

SECTION 26 3355 – BATTERY-FREE UNINTERRUPTIBLE POWER SUPPLY**PART 1 – GENERAL****1.01 SCOPE**

- A. Supply a single-conversion battery-free uninterruptible power supply system (UPS) as described herein that provides uninterruptible power within specified tolerances during failure or deterioration of the normal power supply.
- B. Include start-up services for all equipment.
- C. Rigging, installation labor and installation materials (including all interconnections between detached pieces of equipment) shall be the responsibility of others.

1.02 SYSTEM DESCRIPTION

- A. The Equipment shall include a single-conversion battery-free UPS Module (UPS) comprised of the following major elements integrated into a single unit:
 - 1. One power stage (MMU) containing input fuses, input contactor, static disconnect switch, integral flywheel energy storage subsystem (FES), bi-directional AC-to-AC converter (BDC), isolating choke and output contactor.
 - 2. An automatic non-interruptive static switch bypass with wrap around contactor and anti-backfeed protection.
 - 3. All controls and accessories necessary for the Equipment to function properly as specified.
- B. The UPS Module shall provide at least 27 seconds ride-through time at rated load without using chemical batteries.
- C. The UPS shall be rated 150 kVA / 120 kW.
- D. An external maintenance bypass (EBP) shall be available as an integrated part of the UPS module without increasing the cabinet size and shall be included when specified.

1.03 QUALITY ASSURANCE

- A. The UPS shall be tested at the factory for proper operation. The UPS module shall be functionally tested, and the MMU shall be burned in for a minimum of 48 hours. Copies of the factory test report and quality control program documentation shall be provided on request.
- B. The UPS module shall be listed and labeled by UL in accordance with the requirements of UL 1778. All other Equipment shall be listed and labeled in accordance with the applicable UL requirements.
- C. UPS shall design and construction shall conform to the following standards as applicable:
 - 1. UL1778, Standards for Uninterruptible Power Supply Equipment.
 - 2. UL1004, Electric Motors.
 - 3. FCC Rules and Regulations 47, Part 15, Subpart J, Class A.
 - 4. NEMA PE 1-1983 UPS Standard.
 - 5. IEEE 587-1980/ANSI C62.41 1980, Category A & B Recommended practice on surge voltages in low power circuits.
 - 6. NEC 2008
 - 7. OSHA safety standards for electrical equipment and service of electrical equipment.
 - 8. CSA C22.2 No.107.1 Commercial and Industrial Power Supplies.
 - 9. Industry Canada ICE-003, Canadian EMC.
- D. All Equipment shall be new and of current design and manufacture.

1.04 PROPOSAL

- A. Provide firm price and delivery lead-time measured from the date of order receipt for the Equipment and services in accordance with the requirements of this specification.

- B. Provide a paragraph-by-paragraph specification compliance that clearly identifies whether the proposed Equipment and services comply with the specification (Comply), comply with the intent of the paragraph and provide the performance specified but deviate in minor detail (Deviation), or do not comply, do not provide the specified performance or substantially deviate from the specification requirements (Exception). If the proposal complies fully with the requirements of a paragraph, the notation "Comply" shall be applied to the paragraph and no notations associated with that paragraph shall relieve the supplier from complying with the requirements of the paragraph. Any Deviation or Exception must be marked with the legend "Deviation" or "Exception", respectively, and explained sufficiently to allow the purchaser or its agents to clearly evaluate the effect and consequences of the Deviation or Exception.
- C. Include all other information required by this specification to be part of the proposal.

