

APC Smart-UPS RT

GUIDE SPECIFICATIONS FOR 5kVA and 6kVA Smart-UPS RT 100/120/200/208/240VAC Uninterruptible Power Supply

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification describes the operation and functionality of a continuous duty, split-phase, solid-state, static Uninterruptible Power System (UPS) hereafter referred to as the UPS.
- B. Configuration Specifics:
 - 1. The UPS shall be available in the following configurations:

MODEL	SKU #
UPS	
APC Smart-UPS RT 5,000VA RM 120 / 208V	SURTD5000RMXLP3U
APC Smart-UPS RT 6,000VA RM 120 / 208V	SURTD6000RMXLP3U
APC Smart-UPS RT 6,000VA RM 100 / 200V	SURTD6000RMXLJP3U
BATTERY PACK	
APC Smart-UPS RT192V RM Battery Pack	SURT192RMXLBP3U
APC Smart-UPS RT 192V Battery Pack	SURT192XLBP
APC Smart-UPS RT 192V Battery Pack for Japan	SURT192XLBPJ

- C. The UPS shall utilize double conversion online topology designed to protect electronic equipment by supplying reliable, network-grade power with extremely tight voltage and frequency regulation. The UPS shall feature an internal bypass and input power factor correction.
- D. The primary sections of the UPS are: input disconnect and filter stage, input PFC power stage (converters), energy storage stage (DC bus capacitor bank), output power stage (inverters), bypass and a battery charger.
- E. The system shall also include user field-replaceable battery modules, battery disconnects, Emergency Power Off (EPO) facility, and an integrated UPS Network Interface Card (NIC), with temperature monitoring.
- F. In addition, this specification describes the performance, functionality, and design of a UPS Service Bypass Panel, hereafter referred to as the SBP, the external Battery Systems, and connectivity solutions.

CSI SECTION 16611 STATIC UNINTERRUPTIBLE SYSTEM

- G. The UPS and associated equipment shall operate in conjunction with a primary power supply and an output distribution system to provide quality uninterrupted power for mission critical, electronic equipment load.
- H. All programming and miscellaneous components for a fully operational system as described in this specification shall be available as part of the UPS.

1.2 STANDARDS

- A. UL 1778 Uninterruptible Power Supply Equipment
- B. CSA
- C. VCCI (Japan model only)
- D. FCC Part 15 Class A
- E. ISO 9001
- F. ISO 14001

1.3 MODES OF OPERATION

- A. Online: The input Power Factor Correction (PFC) power stage (converters) and the output power stage (inverters) shall operate in an on-line manner to continuously regulate power to the critical load. The input PFC stage shall be capable of full battery recharge while simultaneously providing regulated power to the load for all line and load conditions within the range of the UPS specifications.
- B. On Battery: Upon failure of the AC input source, the critical load shall continue being supplied by the output power stage (inverters), which shall derive their power from the battery system. There shall be no interruption in power to the critical load during both transfers to battery operation and retransfers from battery to online operation.
- C. Bypass: The bypass mode shall be used to provide transfer of critical load from the inverter outputs to the primary power source. This transfer, along with its retransfer, shall take place in a time less than or equal to 4ms. In the event of an emergency, this transfer shall be an automatic function.
- D. External Service Bypass Panel (SBP): The maintenance service bypass panel shall provide power to the critical load from the bypass power source during times where maintenance or service of the UPS is required or the removal of the UPS is desired. The SBP shall provide a mechanical means of complete isolation of the UPS from the electrical wiring of the installation. The SBP shall be constructed in a free-standing, rack mounted or wall-mounted NEMA 1 enclosure, unless otherwise stated in this specification. It shall be designed for single phase input with a “no break” transfer between bypass and UPS power. The UPS shall have the option of a hardwire Input / Output kit to facilitate External Service Bypass connections.

CSI SECTION 16611 STATIC UNINTERRUPTIBLE SYSTEM

1.4 SUBMITTALS

A. Proposal Submittals:

1. As bid system bill of materials.
2. Product catalog sheets or equipment brochures.
3. Product guide specifications.
4. System single-line operation diagram.
5. Installation information, including weights and dimensions.
6. Information about terminal locations for power and control connections.

