Digital ProcessPower® (DPP) Series Uninterruptible Power Supply (UPS) Specification

1 & 3-PH Systems

Specification #: DPP-001-SPEC
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1.0 General System Parameters

1.1 Scope

This specification describes a continuous duty solid-state on-line, uninterruptible power supply (UPS). AC power is converted to DC power by a rectifier/charger section, which provides power to operate the inverter and keep the batteries fully charged. The inverter then converts the DC power back to clean, conditioned AC power. The UPS shall operate in conjunction with the existing building/plant electrical systems to provide high quality power to the critical load

1.2 UPS Type

Float Configuration, Double Conversion UPS Design (AC to DC to AC), Reverse Transfer Type

1.3 UPS System Components

Input Isolation Transformer
Rectifier/Charger
PWM Inverter
Output Isolation Transformer
Static Transfer Switch
2-Position Manual Bypass Switch

1.4 Codes and Standards

Unless noted otherwise, the design, fabrication, testing, and performance of the system shall be in accordance with the latest revisions of the following industry/agency standards and codes, where applicable:

UL 1778 - Uninterruptible Power Supply Equipment
NEMA – PE1 - Uninterruptible Power Systems
American National Standards Institute (ANSI)
National Electric Code (ANSI/NFPA 70)
Institute of Electrical and Electronic Engineers (IEEE)

2.0 Operation

2.1 Normal Mode Operation

Utility power shall be connected, via a dry-type input isolation transformer, to the input of the rectifier/charger module. An alternate AC supply shall be connected to the static switch and to a mechanical bypass switch. Under normal conditions the battery charger supplies regulated DC power to a battery and to an inverter whose conditioned power output supplies either 1 or 3-phase power, via an output isolation transformer, to the critical load.

2.2 Emergency Mode Operation

In the event of AC power or the battery charger failure, DC power from the battery shall be automatically fed to the inverter without switching and without interruption of the output power from the inverter. Upon restoration of AC power, the charger shall automatically supply the input to the inverter and the battery.

2.3 Recharge

Upon restoration of AC power (provided a Low DC Disconnect has not occurred), the rectifier/charger shall automatically supply the input to the inverter and recharge the battery. If a Low DC Disconnect has occurred, a manual closing of the Inverter's DC input breaker must be performed to recharge the batteries. The inverter will automatically start when inverter conditions are normal.

2.4 Bypass Mode Operation

In the event of UPS inverter failure, the static switch shall automatically transfer the load to the alternate AC source without an interruption of power to the load. Transfer back to the inverter shall be accomplished by automatically

synchronizing the UPS inverter to the alternate line and then transferring the total connected load in one step to the inverter via the static switch. All transfers and re-transfers shall be automatic unless manually overridden.

2.5 Operation Without Battery Mode Operation

If the battery is taken out of service, the UPS inverter shall continue to meet the entire performance criterion specified with the exception of emergency mode operation.

2.6 Mantenance Bypass Mode Operation

The maintenance bypass switch of the UPS shall perform a make-before-break transfer of the entire load from the UPS to the alternate AC line, and from the AC line back to the UPS. The synchronization of the alternate AC line and the UPS shall be accomplished by the UPS, provided the alternate AC line is within the capture range of the UPS synch circuitry. In the bypass position, the bypass switch shall completely isolate all elements of the UPS from the output and the alternate AC line.

3.0 Rectifier/Charger

3.0 Function

Incoming AC power shall be converted to regulated DC output by the rectifier/charger. The rectifier/charger shall be a constant potential, phase-controlled, solid-state type with constant voltage and current control circuitry. The components within the rectifier shall be capable of operating independently from the remaining system. Under normal input to the rectifier/charger, the battery bank may be disconnected from the system without affecting the inverter output.

3.1 AC Input Voltage, Phase, Frequency

See data sheet DPP-001-DATA.

3.2 Input Voltage Range

Input voltage can deviate by ±10% without resulting in a degradation of the charger's stated operational capabilities. The charger can handle inputs as low as –15% without discharging the connected battery.

3.3 Input Frequency Range

Input frequency can deviate by ±5%.

