximum 125 seconds in 1 second stages.
- Inverter Synchronization Speed to Bypass Line – Selects the synchronization speed of the inverter to the bypass line: 0.1 to 1 Hz/sec (parallel units), 0.1 to 3 Hz/sec (single units).

C. Remote Emergency Power Off (EPO)

The UPS shall be equipped with provisions for local and remote emergency power off and Dry Contact input that shall be used to command UPS shutdown remotely.

D. DB-9 Connector: One DB-9 connector with serial output shall be provided for field diagnostics.

E. Dry Contacts: The UPS shall be provided standard with a programmable input/output relay board. This board shall have 5 dry contacts (i.e., 3 for input signals and 2 for output signals).

1. Contacts shall be programmed as:
    a. Bypass
    b. Battery Discharging
    c. End of battery Discharge
    d. Inverter Off (input).
    e. EPO (input).

2. The contacts shall capable of switching up to 30 V AC or DC at UP 1 Amp.

3. In place of the three standard ALARM functions above, the unit shall have the capability to be reprogrammed to any (3) of the customized alarms below:

    a. Disturbances on Bypass Line
    b. Manual Bypass ON
    c. Bypass Line Voltage Fail
    d. Main Line Voltage Fail
    e. Pre-alarm , Low Battery Voltage
    f. Output Overload
    g. Internal Fault
    h. Bypass for Output Overload
    i. Over Temperature or Fan Failure
    j. Input Voltage Sequence OK
    k. Output OFF

Section 6.0
PARALELLING

6.1 Parallel Configuration

6.1.1 The UPS shall have expansion capabilities for up to 8 modules (same rating) in a parallel configuration for capacity or redundancy as required to support future growth and to increase both the reliability of the to the load. The UPS units shall be connected in parallel and shall share the connected load.

Having a redundant unit means having one more UPS than the minimum number of elements required to power the load, so that if a faulty unit is automatically excluded, power is still supplied correctly. The UPSs connected in parallel are coordinated by a card which ensures the interchange of information. The information shall be exchanged between the UPSs via a cable connecting them in a loop. The loop connection provides redundancy in the connection cable (communication in the cables between the individual units). This is the most reliable means of connecting the UPS and also allows the hot insertion or disconnection of a UPS. Each UPS has its own controller that continuously communicates with the whole system so as to guarantee the operation of the system. The cable transmits the signals from a “Master” UPS to the other “Slaves” using an opto-isolated system in order to keep the control systems electrically isolated from each other. The operating logic envisages that the first unit that is activated becomes the “Master” and takes control of the other “Slaves”. In the event of a fault in the “Master” unit, control is immediately switched to a “Slave” which then becomes the “Master”. The current system provides basic operation, each unit having its own battery. The system may be personalized (by means of a code inserted on the display panel) with all the units connected to a single battery.

In a system with several UPS units connected in parallel, there shall be a single MASTER unit and the remaining units shall be SLAVE units. The UPS units shall all be the same rating and the MASTER is chosen on start-up. The MASTER and SLAVE units shall be capable of exchanging roles. If a unit is being serviced, e.g. due to an inverter fault, it will automatically be excluded. The load at this point shall be shared between the units that are still active; if the power in the output is excessive for the remaining UPSs, the system logic shall switch all the units, including the UPS that was excluded, onto the by-pass line.

6.1.2 Single Module Paralleling

A Parallel Systems Joiner shall be installed in each UPS Module enabling the connection of the outputs from separate UPS Modules in a parallel configuration into a dynamic dual bus for system expansion, fault tolerance and ease of maintenance.

6.1.3 Group Module Paralleling

A UPS Group Synchronizer (UGS) shall be included and shall synchronize the outputs from two separate groups of parallel UPS Modules which may be supplied from separate AC sources. It shall enable the outputs from the groups to be configured into a dual bus format.

The UPS maintains synchronization between the outputs of the parallel groups, regardless of input supply variations. For example, one group may be on battery power or standby power and the other powered by the mains power supply. The device can be generally used with up to eight UPS modules between two separate groups.

If one of the UPS modules within the two parallel systems fails, or has to be switched off for maintenance or emergency service work, the two outputs of the parallel UPS systems are merged by the PSJ (which acts as an output coupling switch) to allow power sharing.

