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TOSHIBA G9000

80/100/160/225 kVA

GUIDE SPECIFICATION
THREE PHASE UNINTERRUPTIBLE POWER SUPPLY

Table of Contents

1 SCOPE 5

1.1 SYSTEM 5

2 SYSTEM DESCRIPTION 5

2.1 APPLICABLE STANDARDS: 5
2.2 COMPONENTS: 5
2.3 SYSTEM OPERATION: 6
2.3.1 Normal 6
2.3.2 Loss of Main Power 6
2.3.3 Return of Main Power 6
2.3.4 Transfer to Bypass AC source 6
2.3.5 Maintenance Bypass 6

3 GENERAL CONDITIONS FOR INSTALLATION 6

3.1 REQUIRED OUTPUT CAPACITY: 6
3.2 UPS ENVIRONMENT: 6
3.2.1 Standard Environmental Parameters 6
3.2.2 Discharge Heat from UPS 6
3.2.3 Clearances for installation 7

4 SYSTEM PARAMETERS 7

4.1 UPS REQUIREMENTS: 7
4.1.1 General Requirements: 7

5 FUNCTIONAL DESCRIPTION 9

5.1 IGBT RECTIFIER 9
5.2 IGBT DC-DC CONVERTER 9
5.3 IGBT INVERTER: 10
5.4 STATIC BYPASS CIRCUIT: 11
5.5 METERING, MONITORING, ALARMS, AND CONTROLS 12

6 MECHANICAL DESIGN 14

6.1 UPS ENCLOSURE 14
6.2 CABLE ACCESS 14

7 WARRANTY 14

7.1 UPS WARRANTY 14
7.2 UPS BATTERY WARRANTY 14
7.3 WARRANTY SUPPORT AVAILABILITY 14

8 BATTERY CABINETS (OPTION) 14

9 COMMUNICATIONS (OPTIONAL) 14

9.1 REMOTEYE II NETWORK ADAPTER 14
9.1.1 SNMP Ability 14
9.1.2 HTTP Familiarity 15
9.1.3 Shutdown Capability 15

9.2 REMOTE STATUS ALARM PANEL (RSAP) 15

10 TOSHIBA DISTRIBUTION CABNET (TDC) (OPTION) 16

11 MAINTENANCE BYPASS PANEL (OPTION) 16

11.1 SITE INSTALLATION 16
11.2 ELECTRICAL CONFIGURATION 16
11.3 MECHANICAL INTERLOCK 16
11.4 EXTERNAL MAINTENANCE BYPASS: 16

12 AUXILIARY TRANSFORMER CABINETS (OPTION) 16

13 POWER DISTRIBUTION UNITS (OPTION) 16

14 EXTENDED SERVICES (OPTION) 17

1 SCOPE

1.1 System

These specifications describe a high efficiency continuous duty, three-phase, on-line, solid-state Uninterruptible Power Supply system (UPS). The UPS shall operate utilizing the existing power distribution system to provide high quality, uninterruptible power to critical loads.
The UPS shall consist of an AC/DC multi-level Insulated Gate Bipolar Transistor (IGBT) Rectifier, DC/DC Converter/Battery Charger, DC/AC multi-level IGBT Inverter, integral static bypass, front-accessible controls, display, and monitor.

2 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:

UL 1778/cUL Listed
FCC Class A, Article 47, Part 15.B
ISO 9001
ISO 14001
ANSI C62.41

2.2 Components:

The UPS shall consist of the following components:

1. Multi-level IGBT AC/DC Rectifier
2. IGBT DC/DC Battery Converter/Charger
3. Multi-level IGBT DC/AC Inverter
4. Hybrid Integral Static Bypass (Thyristor switch with wrap around contactor)
5. Microprocessor Logic and Control Panel

** The following components shall be optional:

1. Battery Cabinet with DC Breaker
2. Toshiba Distribution Cabinet (TDC)
3. Toshiba Tie Cabinet for parallel operation
4. RemotEye II UPS remote communications and web-based monitor card
5. Network communications with MODBUS interface adapter
6. Remote Status Alarm Panel (RSAP)

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

2.3.1 Normal

IGBT Rectifier converts AC input power to DC power for the inverter and for charging the batteries. The IGBT inverter supplies clean and stable AC power continuously to the critical load. The UPS Inverter output shall be synchronized with the bypass AC source when the bypass source is within the AC input voltage and frequency specifications.