3.4 Inrush Current

Inrush current shall be limited to 800% of nominal full load current.

3.5 Input Power Factor

The input power factor shall be a minimum of 0.75 at nominal input voltage, frequency, and at full-rated load.

3.6 Input Current THD

25-35% at the rectifier/chargers input terminals @ full load and nominal system conditions.

3.7 Input Voltage Harmonic Distortion

<5% at the rectifier/chargers input terminals @ full load and nominal system conditions.

3.8 Input Surge Withstand Capability

Meets ANSI C62.41 Category A and B.

3.9 Phase Failure/Improper Phase Rotation

The AC input to the Rectifier/Charger shall be insensitive to phase rotation. The AC input shall be completely isolated from the static bypass circuit. The Rectifier/Charger shall be capable of supplying 66% of its rated load with the loss of one of its three phase inputs.

3.10 AC Input Isolation Transformer

An isolation transformer complete with an electostatic shield for noise suppression shall be supplied. The delta-wye three-phase transformer shall be wound with copper wire and use a UL recognized 200°C insulation system.

An epoxy based insulating varnish shall be applied with a VPI (Vacuum Pressure Impregnation) system to insure a low temperature rise over the 20-year design life of the transformer.

3.11 Current Walk-In

Charger assumes full load over a 5 sec walk-in period. This period is not adjustable.

3.12 Current Limiting/Charger Capacity

The rectifier/charger shall be equipped with electronic current-limiting circuitry to limit the DC output current to 100% of the full load output current rating.

The rectifier/charger shall have sufficient capacity to support the total connected load and recharge the system's fully discharged battery at the equalize condition to 90% of full capacity within 8-10 times the specified discharge period of the battery.

3.13 Output Voltage

See data sheet DPP-001-DATA.

3.14 Output Regulation

The rectifier/charger's output steady state voltage shall not change by more than ±0.5% at its output terminals from no load to full-rated load, with input voltage variation of ±10% and input frequency variation of ±5%.

3.15 Output Voltage Adjustability – Float Mode

+/-5% - Programmed via the touch screen LCD Panel. All syetem set points are password protected.

3.16 Output Voltage Adjustability – Equalize Mode

+/-5% - Programmed via the touch screen LCD Panel. All syetem set points are password protected.

3.17 Ripple

The output ripple shall be less than 2% RMS when connected to a battery bank having an eight hour, ampere hour rating of at least four (4) times the full load ampere rating of the battery charger. Ripple shall be measured as prescribed by NEMA PE 5 at nominal load and line conditions.

3.18 AC to DC Efficiency

AC-DC efficiency of the rectifier/charger shall be 92%-94% at nominal line and load conditions.

3.19 Automatic Equalize w/Batt. Current Monitoring

If this feature is enabled in the software. The Charger will be automatically placed in equalize mode after a battery discharge of 5 minutes duration. AC Input voltage failure is monitored to determine the length of equalization. Equalize mode is terminated (back to float) when battery current from the charger drops to a preset limit.

3.20 Manual Equalize

Charger can be manually placed into a equalize mode. An internal 0-99 Hour electronic timer shall be provided to manually place the charger into a high voltage equalize mode for a specific amount of time and then automatically return it to its normal float mode when the time has elapsed. At anytime during the manual equalize process the charger can be manually returned to float mode operation by pressing the "Float" button on the front control panel. This feature can be enabled or disabled via software.

3.21 Rectifier Bridge Protection

The rectifier semiconductor devices shall be protected by fast acting fuses. These fuses are located on the secondary side of the input transformer.

4.0 Inverter

4.1 Inverter Technology

Regulated DC power shall be converted to AC power by a Pulse-Width-Modulation (PWM) type inverter. The inverter shall supply AC power continuously to the critical loads.

The inverter shall be equipped with circuitry to provide constant AC voltage regulation and transient response.

4.2 DC Input Voltage

See data sheet DPP-001-DATA.

4.3 DC to AC Efficiency

DC-AC efficiency of the inverter shall be 85-87% for systems with 120V (nominal) DC bus voltages and 87-89% for systems with 240V (nominal) DC bus voltages at nominal input and output conditions.