1.05 SUBMITTALS

- A. Provide general arrangement drawings showing all exterior dimensions, cable access, shipping splits, and clearances. Show sizes, weights, and relationships between individual shipping units, the location and designation of all field wiring termination areas, and the maximum number and permissible size range of power conductors which can be accommodated for each power termination, heat rejection, air flow, and location of air inlets and outlets.
- B. Provide assembly and mounting details for all Equipment and shipping splits.
- C. Provide electrical, mechanical, and environmental specifications for the proposed equipment. Also include this information in the bid.
- D. Provide the same paragraph-by-paragraph response to these specifications in sufficient detail to clearly show all deviations. Clearly identify any changes in this compliance compared to the compliance supplied with the proposal. The submittal may be rejected if it contains any deviations or exceptions not included in the proposal.
- E. Provide electrical one-line drawings showing all power and control interconnect wiring. Include number of conductors, power wiring amperages, arrangement and ratings of all protection devices, and

control wire size and type.

- F. Provide point-to-point interconnect drawings or wire lists detailing the termination points and terminal designations for all field wiring between equipment or shipping splits. This drawing will either contain wiring requirements or shall be keyed to the one-line drawing in a manner that clearly determines wiring requirements.
- G. Provide two copies of all drawings at least 30 days prior to shipment. Ship user manuals with equipment.

1.06 MANUALS

Provide 2 sets of user manuals containing safety, handling, storage, installation, operation and normal maintenance instructions. The manuals should also contain specifications, requirements, descriptions, and features for all equipment.

1.07 WARRANTY AND MAINTENANCE CONTRACT

The manufacturer shall warrant the Equipment against defect in workmanship and materials for one year from date of delivery to the initial end user.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

The approved manufacturer for the UPS is Active Power, Inc. No substitutions are permitted.

2.02 CONSTRUCTION

- A. All materials used shall be new, of current manufacture, high quality, free from defects and shall not have been in previous use except as required for factory testing.
- B. All Equipment except for any remote annunciation panels, remote EPO panels or computer monitoring equipment, shall be free-standing NEMA 1 construction or IEC equivalent. Remote annunciation panels and remote EPO panels shall be wall-mounted.
- C. Cable access shall be permitted from the top or bottom using raceway or conduit without modification.

- D. Construction of Equipment shall facilitate lifting and rigging. Clearance shall be provided in the base of Equipment to allow lifting by forklift from the front or rear. Means shall be provided to lift Equipment by crane without damage using slings and spreader bars provided by the installing or rigging contractor.
- E. All wiring shall be in accordance with NFPA 70, OSHA, and EN. All Connections shall be properly coated with anti-corrosion compound and torqued.
- F. All control wiring interconnections between shipping splits of a single piece of Equipment shall be supplied and fitted with connectors or fanning strips constructed and identified to prevent incorrect connection.
- G. All field control wiring terminations shall be made to terminal blocks or appropriate receptacles for plug-in connections. Receptacles shall have appropriate restraints to prevent plugs from loosening.
- H. All Power interconnections between shipping splits of a single piece of Equipment shall be supplied and equipped with termination or connection hardware.
- I. All components shall be marked at the field replacement level with the part designations shown on Equipment drawings and parts lists. Label all terminal blocks and other wiring termination means with a designation for the termination location and individual termination point within the location.
- J. PCBs shall not be used nor shall any components be used that require toxic or hazardous materials documentation for transportation.

2.03 UPS MODULE

A. DESCRIPTION:

The UPS Module shall be single-conversion design. The input to the UPS module shall be connected to a phase-controlled static disconnect switch through an input contactor and fuses. The output of the static switch shall be connected to the input of an isolating inductor and the output of the isolating inductor shall be connected to the load side of a BDC and to the MMU output contactor. The Other side of the BDC shall be connected to a FES. The output contactors of the MMUs shall connect to the output bus of the UPS module. An automatic bypass shall connect the input of the UPS

module to the output through a fused static switch with anti-backfeed protection and wrap-around bypass contactor.