2.3.2 Loss of Main Power

When Main Power is lost, the battery option shall automatically back up the inverter so there is no interruption of AC power to the critical load.

2.3.3 Return of Main Power

The system shall recover to the operating mode in Item 1 and shall cause no disturbance to the critical load while simultaneously recharging the backup battery.

2.3.4 Transfer to Bypass AC source

If the UPS becomes overloaded, or an internal fault is detected, the UPS controls shall automatically transfer the critical load from the inverter output to the bypass AC source without interruption. When the overload or internal warning condition is removed, after a preset "hold" period the UPS will automatically re-transfer the critical load from the bypass to the inverter output without interruption of power to the critical load.

2.3.5 Maintenance Bypass

An optional manual make-before-break maintenance bypass panel may be provided to electrically isolate the UPS for maintenance or test without affecting load operation.

3 GENERAL CONDITIONS FOR INSTALLATION

3.1 Required Output Capacity:
The UPS will be available in the following output capacities: 80, 100, 160, and 225 kVA (72, 90, 144, and 202.5 kW). Each unit shall be capable of being operated either independently or connected in parallel for a total of up to four like-capacity units.

3.2 UPS Environment:

3.2.1 Standard Environmental Parameters

Operating Temperature	: 32° to 104°F (0° to 40°C)
Operating Humidity	: 5 - 90% (Non-condensing)
Altitude	: 7380 ft. (2250 m) (without derating)

3.2.2 Discharge Heat from UPS at full load.

80 kVA	: 11,307 Btu/Hr
100 kVA	: 14,133 Btu/Hr
160 kVA	: 19,408 Btu/Hr
225 kVA	: 27,292 Btu/Hr

3.2.3 Clearances for installation

Ceiling Level	: 20” minimum from top of UPS to ceiling
Front	: 40” minimum for maintenance (Local and regional codes may apply)
Bottom	: Knockouts for power cable access
Rear	: Zero clearance required
Sides	: Zero clearance if using bottom cable access (Standard knockouts for left/right side cable access)
Base	: Channel mounted

4 SYSTEM PARAMETERS

4.1 UPS Requirements:

4.1.1 General Requirements:

Rated Output Capacity	: 80/100/160/225 kVA (72/90/144/202.5 kW)
AC/DC Rectifier Type	: AC/DC multi-level IGBT Rectifier
DC/AC Inverter Type	:DC/AC multi-level IGBT Inverter Inverter
External Dimensions	(W) (D) (H)*
80 kVA	: 27.6”x 32.8”x 78.7 (80.6)”
100 kVA	: 27.6”x 32.8”x 78.7 (80.6)”
160 kVA	: 35.4”x 32.8”x 78.7 (80.6)”
225 kVA	: 35.4”x 32.8”x 78.7 (80.6)”
	* Unit height with fan assembly installed
Weight	
80 kVA	: 855 lbs
100 kVA	: 855 lbs
160 kVA	: 1160 lbs
225 kVA	: 1230 lbs
Power Cable Access	: Bottom, Sides, Top Entry with optional side cabinet
Paint Color	: Black (Munsell N1.5)

4.1.2 AC Input:

Configuration	: 3-Phase/3-Wire + Ground
Rated Voltage	: 480V
Voltage Variation	: +15% to –20%
Rated Frequency	: 60Hz
Frequency Variation	: +/-10%
Input Power Factor	: Greater than 0.99 lagging at 25%-115% load

Current THD	: <3% THD at 60%–100% load <6% THD at 25%–59% load (No input harmonic filter required)

4.1.3 Charging Function:

DC Nominal Voltage	: 480 V
AC Ripple on DC Bus	: < 0.2% of DC Voltage
DC Voltage Range	: 400 V to 545 V
DC Float Charging Voltage	: 545 V
Maximum charging current:	
80 kVA	: 20 A
100 kVA	: 25 A
160 kVA	: 40 A
225 kVA	: 56 A
AC Ripple on DC Charging Circuit	:
80 kVA	: 0.23%
100 kVA	: 0.23%
160 kVA	: 0.23%
225 kVA	: 0.29%

4.1.4 Bypass Input:

Configuration	: 3-Phase/3-Wire + Ground
Rated Voltage	: 480 V
Input voltage synchronous range	: +/-10%
Rated frequency	: 60 Hz
Frequency Variation	: +/-5%
Frequency synchronous range	: +/-1.0 Hz
Bypass overload capacity	: 1000% for 1 cycle