4.4 DC Input Range

See data sheet DPP-001-DATA.

4.5 Load Power Factor

See data sheet DPP-001-DATA.

4.6 Output Voltage

See data sheet DPP-001-DATA.

4.7 Output Phase & Wires

See data sheet DPP-001-DATA.

4.8 Voltage Regulation – Balanced Loads

Single-Phase Outputs – +/-1% three-phase RMS average for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor specified herein.

Three-Phase Outputs – +/-1% three-phase RMS average for balanced three-phase load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor specified herein.

4.9 Voltage Regulation – 100% Unbalanced Loads

Single-Phase Outputs – Not Applicable.

Three-Phase Outputs – +/-3% three-phase RMS average for 100% unbalanced load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor specified herein.

4.10 Phase Seperation – Three-Phase Systems Only

100% Balanced Loads - 120° ±1 ° of nominal
100% Unbalanced Loads - 120° ±3° of nominal

4.11 Output Voltage Adjustability

The inverter output voltage can be adjusted ±5% via the touch screen LCD display. All system set points are password protected.

4.12 Output Frequency

See data sheet DPP-001-DATA.

4.13 Frequency Control and Regulation

The output frequency of the inverter shall be controlled by a crystal controlled oscillator, which can be operated as a free-running unit or as a slave for synchronized operation with a separate AC source. The inverter shall track the AC reference source (either 50 or 60 Hz) provided it is within the programmed tracking range. Programmable values range from 0.5% to 8%, default value is 0.5%. Upon failure or excessive frequency deviation of the reference the oscillator shall automatically revert to its free-running mode. In free running mode the inverter's output frequency (either 50 or 60 Hz) shall not deviate by more ±0.1% for any combined variation of input voltage, connected load, battery voltage, ambient temperature, and load power factor specified herein.

4.14 Slew Rate

The inverter frequency rate of change shall not exceed the programmed tracking range when synchronizing to the bypass source. Programmable values range from 0.25Hz/s to 4 Hz/s; the default value is 1 Hz/s.

4.15 Harmonic Distortion

The inverter shall limit the total harmonic distortion of the output voltage to less than 3% total with a 100% linear load and less than 5% with a 100% non-linear (switch-mode) load.

4.16 Crest Factor

The inverter shall be capable of supplying non-linear loads exhibiting a crest factor or up to 3.0 at full load without additional filtering or over sizing.

4.17 Power Factor Corrected Loads

The inverter shall be capable of supplying power factor corrected loads, up to 100% of the inverters rating, without additional filtering or over sizing.

4.18 Overload Rating

The inverter shall be capable of supplying loads up to and including 100% of its rating on a continuous basis for all combined variation of input voltage, connected load, battery voltage, ambient temperature, and load power factor specified herein. The inverter shall be capable of supplying loads up to 125% of its rating for a period of 10 minutes, 150% for a period of 1 minute or 300% for 50milliseconds without transfer to the bypass source.

4.19 Transient Response

The inverter voltage transient response shall not exceed ±5% due to a 0%-100% or 100%-0% step load change.

4.20 Transient Response Recovery

The inverter voltage, shall return to within ±1% of the steady state output voltage within 50 milliseconds.

4.21 Load Power Factor Range

The inverter shall be capable of handling linear loads of 0.8 – 1.0pf and non-linear loads with a 0.7 to 1.0 harmonic pf while maintaining +/-1% regulation.

4.22 DC Input Transient

The DC input shall include an input filter to suppress externally generated DC transients and to control inverter switching transients at the battery. Filtering shall be designed to suppress transients of 4000 volts, with a 10 microsecond duration, occuring at the inverters DC input terminals.

4.23 Low DC Disconnect

When the DC voltage falls below a predetermined set point, the Inverter drive will shut off, protecting the Inverter bridge, and the battery input circuit breaker will shunt trip open. The static switch will automatically transfer, to the bypass source.

4.24 Inverter Bridge Protection

When the inverter gate drive sense an IGBT de-saturation condition, it will automatically turn off all gate signals and automatically and seamlessly transfer the load to the bypass source.

