MITSUBISHI ELECTRIC

UNINTERRUPTIBLE POWER SUPPLY

MODEL

1100A SERIES

SPECIFICATIONS

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U-ENS00019 REV J

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STATIC UNINTERRUPTIBLE POWER SUPPLY SYSTEM

PART 1 GENERAL

1.1 SUMMARY

This specification describes a three phase, continuous duty, online, solid-state, uninterruptible power system, hereinafter referred to as the UPS. The UPS shall operate utilizing the existing power distribution system to provide a high quality, reserve source of power to electronic equipment loads. The system shall consist of a converter, system battery, solid-state inverter and an automatic static bypass transfer circuit.

1.2 STANDARD

The UPS has been designed in accordance with and complies with the following standards:

1. UL 1778 (Underwriter Laboratories) Standard for UPS Equipment.
2. CSA 22.2 (Canadian Standards Association – cUL Equipment).
3. IEC (International Electro-Technical Commission) Semiconductor Converter Standards.
4. EMI compatibility: FCC Title 47, Part 15, Subpart B, Class A.
5. IEEE 587, ANSI C62.41 1991 Standard for Surge Withstand Ability.
6. ISO 9001 Quality Assurance program.

1.3 SYSTEM DESCRIPTION

1.3.1 Components

The UPS system shall consist of the following major equipment:

A. UPS
   1. Insulated Gate Bipolar Transistor (IGBT) Converter
   2. Insulated Gate Bipolar Transistor (IGBT) Inverter
   3. Microprocessor (CPU) using Pulse Width Modulation (PWM) for Direct Digital Control (DDC) of all UPS control and monitoring functions
   4. Static bypass switch sized to provide fault clearing
B. Battery system
C. External Input/Output dry contact (option)
D. External Maintenance bypass switch (option)
E. Remote status alarm panel (option)

1.3.2 Mode of Operation

The UPS shall be designed to operate continuously at its rated capacity as an online, automatic reverse transfer system in the following modes:

A. Normal - The inverter continuously supplies AC power to the critical load. The converter converts a utility AC power source to regulated DC power, which then simultaneously serves as the inverter input and as a float charge input to the storage battery.

B. Emergency - In the event of a utility AC power failure, the inverter shall derive its input

from the system battery, therefore providing uninterrupted power to the critical load. This transition shall be accomplished without any switching or coupling, and with no interruption of power to the critical load from either a failure or restoration of the utility AC power.

C. Recharge - Subsequent to the restoration of utility AC power, the converter shall automatically reactivate and provide DC power to the inverter, while also recharging the system battery. This occurs automatically and without interruption to the critical load.

D. Bypass - In the event that the UPS must be taken offline due to an overload condition or UPS failure, the critical load shall be transferred to the bypass source via the static switch without interruption of AC power to the critical load. A paralleling, wrap-around contactor shall be used to maintain the bypass source. The static switch shall only be utilized for automatic emergency transfers. A retransfer from bypass to inverter shall be performed automatically in overload conditions. A retransfer shall be inhibited if satisfactory synchronization of the inverter and bypass is not accomplished. The use of the static switch shall not be required during the manual or automatic retransfer process, which increases reliability.

1.4 SUBMITTALS

1.4.1 Proposal Submittals

Submittals with the proposal shall include:

A. System configuration with single-line drawings
B. Functional relationship of equipment including weights, dimensions, and heat dissipation
C. Descriptions of equipment to be furnished, including deviations from these specifications
D. Size and weight of shipping units to be handled by installing contractors
E. Detailed layout of customer power and control connections
F. Detailed installation drawings including all terminal locations

1.4.2 Delivery Submittals

Submittals upon UPS delivery shall include:

A. Shop Drawings
Submit system configurations with single-line diagrams, detailed layout of power and control connections, dimensional data and detailed installation drawings, including all terminal locations.
B. Product Data
Provide product data for the UPS and battery, including catalog sheets and technical data sheets to indicate electrical performance, UPS type, battery type, detailed equipment outlines, weight, dimensions, control and external wiring requirements, heat rejection and air flow requirements.
C. Owner’s and Technical Manual
D. Test Report
Submit a copy of factory and field test reports.