6.1.4 Parallel System Static Transfer Switch (STS)

When UPS Modules are connected in Group Paralleling configuration a STS devices shall be used to provide a source of power from one of two primary input sources. This can include either two separately derived power sources, the outputs from two uninterruptible power supplies or a combination of the two. The (STS) on the output shall enable the protected load to be supplied from either of the parallel groups. In this configuration, if one of the UPS groups fails, the STS can transfer the load to the second group - providing there is spare capacity. The STS shall free standing and include a Master Switch. This configuration is designed for sites that have large three phase loads.

6.1.5 Hot Insertion/Removal

The system shall have the capability to insert or remove additional UPS modules without disconnecting the load. The hot insertion and removal of the UPS shall make technical support easier and improves the reliability of the system.

6.1.6 Battery System

The parallel configuration shall be capable of using (1) battery system per UPS or (1) battery system for multiple UPSs.

A. Configurations with one (1) battery system for <u>each</u> UPS
   Each unit shall draw the energy from its own battery. At the end of its backup time each UPS shall shutdown. The load shall then remain unpowered if the duration of the power source outage is greater than the backup time of the connected battery system. When the power source is restored the system shall restart automatically. Each UPS shall recharge its own battery system.

B. Configurations with one (1) battery system for <u>multiple</u> UPS units
   Each unit shall draw the energy from the common battery system. At the end of the backup time, the UPS systems shall shutdown. The load shall remain unpowered if the duration of the power source outage is greater than the backup time of the connected battery system. When the power source is restored the system shall restart automatically. Each UPS shall recharge the common battery.

Section 7.0
OPTIONS

7.1 UPS Module Options

7.1.1 Top or Side Cable Entry

Standard cable entry shall be from the bottom with provisions for top or side entry using a matching side car cabinet not to exceed 75” high x 15.75” wide x 33.35” deep.

7.1.2 Input/Output Transformer Cabinet with Maintenance Bypass (Make-Before-Break)

The UPS shall have provisions to accept an input power source of 208 VAC and /or output of 208/120V. An input Auto or Isolation transformer 208 VAC to 480 VAC and/or 480V to 208/120V output transformer shall be housed in a single cabinet. As an integral part of the cabinet, it shall also accept a three (3) Breaker Maintenance Bypass with interlocks and top cable entry capability The cabinet shall match the UPS cabinet and not exceed 75” high x 33.5” Wide x 33.35” deep.

7.1.3 Output Distribution Unit (PDU)

The UPS shall have provisions to provide a 208Y/120 VAC output distribution unit (PDU) to distribute power to the load. The PDU shall contain two (2) branch circuit distribution panel boards accepting any combination of 1, 2 or 3 pole branch circuit breakers housed in a matching cabinet not to exceed 75" high x 22" wide x 33.35" deep. Branch circuit breakers shall be provided by others.

7.1.4 Output Sub-Feed Distribution Unit (Sub-Feed PDU)

The UPS shall have provisions to provide a 208V output distribution unit to distribute power to existing distribution panels. The Sub-Feed PDU shall contain three (3) 125 Amp sub-feed distribution circuit breakers housed in a matching cabinet not to exceed 75" high x 22" wide x 33.35" deep.

7.2 Battery System Options

7.2.1 External Battery Cabinet System

Line up and match extended run time battery cabinet(s) shall be furnished in both adjacent or stand alone versions. The battery cabinet shall be capable of accepting (40) each (1 string) and upgradeable to (80) each (2 strings) of 50Ahr VRLA Maintenance Free Cell type batteries, wired and installed with dimensions of 26.31" Wide x 38" Deep x 75" High. Interconnecting cables and lugs shall be provided by others.

7.2.2 Open Rack Battery System

The UPS shall be capable of utilizing Wet Cell or NiCad batteries installed in an open type seismic qualified rack construction.

7.2.3 String Level Battery Monitoring

The battery system shall have provisions to accept a Wireless Battery Monitoring System that monitors each battery and string. It shall also monitor the battery cabinet internal temperature and provide cycle data and other reports and graphs.