The inverter semiconductor devices are further protected by fast acting fuse on the DC input bus to prevent cascading failures.

4.25 Output Isolation Transformer

An isolation transformer complete with an electostatic shield for noise suppression shall be supplied on the output of the inverter. The transformer shall be wound with copper wire and use a UL recognized 200°C insulation system.

An epoxy based insulating varnish shall be applied with a VPI (Vacuum Pressure Impregnation) system to insure a low temperature rise over the 20-year design life of the transformer.

5.0 Static Transfer Switch

5.1 Static Switch Design

Consists of two pairs of silicon controlled rectifiers (SCRs) per phase with each pair connected in inverse parallel (back-to-back). One set of SCRs shall be connected to the inverter while the other set of SCRs is connected to the bypass power source. The outputs of the two sets of SCRs shall be connected together and shall furnish power to the critical loads.

A independent watchdog circuit is integrated into the SCR gating logic to provide a fail safe (fail to bypass) operation in the event of microprocessor failure.

5.2 Static Switch Rating

At a minimum the static transfer switch SCRs shall be rated to handle the following overload conditions:

125% - Continuously
150% - 10 Minutes
200% - 1 Minute
400% - 1 Second
1000% - 50 milliseconds

5.3 Uninterrupted Transfer

The static switch shall automatically transfer the critical load after the control logic senses any of the following conditions:

1. Inverter Failure
2. Inverter Overload
3. Inverter Output Over/Under Voltage
4. High or Low DC Disconnect
5. Manual Transfer via front panel push button

5.4 Transfer Lockout

The transfer logic shall not allow a transfer to the bypass source if one of the following conditions exists:

1. Bypass source out of sync with inverter output
2. Bypass source not available – Bypass voltage less than 70% on nominal.

Exception – Transfers initiated on an inverter failure or a high/low DC disconnect condition are permitted by the system regardless of the bypass sources condition.

5.5 Transfer Time

The sensing and transfer times of the static switch in either direction shall not exceed 4 milliseconds (ms). Manual transfers shall be make-before-break.

5.6 Automatic and Manual Retransfer

An electronic toggle is included to enable or disable the static switch's auto re-transfer mode of operation. This toggle is included as part of the touch screen LCD display. All system set points are password protected.

5.6.1 Uninterrupted Automatic Retransfer

The static switch will automatically retransfer the load to the inverter following an overload condition if the following conditions are all true:

1. Auto-Retransfer is enabled
2. Bypass and Inverter sources are in-sync
3. An overload condition no longer exists on the inverter
4. Auto-retransfer time delay has expired

If any of these conditions are not fulfilled the static switch will not retransfer the load back to the inverter.

Transfers to the bypass source caused by inverter failure, inverter high or low output voltage, high or low DC disconnects, or manually initiated by the user will not be available for automatic retransfer back to the inverter.

Retransfer back to the inverter after these events must be accomplished manually. Logic is provided to prevent manual retransfer if the failure condition(s) still exist or if the bypass and inverter are out-of-sync.

5.6.2 Uninterrupted Manual Retransfer

If the auto retransfer mode of operation is disabled, then all transfers between the bypass source and inverter must be manually initiated.

5.7 Auto Re-Transfer Delay

The auto re-transfer time delay is factory set at 30 seconds, but can be for any value between 1 – 999 seconds. This value is set via the touch screen LCD display.

6.0 Manual Bypass Switch

6.1 Integral Manual Bypass Switch

When specified in data sheet DPP-001-DATA, a two-position manually operated mechanical bypass switch, rotary type, shall be provided to facilitate system maintenance. In the bypass position, this switch and the static switch input breaker would isolate the static switch from the bypass source and connect the output directly to the bypass power source.

The manual bypass switch shall be mounted in the system enclosure to reduce interconnect wiring.

The manual bypass switch shall be of a "make-before-break" configuration to ensure absolute continuity of AC power to the critical U.P.S. loads during switch over.

The manual bypass switch shall not require the assistance of the static switch to insure a zero break load transfer.

