

# **APC by Schneider Electric**

## **MGE GALAXY 3500**

Uninterruptible Power Supply

### **Guide Specifications**

**10 kVA to 40 kVA**

**3×400 in / 400-230 V Solution**

*THIS GUIDE SPECIFICATION IS WRITTEN IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS INSTITUTE (CSI) MASTERFORMAT. THIS SECTION MUST BE CAREFULLY REVIEWED AND EDITED BY THE ARCHITECT OR THE ENGINEER TO MEET THE REQUIREMENTS OF THE PROJECT. COORDINATE THIS SECTION WITH OTHER SPECIFICATION SECTIONS IN THE PROJECT MANUAL AND WITH THE DRAWINGS.*

*WHERE REFERENCE IS MADE THROUGHOUT THIS SECTION TO "PROVIDE", "INSTALL", "SUBMIT", ETC., IT SHALL MEAN THAT THE CONTRACTOR, SUBCONTRACTOR, OR CONTRACTOR OF LOWER TIER SHALL "PROVIDE", "INSTALL", "SUBMIT", ETC., UNLESS OTHERWISE INDICATED.*

*THIS SECTION IS WRITTEN TO INCLUDE THE 2004 MASTERFORMAT AND THE 1995 MASTERFORMAT VERSIONS. WHERE APPLICABLE, THESE ITEMS ARE BRACKETED AND, IN EACH CASE, UNLESS OTHERWISE INDICATED, THE FIRST CHOICE APPLIES TO THE 2004 MASTERFORMAT AND THE SECOND CHOICE APPLIES TO THE 1995 MASTERFORMAT.*

## **SECTION [26 33 63] [16611]**

### **SOLID STATE UNINTERRUPTIBLE POWER SUPPLY**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This specification describes a three-phase, on-line, continuous operation, solid-state uninterruptible power supply (UPS). The UPS shall operate as an active power control system, working in conjunction with the building electrical system to provide power conditioning and on-line power protection for the critical loads.

##### **1.2 STANDARDS**

- A. **Safety:** EN/ IEC 62040-1  
B. EMC/IEC 62040-2 (Class C2 and C3)  
C. **Performance:** EN/IEC 62040-3

##### **1.3 CLASSIFICATION**

- A. Classification according to EN/IEC 62040-3: VFI-SS-112

##### **1.4 SUBMITTALS**

- A. **Product data:** Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications.
1. As bid system bill of materials
  2. Product catalogue sheets or equipment brochures
  3. Product guide specifications
  4. System single-line operation diagram
  5. Floor layout
  6. Capacity data
  7. Piping connection drawing
  8. Installation guide
  9. Drawings for requested optional accessories
- B. **Operation and Maintenance Data:** Submit operation and maintenance data to include in operation and maintenance manuals specified in [Division 01 – GENERAL REQUIREMENTS] [Division 1 – GENERAL REQUIREMENTS], including, but not limited to, safe and correct operation of UPS functions.

1. Submit an installation manual, which shall include, but shall not be limited to, instructions for storage, handling, examination, preparation, installation, and start-up of all systems.
2. Submit an operation and maintenance manual, which shall include, but shall not be limited to, operating instructions.
3. Submit built equipment drawings.

## 1.5 QUALITY ASSURANCE

### A. Qualifications:

1. **Manufacturer Qualifications:** Manufacturer shall be a firm engaged in the manufacture of solid state UPS of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 20 years.
  - a. The manufacturer shall be ISO 9001 & 14001 certified and shall be designed to internationally accepted standards.

## 1.6 PROJECT CONDITIONS

### A. Environmental Requirements: Do not install solid state UPS until space is enclosed and weatherproof, wet work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1. The UPS shall be capable of withstanding any combination of the following environmental conditions in which it must operate without mechanical or electrical damage, or degradation of operating characteristics.
  - a. **Storage Ambient Temperature:** -15°C to 40°C with batteries; -30°C to 70°C without batteries
  - b. **Operating Ambient Temperature:** 0°C to 40°C. 15°C to 25°C is ideal for batteries (if above, the battery lifetime is reduced).
  - c. **Relative humidity:** 0 to 95%, non-condensing.
  - d. **Storage elevation:** 0 to 15000 m.
  - e. **Altitude:** Maximum installation with no derating of the UPS above sea level shall be:
    - 1) 1000 m: 100% load
    - 2) 1500 m: 95% load
    - 3) 2000 m: 91% load
    - 4) 2500 m: 86% load
    - 5) 3000 m: 82% load

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Basis of Design:** Product specified is "APC-MGE Galaxy 3500" system (for industrial environment) as manufactured by APC by Schneider Electric. No substitutes will be considered.