B. OPERATION:

1. The UPS shall operate continuously while maintaining specified output power quality whenever the AC input power is within specified steady state limits. The UPS shall operate properly from turbo-charged diesel generators equipped with isochronous governors and three-phase sensing voltage regulators when they are rated to support the critical load at rated UPS power plus UPS losses and FES recharging power. The UPS shall not require over sizing of engine generator sets to accommodate UPS input harmonics.
2. In Normal Mode the MMU input contactor shall be closed and the static disconnect switch shall be on. The input source shall supply real power to the MMU to support the load and to keep the FES unit fully charged through its associated BDC. The BDC shall exchange reactive current with the input through the isolating inductor to regulate the output voltage. The BDC shall also supply the reactive and harmonic currents required by the load so that the UPS input source is not required to supply these currents. The static disconnect switch shall be phase-controlled to block reverse power flow from the BDCs to the input. UPS output voltage shall remain within 10 degrees of the input voltage during steady state operation at all load levels from no load to full load.
3. When input frequency or voltage deviates outside of predetermined limits, the static disconnect switch shall turn off and the MMU input contactor shall open. At the same time the bi-directional converter shall draw power from the FES unit to maintain power to the load without interruption and within specified tolerance. The load shall continue to be supplied by power from the FES unit until it is fully discharged or until the input returns within specified tolerance and the UPS resynchronizes and reconnects. UPS shall resynchronize in the direction of the smaller angular difference and the maximum frequency slew rate shall be adjustable to accomplish resynchronization from 180 degrees out of phase at a slew rate that can be set at between 0.3 and 3.0 Hz per second. The default slew rate shall be 1 Hz per second. When the UPS module reconnects to the input the power walk-in shall be linear and

without steps. After reconnecting to input power the UPS shall ramp the load from FES power to the input source. The ramping rate shall be adjustable from 240kW per second to 10kW per second..

4. If the input does not return within specified steady state limits before the FES unit is fully discharged, the UPS Module shall shut down without damage or fuse clearing. If bypass range checking is turned off, then the UPS will attempt an overlap transfer if power has returned but the unit has not synchronized when flywheel energy is exhausted. Bypass range checking shall be turned on as the default setting.
5. Except as noted in the preceding paragraph, transfers to and from bypass shall be synchronized and without interruption of load voltage or current. The UPS shall automatically transfer to bypass if it is overloaded, has insufficient MMU capacity remaining to support the connected load, or the output voltage deviates outside specified limits. In Normal Mode operation, the UPS shall transfer to bypass immediately if the load is greater than 200% of rated load. In Discharge Mode, automatic transfers to bypass shall be immediately initiated if the load is greater than 125% of rated load. Bypass transfers shall also occur for less severe overloads if the duration of the overload exceeds specified overload capability. Transfers to bypass shall be inhibited if the bypass is not within +/-10% of nominal voltage unless bypass range checking is turned off., in which case a transfer to bypass will be attempted whenever there is sufficient input voltage to operate the bypass.
6. The UPS Module shall be capable of fully recharging the FES units from maximum discharge in less than 2.5 minutes at the default rate. The recharge rate shall be adjustable to slower rates via afield programmable software setting.
7. The UPS shall accept an input from a normally open external potential-free contact to signal operation from a diesel generator or other alternate source. The UPS shall permit programming of a second set of operating parameters that are activated by the contact closure. These parameters shall include walk-in rate and FES recharge rate.
8. The UPS controls shall be programmable for either automatic or manual starting. When the key switch is in the Online position, automatic start shall cause the UPS to

initially energize the output through the bypass when power is applied to the input in either a black start condition or when restarting after the flywheel has fully discharged. Once the flywheel has been charged to at least 4000 rpm, the UPS shall transfer to Normal Mode and provide UPS protection to the load. If manual starting is programmed, then it shall be necessary to momentarily turn the key switch on the system cabinet to the Reset position and then turn it to the Online position to restart the system and place it in normal operating mode.