6.2 Remote Manual Bypass Switch

When specified in data sheet DPP-001-DATA, a remote manual bypass switch shall be provided in a separate enclosure to be mounted remotely from the UPS cabinet. This three-position switch shall allow the load to be connected to the bypass source and shall isolate the entire UPS system.

The manual bypass switch shall be of a "make-before-break" configuration to ensure absolute continuity of AC power to the critical U.P.S. loads during switch over.

The manual bypass switch shall not require the assistance of the static switch to insure a zero break load transfer.

6.3 Switch Ratings

At a minimum the bypass switch (integral or remote) shall be rated to handle the following overload conditions:

125% - Continuously
150% - 10 Minutes
200% - 1 Minute
400% - 1 Second
1000% - 50 milliseconds

7.0 Accessories

7.1 LCD Touch Screen Display

The display shall be a graphics monochrome display of 320 x 240 pixels. The display shall support a character set with the maximum characters displayed being 40 by 30.

The display is used to communicate voltages, alarms and system statuses. All UPS operation control is accomplished through the membrane switch keypad. This ensures that controls are available in the event the display fails.

7.2 Alarms

The following lists the alarms that are provided as part of the supplied UPS system(s).

Charger Fan Failure – One or more of the fans providing cooling for the rectifier/charges heat sink has failed.

Inverter Fan Failure – One or more of the fans providing cooling for the inverter heat sink has failed.

ST/SW Fan Failure – One or more of the fans providing cooling for the static transfer switch heat sink has failed.

Charger Bridge Over Temperature – The charger bridge heat sink operating temperature has exceeded 95°C. The charger shall shutdown under this condition and the inverter load will be supplied via the battery system.

Inv. Bridge Over Temperature – The inverter bridges heat sink operating temperature has exceeded 95°C. The inverter shall shutdown under this condition and the AC load will be supplied via the bypass power source.

ST/SW Bridge Over Temperature – The static transfer switch bridges heat sink operating temperature has exceeded 95°C.

AC Power Supply Failure – AC power source to the Power Distribution Board (PCB16) has failed.

DC Power Supply Failure – DC power source to the Power Distribution Board (PCB16) has failed.

Charger Loss of Communication – Communication between the rectifier/charger control board and the display interface board has failed.

Inverter Loss of Communication – Communication between the inverter control board and the display interface board has failed.

ST/SW Loss of Communication – Communication between the static transfer switch control board and the display interface board has failed.

Relay Communication Down – Communication between the relay board and the display interface board has failed. PCB 19 provides the relays and terminal strips for the first eight standard and customizable NO-NC contacts for remote system indication.

ST/SW SCR Failure – One or more of the SCR's that make up the bypass side of the static transfer switch has shorted.

Charger Failure – Charger output DC voltage has deteriorated to a level inconsistent with proper system function.

Inverter Failure – The inverter is no longer capable of supporting the load.

Bypass Failure – The bypass power source voltage has deviated by more than 30% (low).

Battery Discharging – The UPS battery or the connected station battery (rectifier configurations) is supplying the inverter's DC requirements.

Low DC Voltage – The DC bus voltage has dropped below the low DC voltage alarm point.

Low DC Disconnect – The DC bus voltage has dropped below 1.75 volts per cell. Under this condition the battery breaker will shunt open.

Battery Breaker Open – Battery input breaker has been opened automatically (battery has reached end of discharge level) or manually.

Inverter Low Voltage – The inverter voltage has gone outside of operational boundaries for more than ¼ cycle.

IGBT Desaturation – A potentially damaging AC voltage has occurred across the inverter's IGBT bridge. The inverter shall shutdown under this condition and the AC load will be supplied by the bypass power source, via a static switch transfer.

Overload Shutdown – The inverter has shutdown due to an overload condition.

Bypass Supplying Load – The bypass power source is now supplying the load.

Retransfer Blocked – The static transfer switch has attempted three successive unsuccessful re-transfers back to the inverter and has locked onto the bypass power source.

7.3 Indicators

The following lists the indicator lights and lighted push buttons that are provided as part of the supplied UPS system(s).

UPS Normal – GREEN LED – system is running normally

UPS Trouble – RED LED – system is running abnormally and is an alarm condition.