OR

- B. **Basis of Design:** Product specified is "APC-MGE Galaxy 3500" system (for industrial environment) or approved equal. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers are acceptable. The Architect/Engineer will be the sole judge of the basis of what is equivalent. Examples of modifications include, but are not limited to the following:

1. Structural reinforcement to accommodate heavier equipment.
2. Increased sizes of circuit breakers, raceways and wiring.
3. Larger back-up generators (including upgraded accessories and wiring) to avoid instability caused by most double conversion UPS systems.
4. Larger HVAC equipment (including duct work and wiring) to accommodate increased heat dissipation of less efficient UPS systems.
5. Filters to prevent input distortion, avoid upstream equipment malfunction and failure of power factor equipment.

### 2.2 DESCRIPTION

- A. The UPS shall consist of the following easy to repair modular rectifier/inverter sections and easy to install internal and external modular battery units.
- B. The UPS shall be provided with separate feeds for rectifier/inverter section and the static bypass switch.
- C. **Modes of operation:** The UPS shall operate as an on-line system in the following modes:
  - 1. **Normal:** The inverter and the rectifier shall operate in an on-line manner to continuously regulate the power to the critical load. The rectifier shall derive power from the AC input source and supply DC power to float charge the battery.
  - 2. **Battery:** Upon failure of the AC input source, the critical load shall continue being supplied by the inverter without any switching. The inverter shall obtain its power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the AC input source.
  - 3. **Recharge:** Upon restoration of the AC input source, the UPS shall simultaneously recharge the battery and regulate the power to the critical load.
  - 4. **Static Bypass:** The static bypass switch shall be used for transferring the critical load to input supply without interruption. Automatic re-transfer to normal operation shall also be accomplished with no interruption in power to the critical load. The static bypass switch shall be fully rated and shall be capable of manual operation. The UPS shall be able to recharge the batteries while supplying full power to the load via the static bypass switch.
  - 5. **Internal maintenance bypass switch:** The UPS shall be provided with an internal manual bypass switch for supplying the load directly from the mains supply, while the UPS is taken out for maintenance. The switch should be removable when the individual UPS unit has to run in parallel with other units.
  - 6. **External maintenance bypass transformer [optional]:** The external Maintenance Bypass Panel shall be used for paralleling of multiple UPS units (optional for single UPS unit) to supply the load directly from the mains supply, if the UPS system has to undergo maintenance or service. An UPS input, output, common output and bypass breaker shall be housed in the same low-voltage assembly. The manual bypass breaker must be monitored by each UPS via an auxiliary contact. The Maintenance Bypass Panel must be housed in a wall mounted low-voltage assembly.
- D. The UPS shall be provided with RS-232 signaling and WEB/SNMP integration. This system must provide a means for logging and alarming of all monitored points plus email notification.
- E. The UPS shall have nominal voltage of 3×400/230 V (adjustable for 3×380/220 V, 3×415/240 V), 50 Hz, L1, L2, L3, N, PE.
- F. The UPS will be capable of paralleling up to max 4 like kVA and type UPS systems for capacity.
- G. The UPS shall be compatible with all types of data centers, data rooms and facilities. Dedicated service to one specific environment shall not be acceptable.

### 2.3 STATIC UPS

- A. **General:** The UPS shall be housed in a freestanding enclosure. The enclosure shall be designed to blend into an IT environment. The cabinet shall be equipped for fork truck lifting. The UPS cabinet shall be painted with the manufacturer's standard color. All service access shall be from the front. Installation access shall be from the lower backside of the system.
  - 1. The UPS shall be in a self contained cabinet and comprise 10 kVA, 15kVA, 20kVA, 30kVA and 40kVA power section; Bypass Static Switch; Battery for standard run time and interface LCD display all mounted in a separate cabinet. The UPS shall permit user installable and removable battery units.  
The power section shall be of the Double Conversion On-Line topology with power factor corrected inputs.
    - a. The UPS shall be sized for \_\_\_\_\_ kVA and \_\_\_\_\_ kW load at power factor 0.8.
    - b. The UPS battery shall be sized for \_\_\_\_\_ at a power factor of \_\_\_\_\_ for \_\_\_\_\_ minutes.
  - 2. The UPS shall have a short circuit withstand capability of 30 kA.
- B. **System Input**
  - 1. **Nominal Input voltage rating:** 3×400/230 V (adjustable for 3×380/220 V or 3×415/240 V)
  - 2. **Input Voltage Range:** 304-477 V

3. **Earthing Principle:** [TN-S] [TN-C-S] [TN-C] [TT] or [IT].
4. **Input Frequency:** 40-70 Hz (auto sensing).
5. **Input Power Factor:** 0.98 at load > 50%.  
**Magnetizing Inrush Current:** NONE, if optional input isolating transformer is installed then 500% of nominal input current for less than one cycle.
7. **Input Current Distortion with no additional Filters:** < 5% THDI at 100% load.
8. **Power Walk-in/Soft-Start:** Shall be linear from 0 to 100% of the load over a 15-second Period.