B. Delivery Submittals:

1. Installation manual, which includes instructions for storage, handling, examination, preparation, installation, and start-up of UPS.
2. User manual, which includes operating instructions.

PART 2 - PRODUCT

2.1 MECHANICAL DESIGN

- A. The UPS shall be contained in a rugged steel cabinet with a plastic front bezel.
- B. The UPS dimensions shall be 5.1 x 17 x 26 in. (HxWxD).
- C. The UPS cabinet shall be configurable between Tower and Rack-Mount configurations.

2.2 SYSTEM CHARACTERISTICS

A. System Capacity via the standard NEMA L14-30P input connector:

1. The 5000VA (120V / 208V) system shall be rated as follows:
 - a. 4,350VA or 3,500W, line – line, whichever limit is reached first.
 - b. 2,500VA or 2,000W, per phase, whichever limit is reached first.

CSI SECTION 16611 STATIC UNINTERRUPTIBLE SYSTEM

2. The 6000VA (120V / 208V) system shall be rated as follows:
 - a. 5,000VA or 3,675W, line – line, whichever limit is reached first.
 - b. 2,880VA or 2,100W, per phase, whichever limit is reached first.
 3. The 6000VA (100V / 200V) system shall be rated as follows:
 - a. 4,800VA or 4,200W, line – line, whichever limit is reached first.
 - b. 2,400VA or 2,100W, per phase, whichever limit is reached first.
- B. System Capacity via optional hardwire input connection kit SURT018:
1. The 5000VA system shall be rated as follows:
 - a. 4,350VA or 3,500W, line – line, whichever limit is reached first.
 - b. 2,500VA or 2,000W, per phase, whichever limit is reached first.
 2. The 6000VA (120V / 208V) system shall be rated as follows:
 - a. 5,200VA or 3,675W, line – line, whichever limit is reached first.
 - b. 3,000VA or 2,100W, per phase, whichever limit is reached first.
 3. The 6000VA (100V / 200V) system shall be rated as follows:
 - a. 6,000VA or 4,200W, line – line, whichever limit is reached first.
 - b. 3,000VA or 2,100W, per phase, whichever limit is reached first.
- C. Input:
1. AC input nominal voltage:
 - a. 200VAC or 208VAC or 240VAC, split phase, 4-wire (2PH+N+G).
 2. AC input voltage window:
 - a. Full Load, 85 - 138 (Line to Neutral) VAC, per phase.
 - b. Half Load, 50 - 138 (Line to Neutral) VAC, per phase.
 3. Input frequency range: 45-65Hz.
 4. Input Power Factor; > 0.95 at 100% load.
 5. Input Current Distortion:
 - a. < 10% at 100% load. (SURTD5000RMXLP3U & SURTD6000RMXLP3U)
 - b. <4.5% at 100% load. (SURTD6000RMXLJP3U)

CSI SECTION 16611 STATIC UNINTERRUPTIBLE SYSTEM

D. UPS Output:

1. AC Output Nominal Output: (Customer configurable), 100V (200V) or 120V (208V/240V), 4 wire (2Phase + N + G), 50 / 60 Hz.
2. AC output voltage distortion: < 2% @ 100% linear load; < 5% @ 100% non-linear Load (SURTD5000RMXLP3U & SURTD6000RMXLP3U) and < 7% @ 100% non-linear Load (SURTD6000RMXLJP3U)
3. AC output voltage regulation (Static): +/-1%.
4. AC output voltage regulation (Dynamic): +/-5%, for 10 to 90% load step.
5. Voltage Transient Recovery within < 50ms recovery time, 10 to 90% load step.
6. Overload Rating:
 - a. Online: 104% - infinite; 125% - 1 minute; 150% - 30 seconds.
 - b. In bypass: Overload shall be limited by the external input circuit breakers feeding the UPS.
7. Crest factor: 3:1.
8. System AC-AC Efficiency: 89% at 100% load (SURTD5000RMXLP3U & SURTD6000RMXLP3U) & 86% at 100% load (SURTD6000RMXLJP3U)
9. System DC-AC Efficiency: 90% at 100% load (SURTD5000RMXLP3U & SURTD6000RMXLP3U) & 88% at 100% load (SURTD6000RMXLJP3U)
10. Output Power Factor Rating: 0.5 Lagging to 0.5 Leading.
11. Output frequency: 50/60 +/- 3Hz (Tracking) or 50/60 +/- 0.1Hz (Free running) or 50/60 +/- 1Hz (Free running) - user selectable.
12. Output connectors: (1) L6-30R, (1) L14-30R & (4) 5-20R.
13. Output frequency Slew rate: 0.1Hz/sec.