Float – GREEN Push Button Mounted LED – charger is operating in float mode.

Equalize – AMBER Push Button Mounted LED – charger is operating in equalize mode.

Inverter to Load – GREEN Push Button Mounted LED – load is supplied via the inverter.

Bypass to Load – AMBER Push Button Mounted LED – load is supplied via the bypass source.

7.4
7.5 Alarm Relays

Alarm relay are rated 120VAC @ 3 amps. The following lists the alarm relays that are provided as part of the supplied UPS system(s).

UPS Trouble – All UPS alarm conditions.

Bypass Supplying Load – Bypass power is supplying the AC load.

Loss of Communications – Any of the systems communications have failed.

7.5 Measurements

The following lists the measurements that are provided as part of the UPS system(s):

Battery Voltage
Battery Current (+ = Charging, - = Discharge)
Rectifier Current
AC Output Voltage
AC Output Current
AC Output Frequency

7.6 Ciruit Breakers and Semiconductor Protection

The protective devices shall not be activated when the system is started under any normal operating conditions.

AC Input Circuit Breaker – A front access molded case breaker shall be provided for charger/rectifier disconnection and overload protection. The A.I.C. rating of the breaker shall be 10KA minimum.

Bypass Circuit Breaker – A front access molded case breaker shall be provided for Bypass disconnection and overload protection. The A.I.C. rating of the breaker shall be 10KA minimum.

Battery Input Circuit Breaker – A molded case breaker shall be provided for DC input disconnection of both input lines and overload protection. The A.I.C. rating of the breaker shall be 10KA minimum.

Semiconductor Fuses – The semiconductors shall be protected from cascaded failure with special fast acting fuses.

8.0 Testing

8.1 Shop Testing

The system testing shall be in accordance with the latest revision of AMETEK Solidstate Controls test procedure #01-191011. A copy of this test procedure is available upon request. Test data shall be supplied to verify test results.

9.0 Environmental Conditions

9.1 Acoustical Noise

The audible noise generated by the unit under rated operating conditions shall not exceed 65 - 72 dBA at a distance of 1.5 meter (typical) from any side of the enclosure and 3 feet above ground. The sound levels shall be measured with the unit operating at rated load, voltage and frequency. Note: addition of a drop/drip shield may increase audible noise by 1-3 dB.

9.2 Temperature

The system shall operate at rated output, without any adverse affects, in an ambient temperature of 0°C to 40°C.

9.3 Humidity

The system shall operate at a relative humidity of 5% to 95% non-condensing for a temperature range of 10°C to 40 °C.

9.4 Altitude

The system shall operate at any altitude from sea level up to 3300 meters (10,000ft) without de-rating.

9.5 Storage Temperature

The system shall be designed for storage temperatures –20°C to +70°C. Prolonged storage (>1 Year) will result in electrolytic capacitor degradation.

10.0 General Requirements

10.1 Power Supplies

Two, redundant power supplies shall be provided. Power to the power supplies shall originate from any of the following sources: the rectifier/charger input, bypass input and battery input. Loss of any of the three power sources shall be displayed on the appropriate menu of the front panel display and be communicated to the operator through the closure of the systems' common trouble (summary) alarm, form "C" contact. The loss of an individual power supply shall also be alarmed via the front panel display and be communicated to the operator through the closure of the systems' common trouble (summary) alarm, form "C" contact.

10.2 Transformers

All power transformers or chokes shall be designed using copper windings for reliability and efficiency. The insulation type shall have a temperature rating of at least 200 C (UL 1446, Class N). An epoxy based insulating varnish shall be applied with a V.P.I. (Vacuum Pressure Impregnation) system to insure a low temperature rise over the 20-year design life of the transformer.

10.3 System Efficiency

The overall AC to AC efficiency shall be greater than 78-80% depending on KVA size, with the U.P.S. at full rated load and nominal input voltage.

10.4 Cooling

Forced-air cooling shall be provided when necessary to ensure that all components are operating at or below their specified operating temperature.