C. **System Output**

1. **Nominal Output Voltage Rating:** 3×400/230 V (adjustable for 3×380/220 V or 3×4240 V).
2. **Earthing Principle:** [TN-S] [TN-C-S] [TN-C] [TT] or [IT].
3. **Output Voltage Regulation for Steady State and Transient Variations (at default parameter settings):**
  - a. ± 1% steady state for a static 100% balanced load.
  - b. ± 1% steady state for a static 100% unbalanced load.
  - c. ± 5% for a 0 to 100% load step.
4. **Max. Voltage Transient Recovery Time:** 50 milliseconds to nominal.
5. **Output frequency Regulation:**
  - a. Synchronized to mains over the range of 40-70 Hz in normal operation
  - b. 50 Hz ± 0.1 Hz in battery operation.
6. **Output voltage Harmonic Distortion:**
  - a. <1.5% THDI maximum and 1% single harmonic for a 100% linear load
  - b. <3.5% THD maximum for a 100% non-linear load
7. **Overload Capability:**
  - a. 150% for 60 seconds in normal and battery operation.
  - b. 125% for 10 minutes in normal and battery operation.
  - c. 110% continuous in bypass operation.
  - d. 800% for 500 milliseconds in bypass operation.
10. **Phase displacement:**
  - a. 20 degrees ± 1 degree for balanced load.
  - b. 20 degrees ± 1 degree for 50% unbalanced load.
  - c. 20 degrees ± 3 degrees for 100% unbalanced load.
11. **Output Power Factor Rating:** For loads exhibiting a power factor of 0.5 leading to 0.5 lagging, no derating of the UPS shall be required.
12. **Short Circuit Withstand:** The UPS must withstand a bolted-fault short circuit on the output without damage to the UPS module.
13. **System AC-to-AC efficiency 100% load**
  - a. 10 kVA 94.9%
  - b. 15 kVA 95.5%
  - c. 20 kVA 95.4%
  - d. 30 kVA 96.1%
  - e. 40 kVA 95.5%
14. **System AC-to-AC efficiency 50% load**
  - a. 10 kVA 94.8%
  - b. 15 kVA 95.3%
  - c. 20 kVA 95.5%
  - d. 30 kVA 96.0%
  - e. 40 kVA 96.0%
15. **Acoustical noise at full load:** dB(A) of noise, typically, measured at 1 meter from the operator surface:
  - a. 10 kVA 51
  - b. 15 kVA 51
  - c. 20 kVA 51
  - d. 30 kVA 55
  - e. 40 kVA 55

## 2.3 COMPONENT DESCRIPTION

A. **Rectifier**

1. Each UPS power module shall include an active power factor corrected, Insulated Gated Bipolar Transistor (IGBT) rectifier.
2. DC buss voltage shall be ±192 V DC nominal.

3. The battery charging shall keep the DC bus float voltage of +/- 220 V, +/-1%
4. The DC buss voltage shall be compensated against temperature variations (Battery Temperature Compensation) to always maintain optimal battery float charging voltage for temperature excursions above or below 25°C. Temperature compensation rate shall be 320 mV/°C for ambient temperatures > 20°C and 0 mV/°C for ambient temperatures < 20°C.
5. DC ripple voltage shall be less than ±1% of nominal with no battery connected.
6. Input power factor shall be 0.98 lagging at 100% load with out the use of passive filters. Rectifier shall employ electronic waveform control technology to maintain the current sinusoidal.
7. Pulse Width Modulation (PWM) current control shall be used. Digital Signal Processors (DSP) shall be used for all monitoring and control tasks. Analog control is not acceptable.
8. Reflected input current Total Harmonic Distortion (THD) shall not exceed 5% at 100% load.
9. Input voltage window: 304-477 V.
10. Typical battery recharge time per IEEE 485.