2.3 ENVIRONMENTAL

1. Storage Ambient Temperature:
 - a. +14°F to +113° F (-10°C to +45°C) charge the UPS battery every 6 months.
 - b. +86°F to +158° F (+30°C to +70°C) charge the UPS battery every 3 months.
2. Operating Ambient Temperature: +32°F to +104°F (0°C to +40°C). (+77°F / +25°C is ideal for most battery types).
3. Relative Humidity: 0 to 95% non-condensing.

CSI SECTION 16611 STATIC UNINTERRUPTIBLE SYSTEM

4. Storage altitude: 50,000 feet (15,240m) above sea level
5. Operating altitude: 10,000 feet (3,000m) above sea level. At an altitude of 10,000 feet the UPS shall be capable of supporting a load of up to 90% of its nominal capacity.
6. Audible noise: <55dBA, 100 % load at 1m

2.4 INPUT PFC POWER STAGE

- A. The input PFC power stage (converters) of the UPS shall constantly rectify the power imported from the mains input of the system, converting the input mains AC power to DC power for precise regulation of the DC bus voltage, battery charging, and output power stage (inverters) regulated output power.
- B. Input Current Total Harmonic Distortion: The input current THD_I shall be held to 8.5% or less at full system load, while providing conditioned power to the critical load bus, and charging the batteries under steady-state operating conditions. This shall be true while supporting loads of both a linear or non-linear type. This shall be accomplished with no additional filters, magnetic devices, or other components.
- C. Input Current Limit:
 1. The input PFC converters shall control and limit the input current draw from utility to 150% of the UPS output. During conditions where input current limit is active, the UPS shall be able to support 100% load, charge batteries at 10% of the UPS output rating, and provide voltage regulation with mains deviation of up to +/-20% of the nominal input voltage.
 2. In cases where the source voltage to the UPS is nominal and the applied UPS load is equal to or less than 100% of UPS capacity, input current shall not exceed 130% of UPS output current, while providing full battery recharge power and importing necessary power for system losses.
- D. Charging:
 1. The battery charging shall maintain the DC bus float voltage of 218.4V, +/-1% at the nominal temperature of 25°C (77°F)
 2. The battery charging circuit shall contain a temperature monitoring circuit, which will regulate the battery float voltage to optimize battery life.
 3. The battery charging circuit shall remain active when in automatic Bypass and in Normal Operation.
 4. The battery charger shall have a charge capacity of 350W.

2.5 OUTPUT POWER STAGE (INVERTERS)

- A. The UPS output power stage (inverters) shall constantly recreate the UPS output voltage waveforms by converting the DC bus voltage to AC voltage through a set of IGBT switches. In both online operation and battery operation, the output power stage (inverters) shall create output voltage waveforms independent of the mains input voltage waveforms. Input voltage anomalies such as brown-outs, spikes, surges, sags, and outages shall not affect the amplitude or sinusoidal nature of the recreated output voltage sine waves of the output power stage (inverters).
- B. Overload Capability: The output power stage (inverters) shall be capable of withstanding 150% overload for 30 seconds or 125% overload for 1 minute or 104% load for an indefinite length of time. The system shall transfer to bypass if the overload persist and then return back on-line when the overload is removed.
- C. Battery Protection: The UPS shall have monitoring and control circuits to limit the level of discharge on the battery system.