7.3 External Maintenance Bypass

7.3.1. Wrap-Around System Maintenance Bypass Switch

An External Maintenance Bypass (make-before-break) shall be available: For 480V x 480V power requirements the maintenance bypass option shall provide for three (3) circuit breakers mounted in a matching cabinet not to exceed 75" high x 15.75" wide x 33.35" deep.
For 480V input and 208/120V output or 208V input and 208/120V output, see 7.2.1 above.
The total enclosure shall provide a wrap-around bypass configuration for total UPS isolation during maintenance or removal of the UPS. Maintenance bypass transfers shall be without interruption and shall have interlocks to protect the UPS from damage in the event of out-of-sequence transfers. Key release interlocks shall be included.

7.4 Communications

7.4.1. Monitoring and Shutdown Software

The UPS shall have Monitoring and Shutdown Software available to provide communication
: across a LAN networks:

FLU-Powershield: Communication Software shall provide efficient, user-friendly UPS management using bar chart displays to show major operational information such as the input voltage, UPS load percent and batteries charge percent. The software also provides detailed information on fault conditions and UPS operating characteristics. PowerShield has been

developed with a client/server architecture that makes it flexible and easy to use, and provides multi-lingual and on-line support.

Operating systems supported include Windows 2000, 2003Server, XP, Vista, 2008 Server, 7, Linux, Novell Netware, Mac OS X and most common UNIX operating systems such as: IBM AIX, HP, SUN Solaris INTEL and SPARC, SCO Uniware and Open Server, Silcon Graphics IRIX, Compaq Tru64 UNIX and DEC UNIX, Open BSD UNIX and FreeBSD UNIX, NCR UMIX, HP Open VMS VMWare ESX and VSPHERE.

FLU-PowerNETGuard Supervision software shall centralize UPS management using network interface (SNMP) communications. It is ideal for Data Centre managers and medium to large sized networks. PowerNETGuard uses the RFC1628 standard Management Information Base (MIB) and ensures standardized UPS management wherever they are located.

Operating systems supported include Windows (98, ME, NT, 2000, 2003, XP and Vista), Kinux, MacOSX, Solaris 8, 9 and 10 and Silcon Grapics IRIX.

7.4.2. Communication Cards

Open slots shall be available to accept any (2) of the following:

FLU-Netman: Internal SNMP Card (external model shall be available) allows UPS management across a LAN using any of the main network communication protocols - TCP/IP, HTTP and network interface (SNMP). NetMan Plus enabled UPS integrate easily into medium and large sized networks and provide reliable communications between the UPS and management systems employed.

FLU-MultiCOM1: Internal MODBUS/JBUS Card (external model shall be available), Protocol converter shall be used to monitor the UPS using the MODBUS/JBUS protocol on RS232 or RS485 serial lines. It can also manage a second independent RS232 serial line that can be used to connect to other devices such as the Netman or a PC using PowerShield software.

FLU-MultiCOM2: Internal Serial/USB Card shall provide the UPS with an additional RS232 serial interface or USB port. The USB port allows the UPS to communicate with Apple Macintosh computers as well as Windows and Linux operating systems.

FLU-Multi I/O: Internal Protocol converter Card shall have a configurable input and output signal contacts to allow UPS integration with control systems. It can be used to connect two devices to a single UPS serial communication port. It can also communicate using the MODBUS/JBUS protocol on RS485 lines.

FLU-IBM AS400: Communication Kit shall have a single-level memory management feature that makes it compulsory for the system to be shutdown in a controlled and orderly manner. Without UPS protection an AS/400 is not protected from mains failures. A momentary loss of power can cause hardware damage, data corruption and a lengthy reboot period.

FLU-I/O Expansion: Internal Card shall provide addition remote alarm functions as identified below. The card shall contain 6 outputs: potential-free contacts for alarms (programmable from the display panel) (and capable of switching up to 30 V AC or DC at UP 1 Amp) , 2 inputs (programmable from the panel) and 1 12V DC maximum 100mA auxiliary input. 2 additional slots shall be available for a total of 12 additional contacts.

- Disturbances on Bypass Line
- Manual Bypass ON
- Bypass Line Voltage Fail
- Main Line Voltage Fail
- Pre-alarm , Low Battery Voltage
- Low Input Voltage
- Output Overload
- Internal Fault
- Bypass for Output Overload
- Over Temperature or Fan Failure
- Input Voltage Sequence OK
- Output OFF

7.4.3 Environmental Sensors Modules (ESM)

ESM modules shall be available to monitor and record environmental conditions.