4.1.5 AC Output:

Configuration	: 3-Phase/3-Wire + Ground				
Rated Capacity	:80/100/160/225 kVA (72/90/144/202.5 kW)				
Rated Voltage	: 480 V				
Efficiency at % Full Load	: 20%	40%	60%	80%	100%
80 kVA	92.5%	95.6%	95.6%	95.6%	95.6%
100 kVA	92.5%	95.6%	95.6%	95.6%	95.6%
150 kVA	94.6%	96.2%	96.2%	96.2%	96.5%
225 kVA	94.7%	96.2%	96.2%	96.2%	96.5%

Voltage Regulation	: +/-1% (0-100% Unbalanced Load) : +/-1% (0-100% Balanced Load)
Voltage Adjustment Range	: +/-3%
Rated Frequency	: 60 Hz
Frequency Regulation	: +/-0.01% (Free-Running Mode)
Frequency Synchronous Range	: +/-0.5 Hz or +/-1.0 Hz (Selectable)
Rated Load Power Factor	: 0.9 PF lagging
Overload Capacity	: 125% for 2 min., 150% for 1 min.

Harmonic Voltage Distortion	: < 2% THD (100% Linear Load)
	: < 5% THD (100% Non-linear Load)
Phase Displacement	: 1° Maximum at 100% load
Voltage Transients:	
100% Load Step Change	: +/-2% Maximum (Without battery assistance)
Loss or Return of Input	: +/-1% Maximum
Transfer from Bypass to Inverter (At Bypass Rated Voltage)	: +/-5% Maximum
Recovery Time	: 1 cycle

5 FUNCTIONAL DESCRIPTION

The UPS shall protect the load against surges, sags, undervoltage, and voltage fluctuation. 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 without interruption in the event of an internal UPS malfunction. The status of protective devices shall be indicated on a LCD graphic display screen on the front of the UPS.

5.1 IGBT Rectifier

5.1.1 General

A solid-state, multi-level IGBT Rectifier shall convert the incoming AC power into DC power to supply the inverter input and system battery.

5.1.2 Voltage Regulation

The rectifier output voltage shall not deviate by more than +/- 1.0% RMS under the following conditions:

- 0% - 100% loading (balanced and unbalanced loading, non-transient)
- +15% - 20% utility voltage change
- +/-10.0% utility frequency change

5.1.3 Reflected Harmonic Content

Input current THD shall be

- < 3% at 60%-100% load
- < 6% at 25%-59% load.

5.2 IGBT DC-DC Converter

5.2.1 General

A solid-state IGBT Battery Converter/Charger shall control battery charging.

5.2.2 Battery Charge Current Limit

The Converter logic shall provide DC for controlled battery charging. The battery current sensing shall be independent of the Converter DC Output current sensing to provide precise battery recharging control. The DC/DC Charging Converter shall include a circuit to regulate the battery charging current to between 100% and 125%.

5.2.3 Battery Protection

The converter shall be provided with monitoring and control circuits to protect the battery system from damage due to excessive discharge. Converter shutdown shall be initiated when the battery voltage reaches a discharge cutoff voltage of 400 VDC. Automatic shutdown based on discharge time is not acceptable.

5.2.4 DC Ripple

AC Ripple on the DC Bus shall be less than 0.2%.
AC Ripple on the Battery charging circuit shall be less than 0.23% for the 80/100/160 kVA UPS, and less than 0.29% for the 225 kVA UPS.

5.3 IGBT Inverter:

5.3.1 General

The inverter shall be composed of multi-level IGBT power transistors controlled utilizing an Advanced Technology PWM logic. The Inverter shall continuously convert DC power from the IGBT Rectifier to AC power for the critical loads. When the utility voltage or frequency exceeds the specified UPS input tolerances, the inverter shall continuously convert DC power from the battery source to AC power for the critical load.

The inverter shall be capable of providing rated output while operating at any battery voltage within the battery operating range. When the DC battery voltage reaches the operational low voltage limit during a loss of utility AC power, the inverter shall automatically shut off.

5.3.2 Output Voltage

The Inverter output voltage shall not deviate by more than +/- 1.0% RMS under the following steady state conditions as the Inverter DC input varies from maximum to minimum:

- 0% to 100%Unbalanced load
- 0% to 100%Balanced load

5.3.3 Synchronization

The Inverter output voltage shall 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 shall change its frequency (slew rate 1Hz/sec) and track the bypass AC source until synchronization is achieved without causing any disturbance to the load.