C. UPS MODULE CONSTRUCTION:

1. The UPS Module shall not require side or rear access or clearance for service or ventilation. All components shall be removable from the front and all normal service and adjustment shall also be from the front.
2. Equipment shall be constructed to fit through a normal doorway having clear dimensions of at least 35 inches wide by 79 inches high.
3. The UPS shall have modular, field-replaceable power electronic sub-assemblies for ease of maintenance in the field.
4. Proper forced-air ventilation shall be provided to ensure that all components operate within their specified temperature ratings. Fans shall be redundant so that any single fan failure shall not cause any component temperature to increase beyond acceptable limits, and shall not cause the UPS to shut down or operate at reduced capacity. All fans shall be equipped with fan failure sensors connected to an alarm on the UPS control panel.
5. Temperature sensors shall be provided to monitor internal UPS temperatures. Upon detection of temperatures that exceed the manufacturer's recommendations, a Notice Condition shall be indicated on the UPS control panel. If temperatures reach a level that is potentially harmful to the UPS module, it shall transfer to bypass, shut down immediately and indicate an alarm condition, Ambient air inlet temperature shall also be monitored, and a notice event shall be logged if the temperature exceeds the specified maximum value.

6. Front service clearance shall not exceed 36 inches. This maximum does not include additional front clearance that may be required by construction codes or regulations. The UPS Module shall be constructed so that no code clearances are needed at the rear or sides.
7. The UPS module shall allow attachment of power cables of up to two 500 MCM conductors per phase. Cable access shall be from top or bottom without modification of the equipment.
8. UPS module footprint shall not exceed 14 square feet and the floor loading shall not exceed 250 pounds per square foot, based upon the equipment footprint and one-half of the minimum required front service clearance area.
9. The UPS Module shall have built-in surge suppression. Surge suppressors shall have built-in failure indication.
10. The UPS Module shall be protected against overloads and short-circuits on its output. All power semiconductor devices shall be properly fused and shall have appropriate current-limiting means to prevent cascading failures. Extensive internal monitoring and diagnostics shall be included to minimize UPS damage from internal failures.
11. Control power shall be internally derived from redundant sources. Control power from external sources shall not be required during operation.
12. The UPS Module shall have a withstand rating of at least 42,000 amps.
13. Cable access shall be allowed from the top or bottom without modification of the UPS.

D. ELECTRICAL REQUIREMENTS:

1. Input:
 - a. Nominal voltage
Connection 480 V
3-phase, 3-wire + ground
from grounded wye
source
 - b. Voltage range +/- 10% default
+10% - 15% Maximum;
Programmable within
maximum range
 - c. Nominal frequency 60 Hz
 - d. Frequency range Programmable within +/-
10% maximum; +/- 3%
default factory setting
 - e. Input Current 152 A nominal at full load
320 A maximum
including recharge and
low line
 - f. Magnetizing current None
 - g. Power factor 0.99 at rated load and
nominal voltage
 - h. Harmonic current
distortion <3% of full load current
with linear load; less than
8% with 100% non-linear
load

2. Output:
 - a. Rating 150 kVA / 120 kW
 - b. Current 181 A RMS
 - c. Nominal voltage Same as input
 - d. Connection 3-phase, 3-wire + ground
 - e. Voltage regulation -
Steady state +/-1% for +/- 10% input,
balanced or unbalanced
loads
Transient
Recovery time +/- 5% for 100% step load,
<50 msec.
 - f. Frequency regulation Utility synchronized in
Normal Mode
0.2% free running
 - g. Power factor 0.7 lag to 0.9 lead
 - h. Harmonic voltage
distortion 3% THD at rated linear
load; 5% for maximum
non-linear load in
accordance with EN

- | | | |
|----|--------------------------------------|--|
| | | 62040-3 |
| i. | Overload capability –
Normal mode | <125% - 10 minutes
<200% - 30 seconds |
| j. | Ride-through time | 27 seconds at rated load |

E. EFFICIENCY:

1. The UPS Module efficiency shall be at least 96 percent.
2. Efficiency is defined as the total output kW divided by the input kW under the following operating conditions: Normal Mode operation that provides full UPS protection without operator intervention, rated 1.0 power factor balanced load, nominal input voltage, FES connected and fully charged, and ambient temperature between 15⁰C and 30⁰C.