2.6 AUTOMATIC BYPASS

- A. As part of the UPS, system automatic bypass relays shall be provided. The system automatic bypass shall provide a transfer of the critical load from the Inverter outputs to the automatic bypass input sources during times when the inverters cannot support the load. Such times may be due to prolonged or severe overloads, or UPS failure. The UPS shall constantly monitor the output currents, as well as the bypass source voltages, and inhibit potentially unsuccessful transfers to automatic bypass from taking place.
- B. The design of the automatic bypass switch power path shall consist of two electromechanical relays.
- C. Automatic Transfers: An automatic transfer of load to bypass shall take place whenever the load on the critical bus exceeds the overload rating of the UPS. Automatic transfers of the critical load from bypass back to normal operation takes place when the overload condition is removed from the critical bus output of the system. Automatic transfers of load to bypass shall also take place if for any reason the UPS cannot support the critical bus.
- D. Manual Load Transfers: Manually initiated transfers to and from bypass may be initiated through the UPS computer interfaces (serial or network communications) or by engaging the bypass switch on the rear panel of the unit.

2.7 DISPLAY AND CONTROLS

- A. Control Logic: The UPS shall be controlled by an embedded DSP which performs the following functions:
 - 1. Monitoring quality of input, bypass and output voltages;

CSI SECTION 16611 STATIC UNINTERRUPTIBLE SYSTEM

2. Monitoring vital parameters of the UPS;
 3. Executing the state machine;
 4. Intelligent battery management;
 5. Controlling the input and output power stage;
 6. Remaining runtime calculation;
 7. Self-diagnostics, self-test and proactive fault detection;
 8. Communication to the host server via serial port;
 9. Communication to the Network Interface Card or another SmartSlot accessory card if equipped.
- B. Display/Control Unit: A display/control comprising of 16 LED and 2 pushbutton switches shall be located at the front of the UPS. The display/control panel shall be capable of being turned 90 degrees clockwise or counterclockwise to accommodate the orientation of the UPS, in either a tower or rack-mounted configuration.
- C. Display/Control Unit pushbutton: The following controls functions shall be actionable by the use of the pushbutton switches located at the Display/Control Unit:
1. Turn the UPS on;
 2. Turn the UPS off;
 3. Initiate self-test in order to test battery condition;
 4. Silence audible alarm;
 5. Cold start.
 6. Displaying input RMS voltage on the battery capacity LED bar graph.
- D. Manual Bypass switch: A switch shall be provided on the rear of the UPS such that when it is engaged it forces the UPS into the bypass state, provided the input voltage and frequency are within acceptable limits.
- E. EPO terminal: The UPS is equipped with Emergency Power Off (EPO) terminal which can be wired so as to provide means to instantaneously de-energize the UPS and its load from a remote location in case of emergency.
- F. Data displayed on the Display/Control Unit: The following indicators shall be available on the Display/Control Unit via LED indicators:
1. The UPS load LED bar;

2. The UPS is online;
 3. The UPS is on battery;
 4. The UPS is in bypass;
 5. The UPS is overloaded;
 6. The UPS is in fault state;
 7. The battery needs to be replaced;
 8. The battery capacity/utility voltage LED bar
- G. Audible Alarms: Using audio signal, the UPS will notify the user about important events. The following is the list of distinct audio alarms:
1. The UPS is online.
 2. The UPS is on battery.
 3. The UPS is in bypass.
 4. The UPS has an internal fault.
 5. The UPS is overloaded.
 6. The UPS battery is disconnected or must be replaced;
- H. Communication Interface: Communication interfaces shall be provided as follows:
1. RJ-45 Serial Port connector, for interfacing with terminal emulation software.
 2. RJ-45 Ethernet connection, on installed Network Management Card.
- 2.8 BATTERY
- A. The UPS battery system shall comprise of user replaceable, hot swappable, battery modules.
 - B. The battery blocks housed within each removable battery module shall be of the Valve Regulated Lead Acid (VRLA) type, with a design life of 3 – 5 years.
 - C. The UPS shall incorporate an Intelligent Battery Management system to continuously monitor the health of the battery system and notify the user if that system is weak or needs replacing.

- D. It shall be possible to add additional battery modules to increase runtime. These modules shall be hot-pluggable, allowing for easy and quick installation or replacement without the need for electrical wiring, electrician services or powering down of the UPS. The maximum number of external battery packs, SURT192RMXLBP3U or SURT192XLBP or SURT192XLBPJ, that may be connected to the UPS shall be limited to 10.
- E. Each UPS Battery Module shall have a means of DC disconnect for transportation and to disconnect the battery module completely from the internal bus while installed in the UPS system.
- F. Charging:
 - 1. The intelligent battery management system shall contain a temperature monitoring circuit and compensation algorithm that regulates the battery charging voltage so as to optimize battery life.
 - 2. The battery charging circuit shall remain active when in bypass or on-line modes of operation.
- G. The UPS shall be shipped with battery modules preinstalled but disconnected.