FLU-Sensor: Environmental Sensor Module shall monitor and record environmental conditions as well as activities in protected areas and at the premises where the UPS is installed. Environmental sensors monitor and record environmental conditions and activities within a designated building area. The sensors provide extensive management and control, triggering cooling fans and locks in response to changes in temperature and humidity. Remote monitoring and control can be provided via the internet, SNMP and PowerShield software. NetMan Plus can support up to 6 separate sensors. The environmental sensors are easy to install and do not need a separate external power supply.

7.4.4 Remote Monitor Alarm Panel (RMAP)

The RMAP shall be available for monitoring the UPS from remote locations.

FLU-MultiPanel: Remote Monitoring Panel device shall provide a detailed UPS status overview in real time. It shall be compatible with all UPS and can display values for UPS specific input and output supplies, and battery set measurements. MultiPanel has a high-definition graphical display and can report in 7 languages: English, Italian, German, French, Spanish, Russian and Chinese.
It shall have 3 independent serial ports, one of which allows for UPS monitoring via the MODBUS/JBUS protocol (on either an RS485 or RS232 serial line). The others can be used with devices such as the Netman Plus or a PC running PowerShield software.

7.5 IBC Seismic Withstand Certification

Site specific Seismic Withstand Certification per IBC (International Building Code) Areas A through F. Bracing hardware with drawings shall be available.

7.6 Harsh Environment Enclosure

The UPS and any accessory cabinet(s) shall have the capability to be mounted and completely wired internal to, include AC cooling, inside any NEMA type enclosure (NEMA 12, 3R, 4X) by the manufacturer.

7.7 Spare Parts

Shall be available in three levels, Level 1. Minor, Level 2. Medium and Level 3. Major.

7.8 Service Agreements

Multi level service and maintenance agreements shall be available.

Section 8.0
Execution

8.1 Factory Testing

Before shipment, the manufacturer shall fully and completely test the system to factory standards to assure compliance with the specification. Each subassembly shall undergo thorough testing prior to installation in the system. The total system shall be exposed to a functional load test and shall be subjected to a minimum of 24 hours "burn-in" test prior to shipment.

A complete test report shall be available for each unit and kept on file for future reference.

8.2 Site Start-Up

Site start-up and testing shall be provided by the manufacturer's field service representative during normal working hours (M/F-8/5). Individual scheduling requirements shall be met with ten working days advance notice.
Site testing shall consist of a complete test of the UPS and accessories by the UPS manufacturer in accordance with manufacturer's standards. Commissioning must be performed by manufacturer's approved service representative for warranty to apply.

8.3 UPS Limited Warranty

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.

8.4 Battery Limited Warranty

The battery manufacturer's standard warranty shall be passed through to the end user.

8.5 Serviceability

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

8.6 Materials

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

8.7 System Reliability

The UPS MTBF shall not be less than 350,000 hours for the inverter.

8.8 Operating and Maintenance Manuals

The specified UPS system shall be supplied with one copy of the User's Manual. Additional copies may be printed from the manufacturers web site.

8.9 Field Engineering Support

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.

8.10 Qualifying Experience

The manufacturer shall have a minimum of ten years experience in the design, manufacture, and testing UPS systems. This specification outlines the minimum requirements for a UPS. Every supplier shall provide a specification compliance statement with its proposal referencing each section of this specification.

