

TOSHIBA International Corp

**GUIDE SPECIFICATION
SINGLE PHASE UNINTERRUPTIBLE POWER SYSTEM**

TOSHIBA 1600XP
3.6-22 kVA - Internal Battery

UPS GUIDE SPECIFICATIONS – Single Phase, 3.6-22 kVA

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1.0 SCOPE

1.1 System

This specification describes a continuous duty, single-phase, on-line, solid-state uninterruptible power supply system, hereafter referred to as the UPS.

2.0 SYSTEM DESCRIPTION

2.1 Applicable Standards:

The UPS shall be designed in accordance with and be compliant with the following sections of the current revisions of the following standards:

- ANSI C62.41 (IEEE 587) – Standard for Surge Withstand ability
- UL 1778 (CUL)
- National Electrical Code (NFPA-70)
- NEMA PE-1
- OSHA
- ASME
- ISO 9001, 14001

2.2 Components:

The UPS shall consist of the following components:

- A. Converter
- B. Chopper / Charger
- C. Pulse-Width Modulated (PWM) Inverter
- D. Static Switch Bypass
- E. Microprocessor Controlled Logic and Touchpad Control Panel
- F. Input Circuit Breaker
- G. Battery System
- H. Output Isolation Transformer

2.3 System Operation:

The UPS shall operate as an on-line, fully automatic system in the following modes:

A. NORMAL - Incoming AC power is boosted using a chopper circuit, and converted into DC power. The DC power is then used to charge the battery bank while at the same time providing clean, DC power to the inverter circuitry. The inverter converts DC power to regulated AC power which feeds the load.

B. EMERGENCY - Upon failure of commercial AC power, the UPS shall derive power from the battery bank and continue feeding the load with clean, regulated AC power. There is no interruption to the critical load upon failure or restoration of commercial AC power.

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C. RECHARGE - Upon restoration of the commercial AC source, the rectifier/chopper powers the inverter while simultaneously recharging the battery bank. The UPS shall have the following recharge process:

- a) A constant level of current is used to recharge the batteries (the process shall utilize a current-limit function to prevent overcharging batteries, thus extending the life of the batteries)
- b) As the batteries reach the normal charge level, a constant-voltage control shall begin which causes the battery recharge current to gradually decrease
- c) Under normal operation, the UPS battery bank "floats" at the 2.25-2.27 volts per cell DC level to stay fully charged and ready for the next discharge.

D. BYPASS MODE - Upon detection of an internal fault or output overload, the UPS shall automatically switch from inverter power to an internal bypass via the static switch. Transfer shall be within 4 milliseconds, causing no interruption to the critical load. While in bypass, the UPS shall protect against spikes and common/normal mode noise by utilizing line filters and an output isolation transformer. "Return from Bypass mode" shall be an automatic function, without interruption to the critical load. Transfer to Bypass may also be performed as a manual operation via the UPS front panel.

E. POWER CONDITIONING MODE - Should the batteries be removed from the UPS, the UPS shall continue to function and still provide protection against spikes, common/normal mode noise, load steps and frequency shifts (without battery back-up capability).

3.0 SYSTEM PARAMETERS

A. UPS Input:

Input Voltage	: 208/240VAC Single Phase
Input Voltage Requirement	: 2 Wire + Ground
Voltage Variation	: +10% to -30% *
Rated Frequency	: 50/60 Hz
Frequency Range	: 45 - 65 Hz
Power Factor	: > 0.95 lagging
Input Capacity	: 110% of UPS Output Capacity
Input Current Limit	: 125% of nominal capacity
Input Current THD	: < 5% Total Harmonic Distortion (THD)

* For continuous operation at -30%, derate the maximum operating temperature to 90 °F (32 °C.)

B. UPS Output

Rated Voltage	: 120/208/240 VAC Single Phase
Output Voltage Requirements	: 1 Phase, 2 Wire + Ground
Output Capacity	: <u>kVA</u> <u>kW</u>
	3.6 kVA 3.1 <u>kW</u>

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	6 kVA	5.1 kW
	8 kVA	6.8 kW
	10 kVA	8.5 kW
	14 kVA	11.9 kW
	18 kVA	15.3 kW
	22 kVA	18.7 kW
Rated Load Power Factor	: 0.85 lagging	
Efficiency	: >83% (AC/AC)	
Voltage Regulation	: +/- 3% nominal (balanced load)	
Rated Frequency	: 50/60 Hz (Autoselectable, selectable)	
Frequency Regulation	: +/- 0.5, 1.0, or 1.5 Hz	
Frequency Synch. Range	: +/- 1.0 Hz	
Voltage Transients	: +/- 8% (100% step load change)	
Transient Voltage Recovery	: +/- 3% (loss or return of input power)	
Overload Cap. (on inverter)	: 50ms maximum to within 2% of nominal	
	: 125% for 30 sec.,	
	: 150% for 10 sec.	
	: 1000% for 1 cycle	
Crest Factor	: 3.0	
Harmonic Voltage Distortion	: 3% THD @ 100% linear load	
	: 6% THD @ 100% Non-linear	

