

**TOSHIBA INTERNATIONAL CORPORATION**

**SPECIFICATIONS  
THREE PHASE UNINTERRUPTIBLE POWER SYSTEM**

**TOSHIBA G8000 SERIES  
100-300 kVA UPS**

# TOSHIBA G8000 GUIDE SPECIFICATION (100-300kVA)

## 1.0 SCOPE

### 1.1 System

These specifications describe a continuous duty, three-phase, on-line, solid-state Uninterruptible Power Supply system, hereafter referred to as the UPS.

The UPS shall supply highly reliable back-up power to critical loads.

## 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 Withstandability
- UL 1778 Listed
- IEC (International Electrotechnical Commission)
- National Electrical Code (NFPA-70)
- NEMA PE-1
- OSHA
- ASME
- ISO 9001

### 2.2 Components

The UPS shall consist of the following components:

- A. Diode Rectifier + IGBT Converter
- B. Input filter
- C. IGBT Inverter
- D. Inverter Output Isolation Transformers
- E. Static Bypass (Thyristor Switch with wrap around contactor)
- F. Microprocessor Controlled Logic and Control Panel
- G. Battery System with DC Breaker

The following components shall be optional:

- A. Maintenance Bypass (Circuit Breaker)
- B. Input Isolation Transformers
- C. Remote monitor panel
- D. RemotEye II network communications adapter
- E. Memory card

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## 2.3 System Operation

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

- A. Normal: Diode Rectifier and IGBT Converter converts AC input power to DC power for the inverter and charging the batteries. The inverter supplies clean and stable AC power continuously to the critical load, and its output is synchronized with the bypass AC source.
- B. Loss of Main Power: If loss of Main Power occurs, the battery automatically backs up the inverter so there is no interruption of AC power to the critical load.
- C. Return of Main Power: The system will recover to the operating mode as item “A” and will cause no disturbance to the critical load. The system will simultaneously recharge the battery.
- D. Transfer to Bypass AC source: If the UPS overloads, or when an internal fault has been detected, the transfer switch will automatically transfer the critical load from the inverter output to the bypass AC source without interruption. If the overload or internal warning condition is removed, then after a preset “hold” period the UPS will automatically re-transfer the critical load from the bypass to the inverter output without interruption.
- E. Maintenance Bypass/Test Mode: An optional manual make-before-break maintenance bypass switch may be provided to isolate the UPS inverter output and static bypass transfer switch for maintenance. This will allow the UPS to be tested or repaired without affecting load operation.

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## 3.0 GENERAL CONDITIONS FOR INSTALLATION

### 3.1 Required Input Capacity:

Required Input capacity will be about 100-300kVA.

### 3.2 Grounding System:

- A. Ground wiring with grounding resistance less than 10 ohms shall be supplied for the UPS.
- B. It is necessary for the load to be grounded to the same ground point as the UPS, and the ground wiring shall be for the exclusive use of the UPS and load.

### 3.3 UPS Unit's Room:

#### 3.3.1 Environment

Operating Temperature : 0° to 40° C  
Operating Humidity : 30 - 95% (Non-condensing)

3.3.2 Discharge Heat from UPS : Approximately 30,740 – 76,184 Btu/Hr

#### 3.3.3 Clearances for installation

Ceiling Level : 94.5” minimum from floor to obstacle (ceiling)  
Front : 36” minimum for maintenance  
Rear Side : No access required

#### 3.3.4 Entrance dimensions:

31.5” width, 78.8” height minimum

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## 4.0 SYSTEM PARAMETERS

### 4.1 UPS Requirements:

#### 4.1.1 General Requirements:

Rated Output Capacity	: 100-300kVA
Converter Type	: Diode Bridge + IGBT Converter
Inverter Type	: IGBT PWM Inverter
External Dimensions	: 55.1" x 31.5" x 78.7"
(300)	: 82.7" x 35.4" x 78.7"
Weight	: Approximate 2,640 – 4,630 lbs

#### 4.1.2 AC Input:

Rated Voltage	: 480V
Voltage Variation	: +10% to -30%
Rated Frequency	: 50/60Hz
Frequency Variation	: +/-5%
Number of Phase/Wire	: 3-Phase/3-Wire + Ground
Input Power Factor	: Greater than 0.98 lagging at 100% load
Current THD	: Less than 3% at 100% load : Less than 6% at 25% load