1.5 ENVIRONMENTAL CONDITIONS

A. The UPS shall be capable of withstanding any combination of the following external environmental conditions without mechanical damage, electrical failure or degradation of operating characteristics:

1. Operating ambient temperature: +5 degrees C to +35 degrees C (41 degrees F to 95 degrees F), no operating required.
2. Recommended operating temperature range: +20 degrees C to +25 degrees C (68 degrees F to 77 degrees F).
3. Non-operating and storage ambient temperature: -20 degrees C to +70 degrees C (-4 degrees F to 158 degrees F).
4. Operating relative humidity: 5% to 95%, non-condensing.
5. Recommended operating relative humidity: 30 % to 90%.
6. Operating altitude: will vary with model.
7. There should be no inflammable / explosive gas.
8. Dust in the room where the UPS is installed must not exceed normal atmospheric dust levels. In particular, that dust should not include iron particles, oils or fats, or organic materials such as silicone.

B. Audible acoustical noise: When operating under full rated load, noise generated by the UPS at a distance of one meter from any UPS operator surface shall not exceed 58dB, as measured on the A scale of a standard sound level meter at slow response.

C. Input surge withstand capability: The UPS shall be in compliance with IEEE C62.41, Category B.

1.6 WARRANTY

The UPS manufacture shall warrant to the original end user that the Uninterruptible Power Supply System sold by Mitsubishi Electric Power Products, Inc. (the “Product”) shall be free from defects in material and workmanship under normal use and service for a period of twelve (12) months from the date of installation or eighteen (18) months from the date of shipment of the Product, whichever comes first, at the premises of the original end user. For UPS units with installed batteries, the battery warranty is covered by the battery manufacturer.

1.7 QUALITY ASSURANCE

1.7.1 Maintainability

MTTR of the UPS shall not exceed one (1) hour/failure, including time to replace components.

1.7.2 Factory Test

A. The manufacturer shall fully and completely test the system to assure compliance with the specifications before shipment.
B. All UPS’s shall come equipped with one (1) factory test report included in the UPS enclosure. The factory test report shall include the following:

1. Series / kVA

2. Serial number
3. Date of test
4. Approved by / Inspected by / Tested by
5. Inspection of construction
6. Checking of wiring (Black/Red marking on each connection point)
7. Grounding continuity
8. Insulation strength test
9. Control circuit operation
10. Measurement of steady state characteristics (Voltage/ current/ efficiencies)
11. Transient characteristics (0-100% step load, AC input failure)
12. Overload testing
13. Transfer switch operation

PART 2 PRODUCT

2.1 ELECTRIC CHARACTERISTICS

The UPS shall have the following electrical characteristics:

2.1.1 UPS Output Capacity

The Diamond-UPS 1100 Series UPS is available in the following sizes:

kVA	kW
10	9
20	18
30	27
40	36
50	45

The UPS output capacities are in accordance with 0.9 PF.

2.1.2 Battery Capacity

A. Discharge time to end voltage: As specified minutes at full load, 25 degrees C (77 degrees F).

2.1.3 AC Input

A. Nominal input voltage: 120/208V.
B. Number of phase: 3 phase, 4 wire, plus ground.
C. Voltage range: +15%, -30%.
D. Synchronization voltage range: ±10% of nominal.
E. Frequency and range: 60Hz ±10%.
F. Frequency tracking range: 60Hz ±5% Maximum.
(Bypass synchronous range shall be selectable from 1% to 5% in 0.1% increments)
G. Power walk-in time: 10 seconds (0% to 100% load).
H. Power factor:
   1. 0.98 typical at 100% load.
   2. 0.98 typical at 50% load.