9.0 Quick Reference Specification

Electrical Data	UPS Power (kVA)			
	65	80	100	125
INPUT				
Nominal voltage	480Vac 3 phase, 3 or 4-Wire + Grd. (208V Optional with IP Transformer)			
Nominal voltage range without battery contribution	-10%, +15%			
Voltage range in battery mode	-40%, + 15%			
Input frequency range	From 45 to 65Hz			
Nominal current (480V)	78.2	94	118	147
Maximum current at full load and battery recharging (Amps)	90	136	136	168
Power factor at nominal voltage (480 V) and battery charged from 25% to 100% of the load	>0,99			
Current Harmonic distortion (THDi) (with mains distortion <2%) • load 100% • load 75% • load 25÷50%	≤ 3% ≤ 5% ≤ 8%			
Progressive rectifier (Walk-in)	from 0 to 30 seconds (configurable)			
Delay of Progressive start of rectifier (Power Walk-in delay timer)	from 0 to 120 seconds (configurable)			
D.C. INTERMEDIATE CIRCUIT				
Number of cells	240			
Float voltage (2,26 V/el. , can be calibrated) – Vdc	542			
Recharge Voltage (2,34 V/el. , can be calibrated) – Vcc	561			
Maximum output voltage	600			
End of discharge voltage Vcc (1,6 V/el, can be calibrated) - Vac	384			
Ripple current with recharged battery (%)	Approx. 0			
Maximum current to charge battery with 240 cells (mains voltage 480V)				
• Load 100%	16	20	24	30
• Load ≤ 70%	49	60	76	96

INVERTER	
Factor of power reduction for 0,9 o/p leading power factor	0,89
Nominal voltage	480Vac 3 phase, 3-Wire + Grd. (208V Optional with OP Transformer)
Nominal frequency	60Hz
Nominal voltage	+5%, -10%
Static variation	± 1%
Dynamic variation	± 5%
Resistor time within ± 1%	20ms
Crest Factor	3:1
Voltage distortion with linear load	1% (typical), 2% (max)
Voltage distortion with non-linear load	< 3%
Frequency stability with synchronized inverter to the by-pass network.	± 2% (± 1% a ± 6% from control panel)
Frequency stability with not synchronized inverter to the by-pass line	± 0,05%
Speed of frequency variation	1Hz/sec (parallel units can be calibrated from 0.1 to 1Hz/s)
Phase voltage asymmetry with balanced and unbalanced load.	≤ 1%
Phase displacement of the voltages with balanced and unbalanced loads.	120 ± 1 °el
Overload in referred to the nominal power **1.** Three phase	110% for 60 minutes, 125% for 10 minutes, 150% for 1 minute
Single phase	200% for 7 seconds
Short circuit Current • Phase / Phase	180 % for 1 second
Phase / Neutral	300 % for 1 second
Inverter efficiency	94%

BYPASS	
Nominal voltage	480vac 3-phase (with or without neutral)
Nominal voltage tolerance	± 15% (can be regulated from ± 10% to ± 25% from the control panel)
Nominal frequency	60 Hz
Frequency tolerance	± 2% (can be regulated up to a ± 6% from the control panel)
Switching time inverter- by-pass with Inverter synchronized (UPS Normal)	Approx. 0ms
Switching time inverter- by-pass with non-synchronized Inverter (UPS in "Normal Mode")	20ms (Can be calibrated from 10 to 100 ms or with inhibition of transfer onto bypass)
Switching time from by-pass to Inverter (Stand-by/ On Mode)	from 2 to 5ms
Delay in transferring to Inverter after the switching onto by-pass	4 sec
Overload Capacity of by-pass line	125 % for 60 minutes, 150 % for 10 minutes
Short circuit capacity of by-pass line (x nominal current)	kVA 65 80 100 125 1 second 20 15 12 10 500 ms 23 18 15 12 200 ms 26 21 17 14 100ms 30 22 18 15 10ms 40 30 25 20

SYSTEM				
On-Line AC/AC efficiency • Full load • Load 50%	93 % 93.5 %			
Efficiency with UPS in STAND-BY mode	98 %			
Full Load Heat Rejection BTU/hr	15,033	18,500	23,120	28,900
Maximum current dispersion	300mA maximum			

Mechanical				
Dimensions	UPS Rating			
	65	80	100	125
Height x Width x Depth (inche)	75 x 31.5 x 33.5			
Weight – lbs.	1,213	1,213	1,433	1,544

ENVIRONMENTAL	
Ambient Temperature	0 ° C to 40° C
Storage Temperature	-25 ° C to 70° C
Relative Humidity	20 – 90% non-condensing
Altitude	3,281 feet without de-rating
Audible Noise	65 dBA @ 1 meter

STANDARDS	
Agency Listing	UL1778, CE

Staco Energy Products Co.
301 Gaddis Blvd.
Dayton, OH 45403
(866) 261-1191 Toll Free
(937) 253-1723 Fax
Sales@StacoEnergy.com
www.stacoenergy.com