#### B. Batteries

1. Standard battery technology shall be Valve Regulated Lead Acid (VRLA).
2. Batteries shall be housed in the same rack as the power section. Batteries shall be modular on pull out shelves for quick replacement and servicing.
3. Battery voltage shall be Battery Temperature Compensated as outlined in the rectifier section above.
4. **End of discharge:** 154 V DC.
5. For longer runtimes, external battery frames in the same design should be offered.
6. **Battery Charge Current Limit:** The UPS shall be capable of limiting the energy sourced from the mains for purposes of battery charging. As a default setting, the battery charge energy will be set to 100% of its nominal value. When signaled by a dry contact, (such as from an emergency generator) the UPS shall be capable of limiting the battery charge energy taken from the mains. This shall take place in user selectable increments of 75%, 50%, 25%, 10% and 0% of the nominal charge power. The selection shall be made from the UPS front panel display/control unit.
7. The battery charging circuit shall remain active when in Static Bypass and in Normal Operation.
8. The batteries charger shall allow cyclic charging when system is running in normal operation and batteries are full charged to extend the battery life. This operation shall be selectable in the display. Cyclic charge should be 10 hours on and 48 hours off. The Cyclic charge shall end if UPS is overloaded, switch to battery operation, battery voltage drops below 200 V or are deactivated by user.

#### C. Inverter

1. The inverter shall consist of fast switching IGBT power module.
2. Inverter shall be PWM controlled using DSP logic. Analog control shall not be acceptable.
3. The inverter modules shall be rated for an output power factor at 0.8.
4. Nominal output voltage shall be 3×400/230 V and adjustable for 3×380/220 V or 3×415/240 V, 50 Hz, L1,L2,L3,N,PE.
5. **Efficiency of each module at full load:** Not less than
  - a. 10 kVA 94.7%
  - b. 15 kVA 95.1%
  - c. 20 Kva 94.9%
  - d. 30 kVA 95.0%
  - e. 40 kVA 94.8%
6. **Output Voltage Total Harmonic Distortion at full load:**
  - a. Less than 1.5% for 100% resistive load.
  - b. Less than 3.5% for computer load as defined by EN50091-3/IEC 62040-3.
7. **Output voltage regulation:**
  - a. **Static:** Less than 1% at full linear load.
  - b. **Dynamic:** 5% at 100% step load.
8. **Output frequency:** 50 Hz free running.
9. **Crest factor:** Unlimited but regulates it down to 2.7.
  - a. Remote Emergency Power Off (EPO) shall be standard (wall switch and wiring shall be provided by the electrical contractor).

#### D. Static Bypass Switch

1. The static switch shall consist of fully rated Silicon Controlled Rectifiers (SCRs). Part rated SCRs with a wrap around contactor are not acceptable.
2. **The static bypass switch shall automatically transfer the critical load to bypass input supply without interruption after the logic senses one of the following conditions:**
  - a. Inverter overload beyond rating.
  - b. Battery runtime expired and bypass available.
  - c. Inverter failure.
  - d. Fatal error in control system.
3. The static bypass switch shall automatically retransfer from bypass to the inverter, when one of the following conditions occurs:
  - a. After an instantaneous overload-induced transfer has occurred and the load current has returned to less than 100% of the system rating.
  - b. The inverter is active (on).
4. The static bypass switch shall be equipped with a manual means of transferring the load to bypass and back to inverter.
5. If more than 10 transfers from and to inverter occur in a 10 minutes period, the load shall be locked on static bypass. An alarm communicating this condition shall be annunciated.

**E. Mechanical**

1. The MGE Galaxy 3500 UPS power section, Static Bypass Switch, internal manual bypass switch and the VRLA batteries (for standard runtimes) shall be housed in a freestanding enclosure. The enclosure shall be designed to blend into an industrial environment. The UPS cabinet shall be painted with the manufacturer's standard color (Gray ANSI 61). All service access shall be from the front. The enclosure shall have the following specifications:
  - a. Dead front construction
  - b. Heavy-duty design with an all-metal construction.
  - c. Caster fitted for mobility. Leveling feet shall be supplied as standard.
  - d. Electrostatic applied paint.
  - e. The cable entry shall be from the bottom on the back of the UPS.
  - f. The MGE Galaxy 3500 UPS enclosure shall meet an ingress level of min. IP51
  - g. The MGE Galaxy 3500 UPS should be fitted with dust filter in the air inlet to filter dust, molds and spores with particles larger than 3 µm.
2. The UPS module dimensions: Height×Width×Depth

[Choose one, depending on UPS kVA and required backup time:]

G35T10KH1B2S	1500×353×854
G35T10KH2B2S	1500×353×854
G35T10KH1B4S	1500×523×854
G35T10KH2B4S	1500×523×854
G35T10KH3B4S	1500×523×854
G35T10KH4B4S	1500×523×854
G35T10KHS	1500×523×854
G35T15KH2B2S	1500×353×854
G35T15KH2B4S	1500×523×854
G35T15KH3B4S	1500×523×854
G35T15KH4B4S	1500×523×854
G35T15KHS	1500×523×854
G35T20KH2B2S	1500×353×854
G35T20KH2B4S	1500×523×854
G35T20KH3B4S	1500×523×854
G35T20KH4B4S	1500×523×854
G35T20KHS	1500×523×854
G35T30KH3B4S	1500×523×854
G35T30KH4B4S	1500×523×854
G35T30KHS	1500×523×854
G35T40KH4B4S	1500×523×854
G35T40KHS	1500×523×854