I. Reflected input current total harmonic distortion (THD):
   1. 4% typical at 100% load.
   2. 7% typical at 50% load.

2.1.4 AC Output

A. Nominal output voltage: 120V/208V.
B. Number of phase: 3 phase, 4 wire, plus ground.
C. Nominal dynamic voltage regulation:
   1. ±1% for balanced load.
   2. ±2% for unbalanced load.
D. Voltage stability: ±1%
E. Manually adjustable output voltage: ±3% range.
F. Voltage transient response:
   1. 100% step load: ±3%.
   2. Loss or return of AC input: ±1%.
   3. Retransfer from bypass to inverter: ±5%

   (Voltage transient response shall not exceed the above and shall recover to within nominal voltage regulation tolerance within 16.7 ms).
G. Frequency (inverter synchronous): 60 Hz (tracks frequency of static bypass source).
H. Free running output frequency (asynchronous): 60 Hz ±0.01%.
I. Frequency slew rate (inverter synchronized to static bypass): 1 to 5Hz/second (selectable).
J. Output voltage harmonic distortion:
   1. 2% maximum at 100% linear load.
   2. 5% maximum at 100% non-linear load.

   (Load power factor of 0.9. Crest factor 2.5)
K. Voltage phase angle displacement:
   1. ±1 degree for 100% balanced load.
   2. ±3 degrees for 100% unbalanced load.
L. Overload capability:
   1. 105% to 125% for 60 seconds (Voltage regulation maintained).
   2. 126% to 150% for 30 seconds (Voltage regulation maintained).
M. Fault clearing: Typically 1000% for 1 cycle (utilizing bypass source).

2.1.5 DC Input and Battery

1. Voltage: 288V DC nominal, 240V DC minimum.
2. Current ripple (normal operation): less than 5% of the battery AH at switching frequency.

   A. The Battery System shall be sized to provide the specified back-up time to the inverter when the UPS is supplying 100% rated load.
   B. The battery system shall be capable of operating in an average ambient temperature of 25°C, with excursions of 16°C to 32°C and shall be sized as follows:
      - Float Voltage: 327V DC (2.25 to 2.27 V/cell)
      - Final Voltage: 240V DC (1.67 V/cell)

2.1.6 Efficiency

Capacity (kVA)	Battery to AC				AC to AC			
	100%	75%	50%	25%	100%	75%	50%	25%
10	93.8	94.1	94.2	93.0	92.2	92.4	92.4	90.5
20	93.9	94.1	94.4	93.1	92.3	92.6	92.5	90.9
30	93.8	94.1	94.4	93.1	92.3	92.8	92.6	91.0
40	93.6	93.9	94.2	93.0	92.2	92.8	92.7	91.1
50	93.3	93.6	93.8	92.7	92.1	92.8	92.9	91.2

2.2 COMPONENTS

The UPS system shall be comprised of the following:

2.2.1 Power Converter Module

2.2.1.1 Converter Section

AC input, converter input contactor, input harmonic filter, and converter utilizing:

2.2.1.1.1 IGBT Converter

A. General

The Converter shall convert the incoming AC power into regulated DC power to supply the inverter input and system battery. The Converter shall utilize the following technologies:

a. Solid state Pulse Width Modulation (PWM) controlled Insulated Gate Bipolar Transistors (IGBT).
b. Input Power: Rated kVA at 1:1 ratio.
c. CPU based control logic.

B. Reflected Harmonic Content

The IGBT converter shall typically not introduce more than 4% reflected input current total harmonic distortion (THD) into the utility AC input source at nominal voltage and rated load. The reflected input current shall typically not exceed 7% THD at 50% load.

C. Automatic Input Power Walk-In

The converter logic and control circuit power walk-in function enables delayed and timed ramping of input current. Upon initiation of the power walk-in function, the ramping of current shall gradually increase the load for 10 seconds. This function is included as standard in the converter control circuitry.

D. Input Overcurrent Protection

Converter input fuse/contactor arrangement and the input current limit control shall provide converter protection against excessive input overload conditions.

E. Step Load Change Operation (0-100%)

In the occurrence of a 100% step load change, the Inverter shall draw power only from the converter to provide the required load demand. The system batteries will not be cycled at any time during a step load change.

F. Input Current Limit

The Converter logic shall limit the input current by limiting the AC input current. Three (3) line-side current transformers shall be employed as a means of sensing the current amplitude. The DC output current limit values are as follows:

a. Input current limit setting: 110% of nominal rated current.
b. The AC input current limit shall be set up so that the converter can provide sufficient capacity to the inverter at the rated load and have the capability to recharge a discharged battery.
c. The input current limit protects converter components from damage due to excessive input current.