5.3.4 Output Control

The Inverter can be manually started and stopped using the LCD touch screen controls.

5.3.5 Overload Capacity:
The Inverter output shall be capable of providing an overload current of 125% for 2 min. and 150% for 1 min. A message on 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 transfer to the bypass source without interruption.

5.4 Static Bypass Circuit:

5.4.1 General:
An integral static bypass circuit shall be provided to supply an alternate source of power to the critical 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 accommodate fault clearing.

The 100% duty rated static bypass panel shall be composed of a thyristor switch with a wrap-around contactor. The thyristor switch shall be a high-speed transfer device. 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 to improve the efficiency and reliability of the system. The thyristor switch shall only be utilized for the time needed to energize the contactor closure.

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

- Inverter output undervoltage or overvoltage.
- Overloads exceeding 125% for 2 min., or 150% for 1 min.
- DC circuit undervoltage or overvoltage.
- Final discharge voltage of system battery is reached and the bypass source is present, available, and within tolerance range

Transferring the output from the inverter to the bypass source and vice versa shall be performed by pressing “START/STOP” icon on the touchscreen display.

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.

- Bypass voltage greater than + 10%, -10% from the UPS rated output voltage.
- Bypass frequency greater than ± 1 Hz from the UPS rated output frequency.

5.4.2 Overload Capacity in Bypass:

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

5.4.3 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 to the load. If the internal warning is cleared, UPS will automatically switch the power flow from the bypass circuit to the main circuit (inverter) without interruption.

5.5 Metering, Monitoring, Alarms, and Controls

5.5.1 Status Indicators

The Front Panel shall include LED status indicators for the following states:

Load on Inverter
Battery Operation
Load on Bypass
Overload
LCD Fault
UPS Fault

5.5.2 EPO (Emergency Power Off) Button

The Front Panel shall have an Emergency Power Off button (EPO) located on the front panel that, when pressed, will shut down the UPS.

5.5.3 Liquid Crystal Display (LCD) Touch Panel

The Front Panel shall include a LCD touch panel that shall provide performance data, statistics, and operating conditions. The following metering will be displayed on LCD touch panel:

AC Input Voltage
AC Input Frequency
AC Output Voltage
AC Output Current
AC Output Frequency
Battery DC Voltage
Battery DC Current
AC Bypass Voltage
AC Bypass Frequency

5.5.4 Mimic Panel

A one-line diagram of the system shall be displayed on the touch panel display panel to provide a visual status of contactors within UPS. The panel shall display the followings:

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

5.5.5 Isolated Control Signals

Normally Open isolated contact signal outputs for remote use will be furnished for the following operating status indications:

- Summary Alarm
- Load on Bypass
- Load on Inverter
- Battery Operation
- Rectifier Operation
- Battery Low Voltage
- Overload
- Total alarm
- Output Contactor Closed

Contact rating:

- Output: 1 A @ 30 VDC.
- Input: 24 VDC

UPS module accepts remote switches to initiate the following remote operations. These contacts shall be field supplied):

- Remote Start
- Remote Stop
- Battery Temperature High
- Power Demand
- Emergency Power Off (EPO)

Contact rating:

- Input: 24 VDC

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

6 MECHANICAL DESIGN

6.1 UPS Enclosure

The UPS shall be a freestanding NEMA1 enclosure equipped with a leveling channel base. The enclosure shall include provisions for hoisting, jacking, and forklift handling.

6.2 Cable Access

Cable access to the UPS shall be

- Bottom entry
- Side entry,
- Top entry with when using optional side cabinet

7 WARRANTY

7.1 UPS Warranty

The UPS shall come with a 36-month warranty on all mechanical, electrical, electronic components. Parts, labor, and travel are included during warranty period. Optional extended warranties shall be available.

7.2 UPS Battery Warranty

The back-up batteries shall come with a ten-year warranty: three years full, then seven years pro rata. Parts, labor, and travel are included during warranty period. Optional extended warranties shall be available. See Toshiba warranties at www.toshiba.com/ind

7.3 Warranty Support Availability

Warranty and technical support shall be available 24/7/365. (877-867-8773)

8 BATTERY CABINETS (OPTION)

The UPS manufacturer can provide optional matching battery cabinets with DC breaker.