**2.4 SYSTEM CONTROLS AND INDICATORS**

A. **General:** A microprocessor controlled display unit shall be located on the front of the system. The display shall consist of an alphanumeric display with backlight, an alarm LED, and a keypad consisting of pushbutton switches.

1. **The following metered data, shall be available on the alphanumeric display:**

- a. Year, Month, Day, Hour, Minute, Second of occurring events
- b. Input AC Voltage
- c. Output AC voltage
- d. Output AC current
- e. Input Frequency
- f. Battery voltage
- g. Highest Internal Battery temperature

2. The display unit shall allow the user to display an event log of all active alarms and of the 64 most recent status and alarm events.

**The following minimum set of alarm conditions shall be available:**

- a. Static bypass switch on
- b. EPO Active
- c. Mechanical bypass activated
- d. External bypass switch (Q3) activated
- e. Battery discharged
- f. Return from low battery
- g. Low battery
- h. Load not powered from UPS
- i. UPS in bypass
- j. Runtime calibration aborted
- k. Runtime calibration started
- l. Runtime calibration complete
- m. Battery self test aborted
- n. Battery self test started
- o. Battery self test completed
- p. Number of battery modules decreased
- q. Number of battery modules increased
- r. Fan fault
- s. SBS fault
- t. System not in sync.
- u. Bypass not available, frequency/voltage out of range
- v. Mains voltage/frequency out of range
- w. Site wiring fault
- x. Low battery voltage shut down
- y. XR battery breaker or fuse open
- z. Defective battery detected
- aa. Runtime is below alarm threshold
- bb. Load is above alarm threshold
- cc. Battery over-voltage warning
- dd. Battery over-temperature warning
- ee. Emergency power supply fault
- ff. Output overloaded

3. **The following controls or programming functions shall be accomplished by use of the display unit. Pushbutton membrane switches shall facilitate these operations.**

- a. Silence audible Alarm
- b. Set the alphanumeric display language
- c. Display or set the date and time
- d. Enable or disable the automatic restart feature
- e. Transfer critical load to and from static bypass
- f. Test battery condition on demand
- g. Set intervals for automatic battery tests
- h. Adjust set points for different alarms
- i. Program the parameters for remote shutdown.

4. **The following shall make up the UPS front panel user interface.**

- a. Indicating LED's
  - 1) Load On When Green, this LED indicates the load is being supported by the UPS output
  - 2) On Battery When Yellow, this LED indicates the UPS is running from Battery power

- 3) Bypass When Yellow, this LED indicates the load is being supported by static bypass/mechanical bypass
- 4) Fault When Red, this LED indicates there is a fault condition present in the UPS.
- b. Push Button User Controls
  - 1) Up Arrow
  - 2) Down Arrow
  - 3) Help Key
  - 4) Escape Key
  - 5) Enter Key
- 5. **The following potential free contacts shall be available on an optional relay interface board:**
  - a. Potential Free (Dry) Contacts.
    - 1) Normal Operation
    - 2) Battery Operation
    - 3) Bypass Operation
    - 4) Common Fault
    - 5) Low Battery
    - 6) UPS Off
- 6. **For purposes of remote communications with the UPS the following shall be available and contained within the UPS on a removable, “hot swappable” “smart slot” interface card:**
  - a) RJ-45 Interface port for remote communications with a network via web browser or SNMP, or APC by Schneider InfraStruXure Manager..
  - b) Environmental monitoring feature, capable of locally monitoring temperature and humidity as well as two additional generic set of user determined dry contacts capable of taking an input signal from any APC or third party on/off signal, such as water detection, smoke detection, motion, or fire detection.

## 2.5 BATTERY

- A. The UPS battery shall be of modular construction made up of user replaceable, hot swappable, fused, battery modules. Each battery module shall be monitored to determine the highest battery unit temperature for use by the UPS battery diagnostic, and temperature compensated charger circuitry.
- B. The battery blocks housed within each removable battery module shall be of the Valve Regulated Lead Acid (VRLA) type.