G. Input Power Demand (Option)

The Converter logic and control shall also be capable of providing auxiliary current limiting when initiated by an external dry contact closure (e.g. in the event power demand is required when the UPS is fed from a generator).

Power Demand: Adjustable, maximum 110% of nominal rated current.

2.2.1.1.2 Charger/Booster

A. General

The charger/booster utilizes solid state Pulse Width Modulation (PWM) controlled Insulated Gate Bipolar Transistors (IGBT).

B. Battery Charge Current Limit

The converter logic and DC battery control circuit current limiting function enables controlled battery charging. The battery charge current limit will control the recharge current by reducing the converter output when the set limit is reached. The following battery current limit shall be provided as a minimum:

1. Battery charge current limit: 10% of battery Ah rate.
2. Maximum charge current: 25% ampere of UPS rated kVA (ex: 2.5A @ 10kVA).

C. DC Input Protection

The DC input fuse/contactor arrangement shall provide DC input protection against excessive input overload conditions.

D. Ripple Current

The DC (battery) bus RMS ripple current shall be less than 5% of the battery AH at

100% load at switching frequency.

E. Battery Self-Test (Diamond-Sense)

For a short duration, a small power discharge from the battery is automatically performed. From this small power discharge, the UPS module evaluates the degradation of the system battery. The following advantages are achieved:

1. The Diamond-Sense Battery Self-Test function can be performed even when the load is on inverter.
2. Due to the short duration and small power discharge, battery life expectancy is not effected.
3. The small power discharge has negligible effect on the overall battery backup time.
4. The small amount of power that is discharged by the battery will quickly be replenished.

The Battery Self-Test will automatically occur at a 720 hour interval. An event alarm will occur and be displayed if battery abnormalities are detected.

2.2.1.2 Inverter

A. General

The inverter shall generate AC power derived from DC power supplied from the converter or system battery. The inverter shall be capable of providing rated output, as specified, while operating from any DC voltage within the battery operating range. The inverter shall utilize the following technology:

1. Solid state PWM controlled IGBT power transistor modules
2. UPS Full Direct Digital Control (DDC) Adoption:

   a. Field Programmable Gate Array (FPGA) Control.
   b. CPU based Control

B. Voltage Regulation

The inverter output voltage shall not deviate by more than ±1% RMS with the following steady state conditions:

1. 0 to 100% loading.
2. Inverter DC input varies from maximum to minimum.
3. Environmental condition variations within the specifications defined herein.

C. Voltage Adjustments

The inverter shall have the ability to manually control and adjust the output voltage to within ±3% of the nominal value.

D. Voltage Transient Response

The dynamic regulation and transient response shall not exceed ±3% for a 100% step load (applied or removed), ±1% for a loss or return of AC input and ±5% for an inverter

to bypass transfer, and vice versa.

E. Transient Recovery

Voltage transient response shall not exceed the above specification and shall recover to its nominal voltage regulation tolerance within 16.7 ms.

F. Frequency Control

The inverter output frequency shall be controlled by an oscillator internal to the UPS logic. It shall be capable of synchronizing to an external reference (e.g. the bypass source) or operating asynchronously. A message located on the touch screen shall identify the loss of synchronization. Synchronization shall be continuously maintained at 60 Hz ± 0.01% for the duration of the loss of the external reference. The Inverter output frequency shall not vary during steady state or transient operation due to the following conditions:

1. 0 to 100% loading.
2. Inverter DC input varies from maximum to minimum.
3. Environmental condition variations within the specifications defined herein.

G. Output Voltage Harmonic Distortion

The inverter output shall limit the amount of harmonic content to 2% maximum at 100% linear load, and 5% maximum at 100% non-linear load. The need for additional filtering to limit the harmonic content shall not be required. Therefore, high efficiency, reliability and the original equipment footprint is maintained.

H. Output Overload Capability

The inverter output shall be capable of providing an overload current while maintaining rated output voltage (and voltage regulation) to:

105% to 125% for a 1-minute duration.
126% to 150% for a 30 second duration.

If the time limit associated with the overload condition expires or the overload is in excess of the set current, the load power shall be transferred to the bypass source without interruption.