C. Batteries

1) Internal Battery Type: Sealed, Valve Regulated Lead Acid cells

2) Protection Time:

Internal Battery Backup shall provide the listed backup time at the following loads for each UPS:

UPS Capacity	Run-time at Full Load	
	0.7 PF	.085 PF
3.6 kVA	7 min.	7 min.
6 kVA	7 min.	7 min.
8 kVA	7 min.	7 min.
10 kVA	7 min.	5 min.
14 kVA	7 min.	7 min.
18 kVA	7 min.	5 min.
22 kVA	5 min.	3 min.

3) DC Voltage Range:

UPS Capacity	3.6 kVA	6 kVA	8 -22 kVA
Nominal DC Bus Voltage	144 VDC	216 VDC	288 VDC
Voltage Range	113-164 VDC	170-245.7 VDC	227-327 VDC
Cutoff Voltage (1.6V per cell)	115 VDC	172 VDC	230 VDC

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D. Environmental

Heat Generation:	: <u>UNIT</u>	<u>BTU/hr.</u>
	3.6kVA	1843
	6 kVA	3071
	8 kVA	4095
	10 kVA	5118
	14 kVA	7168
	18 kVA	9213
	22 kVA	11,260
Operating Temperature:		
60 Hz	: 32 to 104° F	(0 to 40° C)
50 Hz	: 32 to 91° F	(0 to 33° C)
Storage Temperature: UPS	: -4 to 104° F	(-20 to 40° C)
Relative Humidity	: 30-90%	(non-condensing)
Audible Noise	: <60 dBA @ 1 meter	
Altitude	: < 6,000-ft. maximum	(< 2,000 m)

4.0 FUNCTIONAL DESCRIPTION

A. Converter / Charger / DC Chopper

DESCRIPTION - The converter/charger shall consist of a solid-state three phase rectifier, DC to DC converter (chopper), output filter, and transient suppresser network to regulate and maintain DC power to the inverter.

1) TRANSIENT SUPPRESSER - The incoming AC utility shall first be connected to a molded case circuit breaker as a means of disconnecting power to the UPS. Power shall flow through a surge absorber to prevent large transients from passing through to the load or damaging the batteries. Power shall then flow through a line filter to prevent sags or surges from passing to the load.

2) CONVERTER/CHARGER - The converter shall serve to change incoming AC power to DC, which shall be supplied to the DC chopper. From this point, DC power is used to recharge the battery bank while simultaneously providing power to the inverter.

- a) Input Frequency Range: 45-65 Hz, continuous, without battery operation
- b) Capacity: Battery recharge shall be to within 90% of nominal from a fully discharged state in 10 times the discharge time.

3) DC CHOPPER - The chopper circuit shall consist of inductors, capacitors, diodes and IGBT's (Insulated Gate Bipolar Transistors). The chopper shall have the function of providing start-up protection (by checking phase rotation of incoming utility power), boosting the DC to the

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inverter (during low AC input voltage conditions), providing power factor enhancement, and reducing reflected harmonics to incoming utility power.

B. Pulse Width Modulated (PWM) Inverter

DESCRIPTION - The PWM (Pulse Width Modulated) inverter shall incorporate an advanced IGBT design, and output over current protection for clean, regulated output power to the critical load.

1) INVERTER - The inverter network shall consist of a high speed IGBT switching network designed to supply non-linear loads with a clean and steady voltage waveform. The inverter switching speed shall be fast enough to limit audible noise to 60 dBA at 3 feet (measured on 'A' scale).

2) OVERCURRENT PROTECTION - The output circuitry shall be equipped with a Hall Effect Current Transformer to detect and protect the inverter from excessively high currents.

C. Static Bypass Switch

1) TRANSFER - The static bypass switch shall consist of thyristor switches in conjunction with an output contactor to permit manual switching from bypass to UPS and UPS to bypass without power interruption. The UPS shall instantaneously transfer to bypass should a component fail during normal operation (provided the UPS and bypass are in synchronization). Auto-retransfer to UPS after an overload condition shall be completed within one second after the bus has dropped to 100% of nominal.

2) REMOTE RUN/STOP - A set of normally open dry contacts shall be provided to remotely transfer the UPS on-line and off-line. When the UPS is in this mode of operation, the UPS front control panel shall be disabled to provide a secured configuration.

D. Microprocessor Control System

1) DESCRIPTION - The UPS system shall be provided with a microprocessor internal control system to perform start-up, transfers, monitoring, and battery recharging. The microprocessor shall provide information to the user (via a touchscreen liquid crystal display with searchable menu tree) such as system status, fault messages and input and output parameters.