#### 4.1.3 Charging Function:

DC Nominal Voltage	: 360V
DC Voltage Range	: 288V to 414V
DC Float Charging Voltage	: 405V

#### 4.1.4 Bypass:

Rated Voltage	: 480/277V
Input synchronization voltage range	: +10% to -10%
Rated frequency	: 50/60Hz
Frequency Variation	: +/-5%
Frequency synchronous range	: +/-0.5Hz, +/-1.0Hz
Number of Phases/Wires	: 3-Phase/4-Wire + Ground

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### 4.1.5 AC Output:

Rated Capacity	: 100-300kVA
Rated Load Power Factor	: 1.0 unity pf
Overload Capacity	: 125% for 10min., 150% for 1min.
Rated Voltage	: 480/277V
Number of Phases/Wires	: 3 Phase/4 Wire + Ground
Voltage Regulation	: +/-0.5% (0-100% Balanced Load)
Voltage Adjustment Range	: +/-5%
Rated Frequency	: 50/60Hz
Frequency Regulation	: +/-0.01% (Free-Running Mode)
Frequency Synchronous Range	: +/-0.5Hz, +/-1.0Hz
Harmonic Voltage Distortion	: 2.5% THD (100% Linear Load) : 4% THD (100% Non-linear Load)

### Voltage Transients:

100% Load Step Change	: $\pm 2\%$
Loss or Return of Input	: $\pm 1.5\%$
Transfer From Bypass to Inverter	: $\pm 2\%$ (Under Bypass Rated Voltage)
Recovery Time	: 2 cycles maximum

### 4.2 Static Bypass:

Rated Voltage (Input)	: 480/277V
Rated Voltage (Output)	: 480/277V
Rated Frequency	: 50/60Hz
Number of Phases/Wires	: 3 Phase/4 Wire
Description	: Thyristor Switch + wrap-around contactor

### 4.3: External Maintenance Bypass (Option):

External Dimensions	: 30" x 12" x 43"
Rated Voltage (Input)	: 480/277V
Rated Voltage (Output)	: 480/277V
Rated Frequency	: 50/60Hz
Number of Phases/Wires	: 3 Phase/4 Wire + Ground
Devices:	
MCCB for Bypass Input	: 1 unit, 3 Pole
MCCB for Output	: 2 units, 3 Pole

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## 5.0 FUNCTIONAL DESCRIPTION

The UPS shall be protected against surges, sags, undervoltage, voltage fluctuation and etc. at the input terminals. The UPS shall have built-in protection against permanent damage to itself and the connected load for all predictable types of malfunctions. The load shall be automatically transferred to the bypass line uninterrupted for an internal UPS malfunction. The status of protective devices shall be indicated on a graphic display screen on LCD indication on the front of UPS.

### 5.1 Diode Rectifier and IGBT Converter

#### 5.1.1 General

A solid-state full-wave bridge Diode Rectifier shall convert the incoming AC power into DC power to supply the inverter input and system battery. The Rectifier's DC/DC converter shall charge battery.  
DC/DC converter shall be composed of IGBT controlled by PWM.

#### 5.1.2 Battery Charge Current Limit

The Converter logic shall provide DC battery current limiting for controlled battery charging. The battery current sensing shall be independent of the Converter DC output current sensing to provide precise battery recharging.  
The DC/DC converter shall include a circuit to limit battery-charging current to an adjustable level of 100% to 125% of maximum battery charging current.

#### 5.1.3 Voltage Regulation

The DC/DC converter output voltage shall not deviate by more than +/- 0.5% RMS due to the following conditions:

- From 0 to 100% loading
- +/-10% mains voltage change
- 5% mains frequency change

#### 5.1.4 Reflected Harmonic Content

Input current THD shall be less than 3% at 100% load and less than 6% at 25% load.

### 5.2 Inverter:

#### 5.2.1 General

For increased performance the inverter shall be composed of IGBT power transistors controlled utilizing a pulse-width-modulation (PWM) design.  
The Inverter continuously converts DC power (from the converter or battery) to very clean, stable (sine wave) AC power for the critical loads. The Inverter shall be capable of providing rated output while operating from any battery voltage within the battery operating range. When the DC bus voltage reaches the operational low voltage limit of the inverter during a loss of main AC power, the inverter will automatically shut off.