F. ENVIRONMENTAL REQUIREMENT:

1. Operating ambient temperature range shall be at least 32⁰F to 104⁰F (0⁰C to 40⁰C).
2. Ambient storage temperature range shall be at least -13⁰F to 158⁰F (-25⁰C to 70⁰C).
3. Relative humidity limits shall be 0% to 95%, non-condensing.
4. Operating elevation limit shall be at least 3000 feet without de-rating. For operation above 3000 feet the ambient operating temperature shall be reduced by no more than 1.2⁰C. for each 1000 feet up to an elevation of 7000 feet.

G. STATIC DISCONNECT SWITCH:

1. The static disconnect switch in the MMU shall be a continuous duty rated, phase-controlled, full wave, three-phase, line-commutated electronic switch using SCRs as switching devices. It shall turn off within one-half cycle of detecting an input voltage or frequency outside of preset limits as specified. Phasing of the switch during normal operation shall also inhibit reverse power flow from the output of the switch to the input. Connection to the AC input through the switch shall be initiated when the phase difference between the input and output is less than one-half degree to reduce inrush currents when reconnecting to input power after a discharge.

2. Each phase of the Static disconnect switch shall be protected by fast-acting fuses.
3. The static switch shall be isolated from the input by a contactor. The contactor shall be opened when an out-of-tolerance input is detected to disconnect the static switch from the input.

H. FLYWHEEL ENERGY STORAGE SUBSYSTEM (FES):

1. Ride-through energy for the UPS system shall be supplied by a flywheel energy storage Module (FES) in the MMU that stores energy in the inertia of a rotating mass. The energy shall be immediately accessible to support the critical load without interruption.
2. The FES shall be a fully integrated device in which the motor, generator, and flywheel energy storage functions are performed by one brushless rotating machine composed of a single rotor and a single stator. The rotor shall be forged from a single piece of 4340 steel and shall have no coils or permanent magnets.
3. The rotor and stator shall be contained in a single evacuated housing and shall have a vertical shaft orientation.
4. When in normal operation, more than 75 percent of the FES rotor weight shall be supported by magnetic suspension provided by field coils mounted inside the FES housing.
5. The field coils and stator windings shall be cast coil type using vacuum impregnation techniques for encapsulation.
6. The flywheel rotor shall be rated for 7,700 RPM and have a plastic yield strength of at least 2.5 times the peak Mises stress resulting from the rated operating speed. Each rotor shall undergo ultrasonic and magnetic particle inspection. The complete FES shall be type-tested to withstand the following fault conditions and copies of the test results shall be available:
 - a. Sudden loss of vacuum.
 - b. AC short-circuits.
 - c. DC short-circuits.
 - d. Catastrophic bearing failure.
 - e. Over speed testing to 120% of rated speed.

I. BI-DIRECTIONAL CONVERTER (BDC):

1. The FES shall be charged and discharged using an AC-to-AC BDC. The BDC shall be composed of two PWM AC-to-DC, four quadrant converters configured in a back-to-back arrangement.
2. Each AC-DC converter shall use three-phase full wave PWM conversion techniques utilizing one or more IGBT converter stages. All stages in each AC-DC converter shall be identical and interchangeable and shall have built-in short-circuit and overload protection.
3. Failure or over temperature of the converters shall be monitored and alarmed. The system shall transfer to bypass as required elsewhere in this specification.

J. STATIC BYPASS SWITCH:

1. A static bypass switch shall be included, consisting of two SCRs per phase arranged in a back-to-back configuration. Fuses suitable for protection of semiconductor devices shall protect each phase of the static switch. An isolating contactor shall be connected upstream of the static switch to provide back feed isolation whenever the bypass source is out of tolerance.
2. A bypass contactor connected in parallel with the static bypass switch shall be commanded to turn on at the same time as the static bypass. The bypass contactor shall be sized for the rated output of the UPS.
3. The UPS shall monitor the static bypass fuses and alarm if a fuse has cleared. Additionally, the position and status of the isolating contactor shall be monitored and alarmed.
4. Except as noted in the Operation section above, transfers to and from bypass shall be synchronized and without interruption of load voltage or current. The UPS Module shall automatically transfer to bypass under the conditions specified in the Operation section above. Transfers to bypass shall be inhibited if the phase difference between the bypass and output is greater than 15 degrees; the frequency difference is greater than 0.1 Hz or the bypass voltage deviates from nominal by more than 10%. A field-

programmable setting shall allow transfer to a bypass source that deviates from nominal by more than 10%.