2) LED INDICATORS - The following LED indicators shall be provided on the UPS front panel displays, which mimic power flow through the UPS:

- a) AC INPUT (Green Lamp) - Lights when normal AC input power is being supplied to the unit.
- b) WARNING (Amber Lamp) – Lamp is OFF when the UPS is normal.
- c) ON-LINE FAULT (Green/Red Lamp) – GREEN when voltage is within specifications, and RED when voltage is out of specifications

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3) SYSTEM METERING - The UPS shall be provided with a touchscreen display which displays, upon request, the following information:

AC INPUT VOLTAGE (Line to Line)
 AC OUTPUT VOLTAGE (Line to Line, Line to Neutral)
 AC OUTPUT CURRENT
 BATTERY VOLTAGE
 BATTERY CHARGING CURRENT
 INPUT FREQUENCY
 OUTPUT FREQUENCY
 INPUT/ OUTPUT kW
 POWER FACTOR

4) SYSTEM DIAGNOSTICS - The following diagnostic information shall be provided to troubleshoot the UPS should a fault occur:

Display	Meaning
BYPOH	Bypass Overheat – Overheating condition occurred.
BYPOL	Bypass Overload – UPS is overloaded.
CHRGV	Charger Overvoltage – Charger overvoltage condition occurred.
CLMT	Current Limit – Load on UPS output exceeds unit specifications.
DCIB	DC Bus Imbalance – DC voltage imbalance occurred.
DCOC	DC Overcurrent – overcurrent condition occurred.
DCOV	DC Bus Overvoltage – DC overvoltage condition occurred.
DCUVBS	DC Bus Undervoltage during Boostup Mode – DC undervoltage condition occurred.
DCUVC	DC Bus Undervoltage During Charging Mode – DC undervoltage condition occurred.
DVCOH	Device Overheat – Overheating condition occurred.
FSOPEN	Fuse Open.
INVOLNR	Inverter Overload (Not Resettable)– Output overload condition occurred.
INVOLR	Inverter Overload (Resettable) – Output overload condition occurred.
OOV	Output Overcurrent – UPS is overloaded.
VOOV	Output Overvoltage – Output overvoltage condition occurred.
VOUV	Output Undervoltage – Output undervoltage condition occurred.

5.0 MECHANICAL DESIGN

A. UPS Enclosure:

The UPS shall be in a freestanding, NEMA1 enclosure equipped with casters and leveling feet. The overall dimensions and weights shall be as follows (without internal batteries):

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<u>UPS Size</u>	<u>Dimensions</u>	<u>Weight</u>
3.6 kVA	22.1 in. H x 10 in. W x 33 in. D	280 lbs.
6 kVA	27.5 in. H x 10 in. W x 33 in. D	346 lbs
8 kVA	28.4 in. H x 13 in. W x 34.9 in. D	476 lbs
10 kVA	28.4 in. H x 13 in. W x 34.9 in. D	476 lbs
14 kVA	39.1 in. H x 17.5 in. W x 36.1 in. D	784 lbs
18 kVA	39.1 in. H x 17.5 in. W x 36.1 in. D	784 lbs
22 kVA	39.1 in. H x 17.5 in. W x 36.1 in. D	835 lbs

B. Cable Entry:

The UPS shall be provided with cable entry at the bottom rear of the UPS enclosure.

C. Ventilation and Maintenance Requirements:

The UPS shall require the following minimum space for ventilation and maintenance: 28" (front), 18" (top), 6" (rear), and 0" (side).

6.0 STANDARD FEATURES

A. Emergency Power Off (EPO)

Emergency Power Off (EPO) terminals which trip open the UPS and battery circuit breakers.

B. RS232 Communication Interface

Serial data link will enable the UPS to interface with a computer to provide power status and diagnostic information.

C. DB9 Dry Contact interface

The following normally open dry contacts shall be provided through a DB9 male connector located on the rear of the UPS:

- 1) UPS On
- 2) Bypass Active
- 3) Input Power Loss
- 4) Battery Voltage Low

D. Battery Test Function

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The UPS shall be provided with a “Battery Test” pushbutton to periodically check the condition of the batteries. Upon detection of a battery problem, the UPS shall notify the user of this condition allowing the user to perform a detailed check of the battery string.

7.0 SERVICE AND WARRANTY

C. Warranty:

The UPS system shall be provided with a comprehensive three-year warranty. The warranty shall cover parts, labor, travel and freight for the UPS. The battery system has a full two year warranty with 3 year’s prorata total of 5 year battery warranty. Typical on-site response time shall be 4 hours (24 hours maximum). The warranty period shall expire three years for UPS and two years for the battery system from date of shipment from manufacturer’s facility.

*Specification subject to change without notices.

**Times are accurate provided normal Preventative Maintenance procedures are followed.