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### **5.2.2 Output Voltage**

The Inverter output voltage shall not deviate by more than +/- 0.5% RMS due to the following steady state conditions:

- a. 0% to 100% loading
- b. Inverter DC input varies from maximum to minimum.

### **5.2.3 Synchronization**

The inverter output voltage will be automatically synchronized with the bypass AC source as long as the source is within the tolerable frequency and voltage range. If the bypass AC source is not within the range, the control circuitry will stop synchronization and operate the inverter in free running mode. When the bypass AC source recovers to within tolerance, the inverter slowly changes its frequency (slew rate 1Hz/sec) and tracks the bypass AC source until synchronization is achieved without causing any disturbance to the load.

### **5.2.4 Battery Protection**

The inverter shall be provided with monitoring and control circuits to protect the battery system from damage due to excessive discharge. Inverter shutdown shall be initiated when the battery voltage has reached the discharge cutoff voltage of 288 VDC. Automatic shutdown based on discharge time is not acceptable.

### **5.2.5 UPS operation**

Pushing the "RUN" and "STOP" switches on the UPS operation panel will respectively start and stop the UPS inverter.

### **5.2.6 Overload Capacity:**

The Inverter output shall be capable of providing an overload current (125% for 10 min. and 150% for 1 min.). A message on the LCD of the control panel shall indicate this condition. If the time limit associated with the overload condition expires or the overload is in excess of the set current limit, the load power shall be transferred to the bypass source without interruption.

## **5.3 Static Bypass Circuit:**

### **5.3.1 General:**

A static bypass circuit shall be provided to supply an alternate source of power to the load in the event the inverter cannot supply rated output power. The bypass circuit shall be capable of supplying the UPS rated load current and also provide fault clearing current.

The static bypass switch shall be composed of a thyristor switch with a wrap-around contactor. The thyristor switch shall be a high-speed transfer device comprised of a naturally commutated thyristor. The wrap-around contactor shall be electrically connected in parallel to the thyristor switch and shall, at the same time as the thyristor switch, be energized and, upon closure, maintain the bypass source to the load. The thyristor switch shall only be utilized for the time needed to energize the contactor, thus increasing overall reliability.

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The UPS system logic shall employ sensing which shall cause the thyristor switch to energize thus providing an uninterrupted transfer of the load to the bypass source when any of the following limitations are exceeded:

- a. Inverter output undervoltage or overvoltage.
- b. Overloads
- c. DC circuit undervoltage or overvoltage.
- d. Final discharge voltage of system battery is reached and the bypass source is present and available within tolerance ranges.

Transferring the output from the inverter to the bypass source and vice versa will be performed by pressing "BYPASS" and "UPS" switches on the operation panel.

Operating Mode	Transfer mode	Transfer Type	
		Synchronized	Unsynchronized
Automatic	Inverter to Bypass (Overload, Internal Fault)	Uninterrupted	Interrupted
"BYPASS" switch operated	Inverter to Bypass	Uninterrupted	Interrupted (forced transfer)
Automatic	Bypass to Inverter (Auto-Retransfer Mode)	Uninterrupted	Transfer inhibited
"UPS" switch operated	Bypass to Inverter	Uninterrupted	Transfer inhibited

If the bypass source is beyond the conditions stated below, interrupted transfer shall be made upon detection of a fault condition.

- a. Bypass voltage greater than + 10%, -10% from the UPS rated output voltage.
- b. Bypass frequency greater than  $\pm 1$  Hz from the UPS rated output frequency.

### 5.3.2 Overload Capacity:

- Continuous duty : 125% of the system rating capacity
- Overload duty : 1000% of ampere rating for greater than 1 cycle.

### 5.3.3 Retry function:

When an internal warning has been detected, power flow will automatically switch from the main circuit (inverter) to the bypass circuit without interruption. If this internal warning is removed for a certain time, UPS will be operated automatically and power flow will switch from the bypass circuit to the main circuit (inverter) without interruption.

### 5.4 External Maintenance Bypass (Option)

A manually operated maintenance bypass switch will be provided to bypass the power feeding the critical load from inverter and static switch without causing any power interruption.