K. CONTROLS AND INSTRUMENTATION:

1. UPS Control Panel:
 - a. A digital control panel shall be located on the System Cabinet. It shall have a color LCD touch-screen graphical display, a "Bypass-Online-Reset" key switch, an EPO button, a horn and a horn silence button.
 - b. The Bypass-Online-Reset key switch shall have 3 positions. The "Online" position of key switch shall place the UPS on-line if sufficient MMU capacity is available to support the connected load. If not, the command shall be ignored until sufficient MMU capacity is available. The "Bypass" position shall manually transfer the UPS to bypass provided the bypass is available and within specified tolerances. If the bypass is not within specified tolerances when the key switch is placed in this position, the command shall be ignored and the UPS shall remain on-line. The "Reset" position shall be a momentary contact operation used to reset the system after complete discharge when auto-restart is not enabled or after the system has been shut down using the EPO.
 - c. The display shall indicate data in real time on the system cabinet. Summary data and events from all MMUs shall be obtained from this LCD display.
 - d. The Red "Emergency Power Off" (EPO) button on the control panel shall completely shut down the UPS, and open its input and output contactors. It shall also turn off the static switch bypass and open the wrap-around breaker. The EPO shall not turn off the maintenance bypass.
 - e. The display shall have screens to show the following:
 - 1) UPS module summary screen showing metering and status data for the UPS module in total.
 - 2) Input and output voltage, current kVA & kW.
 - 3) Detailed telemetry data for electrical, thermal and mechanical diagnostic parameters measured for each MMU.
 - 4) MMU set point screen to show MMU settings.
 - 5) Display & communications settings.
 - 6) Configuration and Identification data to

- facilitate remote communications and service identification of the MMU.
 - 7) An alarm screen showing only MMU alarm events.
 - 8) A notice screen showing MMU notice events and alarm events.
 - 9) An event screen that shows all events including alarms, notice and status events.
 - f. The default screen viewed on the display shall be the UPS module summary.
2. MMU Control Panel
- a. The Control panel shall include an emergency MMU off button and a three position key switch. A horn shall also be included to annunciate notice and alarm conditions audibly. The controls on an individual MMU shall apply only to that MMU.
 - b. The key switch shall permit an operator to control the MMU without risk of load loss. The key switch shall have "Bypass", "Online", and "Reset" positions. The Online position shall be the normal operating position of the key switch to provide UPS protection. Placing the key switch in the Bypass position shall turn off the output of the associated MMU and transfer the load to bypass only if the remaining MMUs do not have sufficient capacity to continuously support the connected load. If the bypass is not available and the remaining MMUs do not have sufficient capacity, the key switch command shall be ignored and the MMU shall remain on-line. The Reset position shall be a momentary key switch position that shall be used to reset the MMU.
3. Status Events:
Status events shall indicate normal events and shall not indicate a problem or failure. Status messages shall be written to the event memory and displayed on the display.
4. Notice Events:
Notice events shall indicate a problem that is not serious enough to shut down the UPS but requires service or attention from a technician. A Notice event shall cause the system to emit an audible alarm. Notice messages shall be written to the event memory and displayed on the display.

