

APC by Schneider Electric

MGE GALAXY 3500

Uninterruptible Power Supply

Guide Specifications

15 kVA to 40 kVA

3×400 in / 1x 230V out 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

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. Installation guide
 - 7. 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:** The UPS shall be provided with an internal manual bypass to simplify the installation and shall be used for supplying the load directly from the mains supply, while the UPS is taken out for maintenance.
 - 6. **External maintenance bypass transformer [optional]:** The external maintenance bypass transformer shall be used for supplying the load directly from the mains supply (3 phase), if the UPS is to be replaced or the load balance on the bypass input to the UPS is required. The bypass transformer must be housed in a stand alone matching cabinet.
- 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 3 and 4-wire + earth configurations.

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 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.
 - 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. **AC Input Voltage Window:** -20% of nominal with without charging
 - 3. **AC Input Voltage Window:** -50% of nominal at 50% load
 - 4. **Earthing Principle:** [TN-S] [TN-C-S] [TN-C] [TT] or [IT].
 - 5. **Input Frequency:** 40-70 Hz (auto sensing)
 - 6. **Input Power Factor:** 0.98 at load > 50%

7. **Magnetizing Inrush Current:** NONE
8. **Input Current Distortion with no additional Filters:** < 5% THDI at 100% load
9. **Power Walk-in/Soft-Start:** Shall be linear from 0 to 100% of the load over a 10-second period

C. **System Output**

1. **Nominal Output Voltage Rating:** 1×230 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% THD 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.
8. **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.
9. **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.
10. **Short Circuit Withstand:** The UPS must withstand a bolted-fault short circuit on the output without damage to the UPS module.
11. **System AC-to-AC efficiency 100% load**
 - a. 15 kVA 95.2%
 - b. 20 kVA 95.0%
 - c. 30 kVA 95.3%
 - d. 40 kVA 94.9%
12. **System AC-to-AC efficiency 50% load**
 - a. 15 kVA 95.0%
 - b. 20 kVA 95.4%
 - c. 30 kVA 95.5%
 - d. 40 kVA 95.6%
13. **Acoustical noise at full load:** dB(A) of noise, typically, measured at 1 meter from the operator surface:
 - a. 15 kVA 51
 - b. 20 kVA 51
 - c. 30 kVA 55
 - d. 40 kVA 55

2.4 COMPONENT DESCRIPTION

A. **Rectifier**

1. Each UPS power module shall include an active power factor corrected, Insulated Gated Bipolar Transistor (IGBT) rectifier.
2. The input current limiter must be design to support 100% load, charge batteries at 10% of the UPS output rating, and provide regulation with mains deviation of up/down to+/-15% of the nominal input voltage. During an overload condition the input current must be limited to maximum 125% of the nominal output current.
3. DC buss voltage shall be ±192 V DC nominal.

4. The battery charging shall keep the DC bus float voltage of +/- 219 V, +/-1%
5. 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 20°C. Temperature compensation rate shall be 320 mV/°C for ambient temperatures > 20°C and 0 mV/°C for ambient temperatures < 20°C.
6. DC ripple voltage shall be less than ±1% of nominal with no battery connected.
7. 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.
8. 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.
9. Reflected input current Total Harmonic Distortion (THD) shall not exceed 5% at 100% load.
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 VDC.
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 1×230 V and adjustable for 1×220 V or 1×240 V, 50 Hz, L1,N,PE.
5. **Efficiency of each module at full load:** Not less than
 - a. 15 kVA 94.9%
 - b. 20 Kva 94.7%
 - c. 30 kVA 94.9%
 - d. 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 1 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 m.
2. The UPS module dimensions: Height×Width×Depth
[Choose one, depending on UPS kVA and required backup time:]

G35T15K3I2B2S	1500×353×854
G35T15K3I2B4S	1500×523×854
G35T15K3I3B4S	1500×523×854
G35T15K3I4B4S	1500×523×854
G35T15K3IS	1500×523×854
G35T20K3I2B2S	1500×353×854
G35T20K3I2B4S	1500×523×854
G35T20K3I3B4S	1500×523×854
G35T20K3I4B4S	1500×523×854
G35T20K3IS	1500×523×854
G35T30K3I3B4S	1500×523×854
G35T30K3I4B4S	1500×523×854
G35T30K3IS	1500×523×854
G35TT40K3I4B4S	1500×523×854
G35T40K3IS	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.
 - j. Cyclic charging
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

- 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.
 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