I. Inverter Current Limit

The inverter output current shall be limited to 250% of the rated load current. Two current transformers in separate locations on the output (which operate separately, offering redundancy) shall be employed as a means of current sensing.

The inverter current limit protects inverter components from damage due to excessive over-current conditions (e.g. excessive load, faults and reverse current)

J. Inverter Output Isolate

The inverter output contactor isolates the inverter from the load and bypass source.

2.2.2 Bypass and Static Switch Module

The UPS contains an automatic bypass static switch circuit and associated bypass static switch transfer control circuitry.

A. General

A bypass circuit shall be provided as an alternate source of power other than the inverter. A high speed Thyristor switch and wrap-around contactor shall be used to assume the critical load during automatic transfers to the bypass circuit. The static switch and wrap-around contactor shall derive power from an upstream bypass feed contactor internal to the UPS. The wrap-around contactor shall be electrically connected in parallel to the static switch and shall, at the same time as the static switch, be energized and, upon closure, maintain the critical load feed from the bypass source. The static switch shall only be utilized for the time needed to energize the wrap-around contactor, therefore increasing reliability. The bypass circuit shall be capable of supplying the UPS rated load current and also provide fault clearing current capabilities. The UPS system logic shall employ sensing, which shall cause the static switch to energize within 150 microseconds. Therefore, this provides an uninterrupted transfer to the bypass source when any of the following limitations are exceeded:

1. Inverter output undervoltage or overvoltage.
2. Overloads beyond the capability of the inverter.
3. DC circuit undervoltage or overvoltage.
4. Final voltage of system battery is reached (bypass source present and available).
5. System failure (e.g. logic fail, fuse blown, etc.).

B. Automatic Retransfers

In the event that the critical load must be transferred to the bypass source due to an overload, the UPS system logic shall monitor the overload condition and, upon the overload being cleared, perform an automatic retransfer back to the inverter output. The UPS system logic shall allow a retransfer to occur only three times within a five-minute period. Retransfers shall be inhibited on the fourth transfer due to the likelihood of a reoccurring problem at the UPS load distribution. All retransfers will be inhibited if the inverter and static bypass line are not synchronized.

C. Manual Transfers

The UPS shall be capable of transferring the critical load to/from the bypass source via the front control panel. If performing manual retransfers to inverter or automatic retransfers, the UPS system logic shall force the inverter output voltage to match the bypass input voltage and then parallel the inverter and bypass sources providing a make-before-break transition allowing a controlled walk-in of load current to the inverter. Manual transfers will be inhibited if the inverter and static bypass line are not synchronized.

D. Static Switch

The static switch shall be a high speed transfer device comprised of naturally commutated Thyristors. The static switch is not required during manual transfers. The static switch shall not use fuses for protection.

2.2.3 Hot Swappable

The Power Converter module and Bypass module shall be a designed draw-out, hot swappable module.
Each module can be swappable under following conditions:

Module	Inverter supply	Bypass supply	Maintenance Bypass supply
Power Converter Module	✓	✓	✓
Bypass Module	✓		✓
Battery Module	✓	✓	✓

2.2.4 UPS Control and Monitoring

A. UPS Control and Monitoring operates and controls the converter, inverter and automatic bypass static switch circuit.

B. The UPS control circuitry utilizes Microprocessor (CPU) and Field Programmable Gate Array (FPGA), which create advanced controllability and simplifies the control circuit. Direct Digital Control (DDC) utilizing CPU and FPGA ensures high reliability, as well as superior functionality and performance.

C. The UPS Control power supply employs a redundant design configuration, utilizing the UPS AC input (utility), Bypass input and Inverter output, therefore enhancing reliability.

2.2.5 Operation/Display Panel

The control panel shall employ the use of a 3.4" touch screen interface, which allows the lock-out of all UPS control functions for security (the Emergency Power Off function shall not be locked out). The operator interface shall provide the following:

1. UPS start-up procedure
2. UPS shutdown procedure
3. Emergency Power Off (EPO)
4. Audible alarm silence
5. System status levels

The UPS shall be provided with a control/indicator panel. The panel shall be on the front of the UPS module. Controls, meters, alarms and indicators for operation of the UPS shall be on this panel.