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## 5.5 Metering, Monitoring, Alarms and Controls

### 5.5.1 Metering

The Front Panel includes a 4-line liquid crystal display (LCD) screen. The 4-line LCD screen provides performance data, statistics, and operating conditions. The following metering will be displayed on LCD screen:

- AC Input Voltage
- AC Output Voltage
- DC Voltage
- DC Current
- Output Current
- Output Frequency

### 5.5.2 Mimic Panel

One line diagram of the system is on the control and monitor panels to provide a visual display of the status of circuit breakers within UPS. There is a 8 key on the graphic display panel. The 8 key allows easy to operate UPS.

Indicators will be furnished as the followings:

- AC Input, DC Input
- Converter in Operation
- Inverter in Operation
- UPS/Bypass supply
- Battery Operating Condition (float charge/discharge)
- Fault, Warning
- Operation Guidance (LCD Display)
- Fault Guidance (LCD Display)

### 5.5.3 Isolated Contact Signals

Form "A" isolated contact signal outputs for remote use will be furnished for the following operating status indications:

- Inverter Operation
- Battery Operation
- Battery Voltage Drop
- Bypass Supply
- Warning
- Fault

Contact ratings: 1A/120VAC, 1A/24VDC, 0.1A/120VDC (resistive).

Isolated contact signal inputs will be furnished for the following remote operations:  
Remote Start, Remote Stop, Remote Emergency Power Off (EPO).

The contact signal inputs and outputs shall be wired to a terminal block located inside the UPS.

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## 5.6 RemotEye II Network Adapter (Option)

### 5.6.1 SNMP Ability

The RemotEye II provides an SNMP interface for Toshiba UPS. This allows easy integration of UPS management into an existing SNMP Network Management System. At any given time, SNMP queries can poll the RemotEye II agent for the current status of its connected Toshiba UPS.

### 5.6.2 HTTP Familiarity

The RemotEye II provides an HTTP interface for Toshiba UPS. This allows easy access of Toshiba UPS information from any machine with a web browser! At any time, a network workstation or management station can open a RemotEye II website. Through the website, UPS system information can be configured and monitored. Plus, RemotEye II provides access to 3 java applets for monitoring, event logging, and trend analysis.

### 5.6.3 Shutdown Capability

Also included with RemotEye II is application software. This software allows RemotEye II to notify and shutdown important network servers. Through the existing network connections, RemotEye II can handle your unattended server shutdown needs!

RemotEye II /External Hardware
AMD 188ES-20MHz
512kB SRAM: 512kB Flash
Two asynchronous serial ports
10 BaseT RJ-45 phone jack connector
Toshiba UPS communication protocol
SNMP over UDP/IP : HTTP over TCP/IP:ARP, RARP, TFTP and ICMP
MIB_II : Toshiba v1.2 MIB :JEM MIB : RFC 1628
Traffic LED for network : Status LED for status : Power LED for Power
2 digit (default setting is Switches 1 and 2 off)
0~40 degrees Celsius
10~80 percent
12VDC ungrounded
2.0 Watts Maximum
5.28”(134mm) x 3.40”(86mm) x 1.10”(27mm) (LxWxH)
0.38lbs(170g)
FCC class A, UL, CUL, CE

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## 5.7 Smart Memory Card (Option)

The UPS will have the option to provide a memory card that stores various digital and analog waveform data for the UPS when any operating event occurs. The waveform data stored in the card will include at least the following:

AC Input Current  
Bypass Voltage  
Battery Voltage  
Battery Current  
Output Voltage  
Output Current

The memory card will serve as a tool to facilitate trouble-shooting and fault diagnosis. The waveform data stored in the memory card can be recorded and analyzed through the use of a personal computer running the associated waveform viewing software.

## 6.0 MECHANICAL DESIGN

### A. UPS Enclosure

The UPS shall be freestanding, front access, NEMA1 enclosure equipped with a leveling channel base. The overall dimensions and weights shall be as follows:

<u>kVA</u>	<u>Dimensions</u>	<u>Weight</u>
100 kVA	55.1" x 31.5" x 78.7"	2,645 lbs
150 kVA	55.1" x 31.5" x 78.7"	2,756 lbs
225 kVA	55.1" x 31.5" x 78.7"	3,307 lbs
300 kVA	82.7" x 35.4" x 78.7"	4,079 lbs