5. Alarm Events:
Alarm events shall indicate a serious problem with the UPS and will cause it to shut down and transfer the load to bypass without interruption, provided bypass power is available. An Alarm event shall cause the system to emit an audible alarm. Alarm messages shall be written to the event memory and displayed on the display.
6. Event Memory:
All event messages shall be stored in an event memory that shall be capable of storing at least 1000 messages. When the event memory is full, it shall continue to store messages by overwriting previous messages starting with the oldest messages first.
7. Viewing the Event Memory:
Event messages shall be accessed from the control panel and viewed on the LCD display. Separate views shall be available that show the following:
 - a. Message screen - all events (status, notice and alarm).
 - b. Notice screen - notice plus alarm events only.
 - c. Alarm screen - alarm events only.
8. Monitored System Variables:
 - a. The following variables shall be monitored and displayed in real time on the UPS control panel.
 - 1) Input variables:
 - ◆ 3-phase AC phase-to-neutral voltage.
 - ◆ 3-phase AC phase-to-phase voltage.
 - ◆ 3-phase current.
 - ◆ Frequency.
 - ◆ Total power (kW).
 - ◆ Total kVA.
 - ◆ Input power factor.
 - 2) Output variables:
 - ◆ 3-phase AC phase-to-phase voltage.
 - ◆ 3-phase currents.
 - ◆ Frequency.
 - ◆ Total power (kW).
 - ◆ Total kVA.
 - ◆ Output power factor.
 - 3) Sensors shall also be provided that will report internal operating system variables listed below.
 - ◆ Cabinet air temperature.

- ◆ Air inlet temperature.
 - ◆ Static Switch temperature.
 - ◆ Positive DC bus voltage.
 - ◆ Negative DC bus voltage.
 - ◆ Flywheel tachometer (RPM).
 - ◆ Percent energy available.
 - ◆ Vacuum level.
 - ◆ Top field coil current.
 - ◆ Bottom field coil current.
 - ◆ Bearing Loading.
 - ◆ Lower bearing unloading force.
 - ◆ Lateral vibration.
 - ◆ Axial vibration.
 - ◆ Top field coil temperature.
 - ◆ Bottom field coil temperature.
 - ◆ Armature temperature.
 - ◆ Top field coil IGBT temperature.
 - ◆ Bottom field coil IGBT temperature.
 - ◆ Top bearing temperature.
 - ◆ Bottom bearing temperature.
 - ◆ RPS advance setting
9. The UPS Module shall have 6 programmable external customer inputs designed to interface to normally open, potential-free contacts. Each of these inputs shall be programmable to any of the following functions: On Generator, Generator set Breaker Open, Remote Switch to Bypass, Remote Switch to On-line, On-Line Inhibit, Remote Horn Silence, Abnormal Room Temperature, Fire Alarm, Building Alarm 1, Building Alarm 2, Building Alarm 3, Building Alarm 4, User 1 (user defined input 1), and User 2 (user defined input 2). The inputs are logged to the event memory and can be used to activate the programmable output contacts. The remote switching inputs switch the UPS between on-line and bypass operation. The On Generator input is used to initiate alternate UPS operational settings as specified in section 2.03 B.
10. The UPS Module shall have 6 programmable form-C, potential-free output contacts. Each output contact can be programmed to indicate any of the following functions: On-line, On-Bypass, Flywheel Discharging, Notice Event or Alarm Event, Alarm Event only, Overload, UPS cabinet over temperature, Genset Start unavailable, Overload bypass, DC fuse failure, fan failure, Run Generator set (continuous

contact), Start Generator set (Momentary Contact), Stop generator set (momentary contact), Transfer ATS to emergency source, and a summary indication that a building alarm input or the fire alarm input is on.

11. The UPS shall have remote communications capability via Ethernet hardware. The factory installed modem shall provide remote notification via modem to a pager and/or a computer equipped with monitoring software.

L. REMOTE COMMUNICATIONS:

1. Remote notification via Modem shall be included to provide dial-out notification to multiple pagers or computers when an Alarm or Notice condition occurs. In North America and EC countries where a special modem license is not required, an internal modem shall be provided. For other parts of the world, an interface to an external modem shall be provided, including a UPS-protected power receptacle installed in the UPS to supply the modem. The installing contractor shall provide any cabling between the UPS and the external modem.
2. A modem shall be incorporated to allow remote monitoring of UPS status, events, telemetry and event memory.
3. Remote monitoring shall also be provided via Ethernet using the CSView monitoring software, the display, or the optional Modbus interface. Monitoring via Ethernet shall also include the ability to transmit Notice and Alarm conditions via e-mail over a LAN and Internet, if internet access is provided.