9 COMMUNICATIONS (OPTIONAL)

9.1 RemotEye II Network Adapter

The UPS shall provide either an internal or external support for an internet web/SNMP adapter RemotEye II. for the optional capability of remote or internet system monitoring.

9.1.1 SNMP Ability

RemotEye II shall provide a SNMP interface for the UPS. The SNMP interface shall provide for easy integration of UPS management into an existing SNMP Network Management System. At any given time, SNMP queries shall be able to poll the RemotEye II agent for the current status of its connected UPS.

9.1.2 HTTP Familiarity

The RemotEye II shall provide a HTTP interface for the UPS to allow easy access of the UPS information from any machine with a web browser. At any time, a network workstation or management station shall be able to open a RemotEye II website. RemotEye II website shall enable the UPS system information to be configured and monitored remotely. RemotEye II shall provide access to 3 java applets for monitoring, event logging, and trend analysis.

9.1.3 Shutdown Capability

The RemotEye II application software shall allow RemotEye II to remotely notify and shutdown selected network servers.

Network Adapter/External Hardware
AMD 188ES-20MHz
512kB SRAM: 512kB Flash
Two asynchronous serial ports
10 BaseT RJ-45 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)
Temperature Range: 0 – 40 °C
Relative Humidity: 10 – 80 %
Power Requirements: 12 VDC ungrounded
2.0 Watts Maximum
Dimensions: 5.28”(134mm) x 3.40”(86mm) x 1.10”(27mm) (LxWxH)
Weight: 0.38lbs(170g)
Certifications: FCC class A, UL, CUL, CE

9.2 Remote Status Alarm Panel (RSAP)

The manufacturer shall optionally provide a RSAP that shall provide a wall-mounted LED mimic display for UPS status events of:

- Input ON
- Bypass ON
- Inverter ON
- Low Battery, AC Fail
- New alarm annunciation
- Battery backup for the RSAP monitor.

10 TOSHIBA DISTRIBUTION CABNET (TDC) (OPTION)

The manufacturer can optionally provide a matching TDC for the UPS.

- The TDC can include a step-down, 480/208/120 V transformer in a matching NEMA1 cabinet.
- The TDC can include a three-breaker MBS with a slidebar interlock. Interlock keys and Solenoid Key-Retractable Unit (SKRU) can be provided.
- The TDC can include up to eight 225 A sub-feed breakers.
- The TDC can include up to two 42-pole distribution panels.

11 MAINTENANCE BYPASS PANEL (OPTION)

The manufacturer can optionally provide a MBS (Maintenance Bypass Panel) for the UPS.

11.1 Site Installation

The MBS can be available in either a wall mount or floor mount configuration.

11.2 Electrical Configuration

The MBS can be available in two, three, or four breaker configurations.

11.3 Mechanical Interlock

The MBS can have the option for a two-kirk-key interlock system.

11.4 External Maintenance Bypass:

- A manually operated maintenance bypass panel can be provided to bypass the power feeding the critical load from inverter to a static switch panel without causing any power interruption.
- Bypass input breaker can supply input power to the UPS module static bypass input. If the system design calls for separate UPS and bypass inputs, a bypass input breaker can be installed on each input.
- UPS maintenance bypass breaker can allow power flow to the load when the UPS is bypassed. This can be a normally open circuit breaker.
- The UPS module output can feed the UPS output isolation breaker.
- Optionally, the two input bypass breaker can be used to feed both the UPS converter input and the UPS bypass input.

12 AUXILIARY TRANSFORMER CABINETS (OPTION)

The UPS manufacturer can provide optional Auxiliary Transformer Cabinets (ATC) for stepping the UPS output voltage down to service load voltages.

13 POWER DISTRIBUTION UNITS (OPTION)

The UPS manufacturer shall provide optional PDUs (Power Distribution Units) for stepping the UPS output voltage down to service load voltages. The PDUs can be provided in either front-access cabinet or Rack-mount style.

14 EXTENDED SERVICES (OPTION)

The UPS manufacturer can offer :

- Startup Service
- Maintenance Contracts (Silver, Gold, Platinum)
- Preventive Maintenance Contracts
- Spare-parts kits (A, B, and C level)
- Extended warranty coverage for up to an additional 5 years
- Enhanced warranty contract (24/7 + Holiday coverage)
- Load bank testing
- Factory witness testing
- Site monitor and power audits