10.5 Wiring

PCB (printed circuit board) control wiring will be 22 AWG PVC ribbon cable. Control wires and power wires, depending on their capacity, will be cross-linked polyethylene. NEC, bulletin 70, and NEMA PE-1 and PE-5 wiring procedures shall be followed as applicable. Power wire for all equipment: 10 AWG through 4/0 is Switchboard cable type chemically cross-linked Polyethylene. Control wire 18 AWG through 14AWG for custom inverters is chemically cross-linked Polyethylene. Power wire: 262 MCM through 777 MCM for larger sizes of chargers and inverters is DLO 90C, 600-2000V Ethylene Propylene Rubber (EPR) inner jacket and a Hypalon outer jacket.

10.5.1 Wire Supports

Permanent wire supports shall be used; no adhesive backed wire supports shall be used.

10.5.2 Wire Marking

All point-to-point wires shall be marked with a permanent marking system on both ends of each wire.

10.6 EMI Suppression

Electromagnetic effects shall be minimized to ensure that computer systems, or other similar electronic systems, shall neither adversely affect nor be adversely affected by the system.

10.7 Nameplate Markings

The nameplate shall be located on the front inside display door and the following minimum information shall be provided on the nameplate:

1. AMETEK Solidstate Controls, Model # and Serial #
2. AC Input Voltage, Phase and Frequency
3. Rated AC Input Current
4. Bypass AC Input Voltage, Phase and Frequency
5. DC Input Voltage and Current
6. Rated Output Voltage, Amps, Frequency, Power Factor, KVA and KW.

10.8 MECHANICAL SPECIFICATIONS

10.8.1 Enclosure

The enclosure shall be a NEMA-1 (IP-20), free standing, with minimum 12GA framework. Door panels shall be a minimum of 14GA steel and side panels shall be a minimum of 18GA.

The enclosure shall be mounted on channels with a 3-inch lifting base open at the front and back to facilitate moving with a forklift and to provide an entrance area for air movement through the enclosure.

The enclosure shall be designed with blank plates on the sides and rear for installation against a wall. The equipment shall be designed to allow replacement or maintenance of all components from the front.

One or more hinged doors shall be provided in the front with door locks on each. Hinged panels, 36” and larger, shall be provided with a 2 point latching system for holding the panels securely. Removable covers shall be attached with machine screws.

10.8.2 Ventilation

Air inlets and outlets shall be protected by screens or perforated metal guards to prevent the entrance of a rod having a diameter of 0.5 inches or longer.

10.8.3 Cable Entry

Cable entry shall be through the top or bottom of the cabinet.

10.8.4 Power Connections

The connections to the AC output or DC input shall be of the stud type and shall be sized for full load service.

Alarm connections shall be sized to allow connection of 12AWG Wire maximum. The alarm terminal boards shall be rated for 300 VAC.

10.8.5 Parts Placement

The system shall be designed to permit front access to modules, fuses, and assemblies. Parts, test points, and terminals shall be placed so they are accessible for circuit checking, adjustment, and maintenance without removal of any adjacent assembly or component or pose a shock hazard.

10.8.6 Component Marking

All PCB's, indicator lights, meters, controls, semiconductors, and fuses shall be clearly marked with the component designation for ease of serviceability.

10.8.7 Personnel Safety

The cabinet shall be constructed so that all controls, except float/equalize, are operable with the doors closed, preventing exposure to high voltage terminals. High voltage warning labels shall be visible when any of the cabinet doors are opened.

10.8.8 Painted Surfaces

All external painted surfaces shall be ANSI 61 Gray enamel with a minimum of 2.0 mil thickness and shall be smooth with no runs, sags, or graininess.