M. CSVIEW™:

CSView™ graphical, real-time monitoring and display software shall be included that runs on PCs equipped with Windows 7, Vista, XP, 2000, ME, 98 or NT4.0 for monitoring CleanSource® UPS modules. All metered values and scalar diagnostic parameters displays shall be selectable between numerical, bar graph and value vs. time graph formats. Digital diagnostic parameter status shall also be displayed. Colors shall be used to indicate normal (green), Notice (yellow) and alarm (red) conditions. Scalar graphical displays shall indicate notice and alarm levels. CSView shall also display events in streaming mode and shall be able to store them to a file on the PC.

2.04. OPTIONS

The following options shall be available for the UPS and shall be included when specified.

A. EXTERNAL MAINTENANCE BYPASS:

1. An internal maintenance bypass shall be available as an option. The bypass shall allow the load to be maintained on-line while UPS maintenance is being performed.
2. Operation of the maintenance bypass shall be completely manual. It shall include three switches to bypass the UPS while isolating the UPS input and output from energized circuits.
3. Bypass components shall have a withstand rating of at least 42,000 amps.

C. REMOTE STATUS PANEL:

This option has 8 LEDs, a horn and horn silence to provide remote indication of UPS module status. The remote monitoring panel shall connect to the UPS via a serial link.

PART 3 – EXECUTION

3.01 SCOPE

- A. Provide on-site quality control and commissioning services as specified.
- B. Technicians performing all specified services shall be trained, certified and authorized by the manufacturer. They shall be primarily employed to service the manufacturer's equipment.

3.02 ON-SITE QUALITY CONTROL

- A. The following general and visual inspections shall be performed on-site at the time the equipment is commissioned:
 1. Inspect equipment for signs of damage.
 2. Inspect equipment for cleanliness & foreign objects. Advise installing contractor if condition is not satisfactory.

3. Verify sizing and connection of neutral and ground conductors.
 4. Verify proper termination of all control wiring.
 5. Verify that the equipment is level and properly anchored.
 6. Verify that all circuit boards are configured and mounted correctly.
 7. Verify the installation conforms to manufacturer's drawings and installation requirements.
 8. Verify that all optional hardware is installed.
- B. Perform the following mechanical inspections:
1. Check all control wiring connections for tightness.
 2. Check all power wiring connections for tightness.
 3. Check all terminal screws and or lugs for tightness.
- C. The following electrical inspections and tests shall be performed on-site at the time of commissioning:
1. Verify all fuse continuity.
 2. Verify input voltages and bypass voltages correspond to the Equipment rating.
 3. Verify phase rotation of inputs and bypass.
 4. Verify connection of Current transformers, and control power transformers.
- D. These services are on a "best effort" basis and shall not absolve the installing contractor's responsibility for properly installing the Equipment.

3.03 START-UP

- A. Perform the following checks as part of system start-up:
1. Energize control power circuits and verify all control voltages.

2. Verify correct firmware revision.
 3. Check operation of control logic and verify correct software set-ups.
 4. Start the Module.
 5. Verify FES starts and charges properly.
 6. Energize the module output. Verify BDC operation correct output voltage regulation and proper phase rotation.
 7. Verify that no alarm conditions exist.
 8. Verify all indications, Notices, Alarms, and metering functions operate properly and are calibrated.
 9. Verify operation of all options. In particular, verify that if a modem is installed it is connected to telephone lines and communicate correctly. Set modem telephone numbers and parameters in UPS software.
- B. Perform the following tests and simulations:
1. Simulate input power failure and verify FES discharge and recharge. Verify that operation alarms & indications are correct.
 2. Manually transfer the system to bypass and return. Verify correct transfer and operation of all indications and alarms.
- C. Complete and sign and date all start up documentation and test results.