2.2.5.1 Graphic Operator Terminal 3.4" Liquid Crystal Display (LCD):

A. The LCD touch screen interfaces with the UPS system control and main processor board to provide menu-driven operator instructions and system operation details. The LCD indicates system operation, operational guidance, measurement data, set up data and alarm messages and logs. All metering shall be digitally displayed on the LCD with an accuracy of 1% or better.
B. The touch screen area is composed of one MAIN sheet and eight MENU sheets: MAIN, METER, OPERATION, STATUS LOG, BATTERY LOG, SETUP, power converter module STATUS, CURRENT and FAULT LOG.

1. MAIN Sheet: The MAIN sheet indicates power flow and measured values. The LCD panel allows the user to verify the status and operation of the UPS components by the mimic display. The following information is available on the MAIN Sheet:

   a. Converter operation
   b. Battery operation
   c. Load on inverter
   d. Load on bypass
   e. Typical measurement values of Input, Bypass, Battery and Output
   f. Alarm/Fault messages

2. METER Sheet: The METER sheet indicates measured values. The following display information is available on the METER sheet:

   a. Input Voltage and Frequency
   b. Battery Voltage and Charging/Discharging Current
   c. Output Voltage, Frequency and Current
   d. Output Active Power
   e. Output Power Factor

3. OPERATION Sheet: The OPERATION sheet prompts the user to select a specific performance:

   a. The Power Converter Module Start
   b. The Power Converter Module Stop
   c. Load transfer to Bypass
   d. Load transfer to Inverter

4. STATUS MENU Sheet: The STATUS MENU Sheet indicates event and alarm/fault information. A maximum of 100 events can be displayed. The following alarm/status information shall be available as a minimum:

   a. Load on Inverter
   b. Load on Bypass
   c. System Startup
   d. System Stop
   e. Manual Transfer
   f. Manual Retransfer
   g. Each Power Converter Module Operation
   h. Minor Fault Data
   i. Major Fault Data

2.2.5.2 LED indication

A. The Bypass Module Operation/Display Panel contains the following LED indication:

   a. Load on Inverter (Green)
   b. Battery operation (Yellow)
   c. Load on Bypass (Yellow)

d. Fault (Red)

B. The Power Converter module contains the following LED indication:

a. Inverter operation (Green)
b. Converter operation (Red)
c. UPS Fault (Red)
d. Control Power 24V

2.2.5.3 Emergency Power Off (EPO) Button

The UPS shall be provided with a set of terminals, which may connect to a remote EPO contact signal. Remote contact shall be non-powered and normally open. The UPS shall also have a unit-mounted EPO button.
When the UPS EPO button is activated, the EPO function shuts down the UPS. The EPO function can be performed both locally or remotely. When EPO is performed, all system UPS's will be shutdown and the critical load will be dropped.

2.2.6 Interface/Diagnostics

2.2.6.1 Controlled Operator Guidance

The UPS microprocessor logic shall, as standard equipment, provide menu-driven operator instructions detailing the operation of the UPS system. The instruction menu shall be accessible via an LCD touch screen display located at the control panel. The microprocessor shall monitor each step, thus prompting itself to the next set of instructions. The following instructions shall be available as a minimum:

a. Inverter stop
b. Inverter start
c. Transfer of critical load to static bypass source

2.2.6.2 Controlled Diagnostics

The UPS shall provide microprocessor-controlled diagnostics capable of retaining fault alarms along with metering parameters in the event of a UPS failure. The microprocessor memory data shall be viewed via an LCD display or LED located at the control panel. The following alarm/status information shall be provided as a minimum:

a. Load on Inverter
b. Inverter Operation
c. Battery Operation
d. Battery Low Voltage
e. Output Overload
f. Battery Depleted
g. Battery Temperature Abnormal (with status input contact)
h. Converter Operation
i. Converter Input Out of Range
j. Inverter Running Asynchronously
k. Load on Bypass
l. Static Bypass Input out of Range

m. Minor Fault
n. Major Fault

2.2.7 UPS Status and Function Interfacing

2.2.7.1 Output Contact

The internal UPS logic shall have Major fault, 12VDC power supply, and (optional) a programmable set of seven (7) normally open, A-type dry contact outputs to allow user interfacing of the UPS operating status. The available parameters are identical to the alarm and status information schedule itemized the following.

a. Load on Bypass
b. Load on Inverter
c. Battery Operation
d. Converter Operation
e. Battery Low Volt.
f. Overload
g. Summary Alarm

2.2.7.2 RS 232 Communication

External communications are provided using Lookups. Refer to the Lookups technical manual U-ENM00017 for details. Field installed, and field tested RS 232 additions shall not be accepted.