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	Data Sheet for DPP Pulse-Width-Modulated (PWM) Uninterruptible Power Supply (UPS) System		Page 1 of 1

AC Input

Nominal Voltage (AC) -	☐ 480 V, ☐ 208 V, ☐ 380V, or ☐ _____ V
Input Range (%) -	±10% (+10% to –15% w/o discharging battery)
Phase -	3∅
Wire -	3 Wire
Frequency (Hz) -	☐ 60 Hz or ☐ 50 Hz
Fault Current Protection	☐ 14kA or ☐ 65kA

DC Input

Nominal Bus Voltage -	☐ 120VDC (60 Cells Lead Acid & 96 Cells NICAD) ☐ 240 VDC (120 Cells Lead Acid & 192 Cells NICAD) ☐ _____ VDC (_____)
Battery Type	☐ 20 Yr Wet (Lead Acid), ☐ 20Yr Valve Regulated (Lead Acid), ☐ 10 Yr Valve Regulated (Lead Acid) ☐ 20 Yr Nickel Cadmium (NICAD), ☐ Other
Float Voltage (VPC) -	☐ 2.25 VPC (Lead Acid Batteries), ☐ 1.45 VPC (NICAD Batteries)
Equalize Voltage (VPC) -	☐ 2.33 VPC (Lead Acid Batteries), ☐ 1.50 VPC (NICAD Batteries)
Battery End Voltage (VPC) -	☐ 1.75 VPC (Lead Acid Batteries), ☐ 1.09 VPC (NICAD Batteries)
Fault Current Protection	10kA – 120VDC bus and 20kA – 240VDC bus

Inverter AC Output

KVA Rating of Inverter -	_____ kVA
Load Power Factor Rating -	☐ 0.8 p.f. or ☐ 1.0 p.f.
AC Output Voltage -	☐ 120 V, ☐ 220 V, ☐ 240 V, ☐ 120/208 V, ☐ 277/480 V, ☐ 220/380 V, or ☐ _____/_____ V
Phase -	☐1∅, 2-Wire or ☐3∅, 4-Wire
Frequency (Hz) -	☐ 60 Hz or ☐ 50 Hz

Bypass Input

Input Voltage -	☐ 120 V, ☐ 220 V, ☐ 240 V, ☐ 120/208 V, ☐ 277/480 V, ☐ 220/380 V, or ☐ _____/_____ V
Phase -	☐1∅, 2-Wire or ☐3∅, 4-Wire 3∅
Fault Current Protection	☐ 14kA or ☐ 65kA

Manual Bypass Switch ☐ Integral or ☐ Remote

Additional Measurements (Via LCD Display)

- ☐ Input Power (AC Input Amps and Volts)
- ☐ Bypass Input Frequency
- ☐ Bypass Input Voltage
- ☐ Output Power (kVA, kW & Power Factor)
- ☐ % Inverter Loading
- ☐ Inverter Output Voltage

Additional Alarms (Via LCD Display)

- ☐ AC Input CB Open
- ☐ Low AC Input
- ☐ AC Input Failure
- ☐ Charger Fuse Blown
- ☐ Charger Overload
- ☐ Charger Failure
- ☐ Charger Available
- ☐ Battery Discharging
- ☐ Low DC Voltage
- ☐ Battery Near Exhaustion
- ☐ Low DC Disconnect
- ☐ High DC Voltage
- ☐ High DC Disconnect
- ☐ Positive to Ground
- ☐ Negative to Ground
- ☐ Battery CB Open
- ☐ Inverter Available
- ☐ Inverter Fuse Blown
- ☐ Inverter Voltage High
- ☐ Inverter Voltage Low
- ☐ Inverter Off Frequency
- ☐ Bypass Off Frequency
- ☐ Out-of-Sync
- ☐ Bypass Off Frequency
- ☐ Out-of-Sync
- ☐ ST/SW Fuse Blown
- ☐ Bypass Voltage Low
- ☐ Bypass Voltage High
- ☐ Bypass CB Open
- ☐ MBS to Bypass
- ☐ AC Output Voltage Low
- ☐ AC Output Voltage High
- ☐ AC Output Overload
- ☐ AC Output CB Open

Miscellaneous Features

- ☐ Drip Shield
- ☐ Environmental Coating of PCB's
- ☐ Rectified UPS Operation
- ☐ Charger Output Diode
- ☐ Parallel Charger Operation
- ☐ Lifting Eye Bolts
- ☐ Padlocks for System Circuit Breakers
- ☐ Lamp Test
- ☐ Latching Alarms
- ☐ EPO – Contact to Shunt AC, DC and Bypass CB's
- ☐ MODBUS RTU Communication
- ☐ Emergency System Indicators (ESI) Panel