## 2.6 ACCESSORIES

- A. **Extended runtime (XR) option**
  - 1. For purposes of extending the UPS battery runtime, external extended runtime options shall be available. The extended runtime option shall be housed in “line up and match” type enclosures and shall contain necessary hardware and cables to connect to the UPS, or between XR enclosures. Each XR enclosure shall be equipped with removable, hot swappable, battery units housed in draw-out cartridges.
  - 2. The extended runtime system shall have a 250 V DC rated, thermal magnetic trip molded case circuit breaker (MCCB). Each circuit breaker shall be equipped with shunt trip mechanisms and 1 NO/NC auxiliary contacts. The circuit breakers are to be equipped as part of a line-up-and-match type battery enclosure.
- B. **StruxureWare Data Center Expert:** A centralized infrastructure management platform hereafter referred to as Data Center Expert shall be available for purposes of complete system monitoring and management of all components outlined in this specification used as a single solution for small IT or part of the StruxureWare software stack providing data to systems such as Data Center Operation.
  - a. **Monitoring** - Data Center Expert shall be capable of monitoring a PDU through a network of Cat 5 cable and a switch supplied by the user. This switch shall relay information to Data Center Expert, which in turn shall allow access to this information via the user’s public network via a single IP address.

- b. **Monitored Values:** Data Center Expert shall be capable of monitoring alarms, general status parameters, voltage and current of the PDU.
- c. **Thresholds:** For individualized customer needs, Data Center Expert shall allow for user configurable thresholds for alarm notification. With this feature, Data Center Expert can notify clients of reaching thresholds for PDU capacity, or branch circuit breaker capacity. Other custom programmable alarm points for non- APC products shall also be available via dry contact input signal.
- d. **Public Network Monitoring:** Data Center Expert shall also be capable of monitoring other APC devices that are connected to the client's public network.

**C. Maintenance bypass panel (MBP)**

- 1. A MBP should be offered as a standard option either for single module or multi module configurations. The maintenance bypass panel shall provide power to the critical load bus from the bypass source, during times where maintenance or service of the UPS system is required. The MBP shall provide a mechanical means of complete isolation of the UPS system from the mains supply. The MBP shall be constructed in a free-standing or wall-mounted IP20 enclosure unless otherwise stated in this specification.
- 2. As a minimum, the MBP shall contain the following features and accessories:
- 3. Current limiting breakers of the appropriate size – limiting the short circuit level to max. Icc = 30 kA for the system.
- 4. Minimum 1 NO/NC auxiliary contact per unit in the parallel system for the purpose of relaying status information of the manual maintenance bypass switch to the UPS.
- 5. In the case of parallel operation sufficient APC CAN bus PCB's to provide adequate communications of the MBP status to the UPS system parallel control system.
- 6. CE marked according to at least EN/IEC60439.
- 7. The MBP shall be made to Form 3b
- 8. The MBP shall be made to IP2XC

**D. Parallel operation**

- 1. For purposes of paralleling UPS units in the event of increased capacity or redundancy, the UPS shall contain as a standard feature, the ability to parallel up to 4 modules. In this mode of operation the output voltage, output frequency, output phase angle, and output impedance of each module shall operate in uniformity to ensure correct load sharing. This control function shall not require any additional footprint and shall be an integral function of each UPS.
- 2. Multi-drop Bus Network: Communication between modules shall be connected in a multi-drop bus network comprising two parallel redundant busses so that the removal of any single cable shall not jeopardize the integrity of the parallel communication system.
- 3. Load Sharing: A load sharing circuit shall be incorporated into the parallel control circuits to ensure that under no load conditions, no circulating current exists between modules. This feature also allows each UPS to share equal amounts of the total critical load bus. Load sharing communications shall be galvanically isolated for purposes of fault tolerance between UPS modules. A UPS module's influence over load sharing shall be inhibited in any mode where the UPS inverter is not supporting its output bus.

**E. Software and connectivity**

- 1. The Ethernet Web/SNMP Adaptor shall allow one or more network management systems (NMS) to monitor and manage the UPS in TCP/IP network environments. The management information base (MIB) shall be provided in DOS and UNIX "tar" formats. The SNMP interface adaptor shall be connected to the UPS via the RS232 serial port on the standard communication interface board.
- 2. Unattended Shutdown
- 3. The UPS, in conjunction with a network interface card, shall be capable of gracefully shutting down one or more operating systems during when the UPS is on reserve mode.
- 4. The UPS shall also be capable of using an RS232 port to communicate by means of serial communications to gracefully shut down one or more operating systems during an on battery situation.

**F. Remote UPS monitoring:** The following three methods of remote UPS monitoring shall be available:

- 1. **Web Monitoring:** Remote monitoring shall be available via a web browser such as Internet Explorer.
- 2. **RS232 Monitoring:** Remote UPS monitoring shall be possible via either RS232 or contact closure signals from the UPS.