2.2.7.3 Input Ports

The UPS shall have EPO (Emergency Power Off) and (optional) four (4) selectable input ports. The selectable input ports include the following parameters:

a. Load on Inverter (Remote transfer operation from Bypass to Inverter)
b. Load on Bypass (Remote transfer operation from Inverter to Bypass)
c. Battery Temp. High
d. Power Demand
e. Trace Trigger

2.2.8 (Option) Remote Status Alarm Panel

The UPS manufacturer shall offer a Remote Status Alarm Panel (RSAP), which shall not allow any control over the UPS. The RSAP shall have, as standard equipment, a battery backup feature, which allows it to continue monitoring UPS status conditions during power outage situations. Ride through shall be for a minimum of 8 hours. The RSAP shall act only as an annunciation panel, providing the following alarms/indications as a minimum:

a. Remote Start
b. Converter on
c. Load on Inverter
d. Load on Bypass
e. UPS Failure
f. Output Overload

g. UPS in battery back-up mode
h. Low battery while in back-up mode

2.3 MECHANICAL DESIGN

2.3.1 Cabinet Structure (Enclosure)

A. The enclosure shall be primed and painted with the Munsell N1.5 (black) color. The enclosure shall be a free standing floor mount design. The enclosure panels shall consist of non-flammable plastic. The inside cover and frame shall consist of minimum 16 gage (1.5mm) steel for maximum strength and durability.

B. The UPS shall be installed in cabinets of heavy-duty structure, meeting with NEMA standard for floor mounting. Caster with locking point and leveling feet shall be included as a standard feature. Operating controls shall be located on the front of the Bypass module. Input, output, and external battery cables shall be installed through the bottom of the cabinet.

2.3.2 Serviceability

The UPS shall have front access for all servicing adjustments and connections for maintenance or service only. Side or rear access shall not be accepted. The UPS shall be designed such that its sides can be pressed against side and rear walls.

2.3.3 Ventilation

Forced air cooling shall be provided to allow all components to operate within their rated temperature window. Forced air shall be provided with redundant high quality fans. All air inlets use air filters that shall be removable from the front of the UPS without exposure to any electrical hazards. Air filters shall be front-cover mounted to prevent floor dust from being sucked into the unit.

PART 3 EXECUTION

3.1 SITE PREPARATION

The owner shall prepare the site for the installation of the equipment.

3.2 INSTALLATION

A. The UPS shall be set in place, wired and connected in accordance with the approved installation drawings and owners / technical manual delivered with the equipment.

B. The equipment shall be installed in accordance with local codes and the manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

A. The equipment shall be checked out and started by a customer support representative from the equipment manufacturer. Visual and mechanical inspection of electrical installation, initial

UPS startup and operational training shall be performed. A signed service report shall be submitted after equipment is operational.

B. The following inspection and test procedures shall be performed by field service personnel during the UPS startup:

1. Visual Inspection
   a. Ensure that shipping members have been removed.
   b. Ensure that interiors are free of foreign materials, tools and dirt.
   c. Check for damage (dents, scratches, frame misalignment, damage to panel devices, etc).
   d. Check doors for proper alignment and operation.

2. Mechanical Inspection
   a. Check all the power wiring connections for tightness.
   b. Check all the control wiring connections for tightness.

3. Electrical Inspection
   a. Check input and bypass for proper voltage and phase rotation.
   b. Check battery for proper voltage and polarity.

4. Start-up
   a. Energize the UPS.
   b. Check the DC output voltage and inverter output voltage.
   c. Check the inverter output voltage on battery operation.
   d. Check for the proper synchronization.
   e. Perform manual transfers and returns.

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