PART 3 - ACCESSORIES

3.1 SERVICE BYPASS PANEL (SBP)

- A. The service bypass panel shall provide power to the critical load from the bypass source, during times where maintenance or service of the UPS is required. The SBP shall provide a mechanical means of complete isolation of the UPS from the electrical wiring of the installation. The SBP shall be constructed in a free-standing, rack mounted or wall-mounted enclosure unless otherwise stated in this specification.

3.2 SOFTWARE AND CONNECTIVITY

- A. Network Adaptor: An APC Network Interface Card (NIC) AP9619 shall be fitted in a SmartSlot to allow one or more network management systems (NMS) to monitor and manage the UPS in TCP/IP network environments.
- B. Unattended Shutdown
 - 1. The UPS, in conjunction with a NIC, shall be capable of gracefully shutting down one or more operating systems when the UPS is operating in the battery mode. APC PowerChute Network Shutdown (PCNS) software shall be available with the UPS.

3.3 REMOTE UPS MONITORING, CONFIGURATION AND CONTROL

- A. The following three methods of remote UPS control, configuration and monitoring shall be made available:
1. Web Monitoring: Remote monitoring shall be available via a web browser such as Internet Explorer.
 2. Monitoring via serial port: Local UPS monitoring shall be possible via the serial port using Terminal mode session.
 3. Simple Network Management Protocol (SNMP): Remote UPS Monitoring shall be possible through a standard MIB II compliant platform.

3.4 SOFTWARE COMPATIBILITY

- A. The UPS manufacturer shall have available software to support graceful shutdown and remote monitoring for the systems detailed on the following web link:

[Operating System and Processor Compatibility Chart](#)

PART 4 - EXECUTION

4.1 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:

- A. Visual Inspection:
1. Inspect equipment for signs of damage.
 2. Verify installation per manufacturer s instructions.
 3. Inspect battery modules.
- B. Mechanical Inspection
1. Check all UPS and external service bypass panel internal power wiring connections.
 2. Check all UPS and external service bypass panel terminal screws, nuts, and/or spade lugs for tightness.

CSI SECTION 16611 STATIC UNINTERRUPTIBLE SYSTEM

C. Electrical Inspection:

1. Verify correct input and bypass voltages.
2. Verify correct UPS control wiring and terminations.
3. Verify voltage of all battery modules.
4. Verify phase, neutral and ground conductors are correctly landed.
5. Inspect external service bypass panel for correct terminations.

D. Site Testing:

1. Ensure correct system start-up.
2. Verify correct control functions.
3. Verify correct bypass operation.
4. Verify correct manual bypass switch operation.
5. Verify system set points.
6. Verify correct inverter operation and regulation circuits.
7. Simulate utility power failure.
8. Verify correct charger operation.
9. Document, sign, and date all test results.

E. On-Site Operational Training: During the factory assisted start-up, operational training for site personnel shall include key pad operation, LED indicators, start-up and shutdown procedures, maintenance bypass and AC disconnect operation, and alarm information.

4.2 MANUFACTURER FIELD SERVICE

- A. 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.
- B. 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

CSI SECTION 16611 STATIC UNINTERRUPTIBLE SYSTEM

shall be capable of shipping parts within 4 working hours or on the next available flight, so that the parts may be shipped to the customer site within 24 hours.

4.3 MAINTENANCE CONTRACTS

- A. A complete offering of preventative and full service maintenance contracts for the UPS system and the battery system shall be available from APC. All contract work shall be performed by APC factory trained service personnel.

4.4 TRAINING

- A. UPS service training workshop: A UPS service training workshop shall be available from APC. The service training workshop shall include a combination of lecture and practical instruction with hands-on laboratory sessions. The service training workshop shall include instruction about safety procedures, UPS operational theory, sub-assembly identification and operation, system controls and adjustment, preventative maintenance, and troubleshooting.

End of Section 16611