3. **Simple Network Management Protocol (SNMP):** Remote UPS Monitoring shall be possible through a standard MIB II compliant platform.
  
- G. **Software compatibility:** The UPS manufacturer shall have available software to support graceful shutdown and or remote monitoring for the following systems:
  1. Microsoft Windows 95/98/XP
  2. Microsoft Windows NT 4.0 SP6/2000
  3. OS/2
  4. Netware 3.2 – 5.1
  5. MAC OS 9.04, 9.22, 10
  6. Digital Unix/True 64
  7. SGI 6.0-6.5
  8. SCO UNIX
  9. SVR4 2.3, 2.41
  10. SCO Unix Ware 7.0 - 7.11
  11. SUN Solaris 2.6-2.8
  12. SUN OS 4.13, 4.14
  13. IBM AIX 4.3x-4.33g, 5.1
  14. HP-UX 9.x-11.i

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. **Verification of Conditions:** Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect/Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
  1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

### 3.2 INSTALLATION

- A. **General:** Preparation and installation shall be in accordance with reviewed product data, final shop drawings, manufacturer's written recommendations, and as indicated on the Drawings.
  
- B. **Factory-Assisted Start-Up:** If a factory-assisted UPS start-up is requested, factory-trained service personnel shall perform the following inspections, test procedures, and on-site training:
  1. **Visual Inspection:**
    - a. Inspect equipment for signs of damage.
    - b. Verify installation per manufacturer's instructions.
    - c. Inspect cabinets for foreign objects.
    - d. Inspect battery units.
    - e. Inspect power modules.
  2. **Mechanical Inspection:**
    - a. Check UPS and external MBC internal power wiring connections.
    - b. Check UPS and external MBC terminal screws, nuts, and/or spade lugs for tightness.
  3. **Electrical Inspection:**
    - a. Verify correct input and bypass voltage.
    - b. Verify correct phase rotation of mains connections.
    - c. Verify correct UPS control wiring and terminations.
    - d. Verify voltage of battery modules.
    - e. Verify neutral and ground conductors are properly landed.
    - f. Inspect external maintenance bypass switch for proper terminations and phasing.
  4. **Site Testing:**
    - a. Ensure proper system start-up.
    - b. Verify proper firmware control functions.
    - c. Verify proper firmware bypass operation.
    - d. Verify proper maintenance bypass switch operation.
    - e. Verify system set points.

- f. Verify proper inverter operation and regulation circuits.
  - g. Simulate utility power failure.
  - h. Verify proper charger operation.
  - i. Document, sign, and date test results.
5. **On-Site Operational Training:** During the factory-assisted start-up, operational training for site personnel shall include, but shall not be limited to, key pad operation, LED indicators, start-up and shutdown procedures, maintenance bypass and AC disconnect operation, and alarm information.
- a. Key pad operation
  - b. LED indicators
  - c. Start-up and shutdown procedures
  - d. Maintenance bypass
  - e. AC disconnect operation
  - f. Alarm information.

### 3.3 FIELD QUALITY CONTROL

- A. **General:** See [Section 01 45 23 - INSPECTING AND TESTING SERVICES] [Section 01410 - INSPECTING AND TESTING SERVICES].
- B. **Manufacturer Field Service:**
- 1. **Worldwide Service:** The UPS manufacturer shall have a worldwide service organization available, consisting of factory-trained field service personnel to perform start-up, preventative maintenance, and service of the UPS system and power equipment. The service organization shall offer 24 hours a day, 7 days a week, 365 days a year service support.
  - 2. **Replacement Parts:** Parts shall be available through the worldwide service organization 24 hours a day, 7 days a week, 365 days a year. The worldwide service organization shall be capable of shipping parts within four working hours or on the next available flight, so that the parts may be delivered to the Owner within 24 hours.
- C. **Maintenance contracts:**
- 1. A complete offering of preventative and full service maintenance contracts for the UPS system and the battery system shall be available. All contract work shall be performed by APC factory trained service personnel.

### 3.4 DEMONSTRATION

- A. **General:** Provide the services of a factory-authorized service representative of the manufacturer to provide start-up service and to demonstrate and train the Owner's personnel.
- 1. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
  - 2. Train the Owner's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventive maintenance.
  - 3. Review data in operation and maintenance manuals with the Owner's personnel.
  - 4. Schedule training with the Owner, through the Architect/Engineer, with at least seven day's advanced notice.
- B. **UPS Training Workshop:** A UPS training workshop shall be available from the UPS manufacturer. The training workshop shall include, but shall not be limited to, a combination of lecture and practical instruction with hands-on laboratory sessions. The training workshop shall include, but shall not be limited to, instruction about safety procedures, UPS operational theory, sub-assembly identification and operation, system controls, adjustments, preventative maintenance, and troubleshooting.

### 3.5 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the solid state UPS shall be without damage at time of Substantial Completion.

**END OF SECTION**

## CHECKLIST FOR GUIDE SPECIFICATION

<b>Type of UPS</b>						
Total rated power (kVA) at PF 0.8			kVA			kW
Manufacturer						
Range of products						
Operating mode (IEC 62040-3)		double conversion VFI	yes		no	
Continuous operation at 40 °C		Without power derating	yes		no	
<b>Rectifier</b>						
Input voltage range		304 V to 477 V @ 100% load	yes		no	
		200V to 477V @ 50% load	yes		no	
Input frequency range		50Hz or 60Hz (tolerance 40Hz to 70Hz)	yes		no	
Sinusoidal input current		THDI upstream ≤ 5% with PFC rectifier	yes		no	
Input power factor		PF > 0.98 with IGBT rectifier (from 50% load)	yes		no	
<b>Battery</b>						
Type	modular	Modular, hot-swappable batteries	yes		no	
		Standard – 3-5years	yes		no	
		Long life – 10-12years	yes		no	
		Sealed lead acid	yes		no	
	Integration	Integrated in UPS cabinet	yes		no	
Backup time		minutes	yes		no	
Integrated battery in UPS cabinet		Up to 40 kVA	yes		no	
<b>Battery management and protection</b>						
Recharge as a function of the temperature			yes		no	
Measurement of actual backup time, depending on load, temperature, age			yes		no	
Cold start on battery power			yes		no	
Protection against deep discharge			yes		no	
Measurement of real backup time			yes		no	
Prediction on end of battery life			yes		no	
<b>Inverter</b>						
Three-phase output voltage		Volts	yes		no	
Voltage regulation		± 1%	yes		no	
Power Factor		0.5 lagging to 0.5 leading	yes		no	
Output voltage distortion at Pn		THDU < 1,5% (linear load) THDU < 3.5% (computer load, IEC 62040-3)	yes		no	
Output frequency		Hz	yes		no	
Voltage transients (load step changes)		+/-5% on 0% to 100% or 100% to 0% load step changes. Recovery < 100ms	yes		no	
Overload capacity		110% In continuous	yes		no	
		125% In for 10 minutes	yes		no	
		150% In for 1 minute	yes		no	
Crest factor		up to 2.7:1	yes		no	
<b>Bypass functions</b>						
Automatic bypass		With static switch	yes		no	
Short-circuit withstand of static switch		8 In (500ms)	yes		no	
Built-in manual bypass		Mechanical (for maintenance)	yes		no	

<b>Efficiency</b>							
Normal mode (double-conversion)		>94.4% (for load >50%)	yes		no		
		up to 95,8% at 100% load	yes		no		
<b>Safety</b>							
EPO terminal block			yes		no		
Built-in full backfeed protection		Complete offer with contactors	yes		no		
<b>User interface</b>							
Alphanumerical display		selection of operating language	yes		no		
	personalisation menu	with password	yes		no		
	display	measurements, status, events	yes		no		
	event log		yes		no		
	status LEDs		yes		no		
	help key	For context-sensitive help	yes		no		
<b>Communication</b>							
Built-in Ethernet card with SNMP			yes		no		
	Supervision software		yes		no		
	Administration software	with shutdown management	yes		no		
Relay I/O card			yes		no		
<b>Certification</b>							
Certified standards and tests		See list above	yes		no		
Performance certification		TÜV	yes		no		
Quality certification		ISO 9001 / 9002	yes		no		
Eco-design and manufacturing		ISO 14001 site	yes		no		
<b>Services</b>							
Technical competency of supplier		level 4 NFX 060-010	yes		no		
Diagnostics and monitoring		remote	yes		no		
Technical support		international	yes		no		
<b>Operation, Maintainability</b>							
Power module can be extracted from front		'Modular' power module - reduced MTTR	yes		no		
Access to communication through front			yes		no		
Access to batteries through front			yes		no		
<b>Environment</b>							
Noise		<51,3 dBA at 100% load (10-20kVA) <55 dBA at 100% load (30-40kVA)	yes		no		
Degree of Protection		IP51	yes		no		
Built-in dust filter			yes		no		
<b>Availability</b>							
Availability of original replacement parts		around the world	yes		no		
Response time of Service teams			t < 4h	4<t< 8	8<t< 24	t>24 h	
Maintenance programmes		Preventive	yes		no		
		predictive	yes		no		
Renovation / substitution programmes			yes		no		