NGS N03 INVERTER & BATTERY CHARGER REPLACEMENT SPECIFICATIONS

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1. General Requirements

1.1. Work Included

1.1.1. The bidder shall provide one (1) complete standalone inverter static switch system (ISS), as specified herein, and hereafter referred to as the "ISS", to provide continuous, regulated AC power to critical loads under normal and abnormal conditions, including loss of the utility DC power. The ISS shall use state of the art PWM technology.
1.1.2. The bidder shall provide two (2) battery chargers as specified in section 3 of the specifications.
1.1.3. The following shall be furnished along with the equipment:
1.1.3.1. Factory Testing
1.1.3.2. Protective packing
1.1.3.3. Equipment manuals

1.2. Related Work

1.2.1. Electrical Installation of equipment will be done by JEA's approved electrical contractors. Equipment parameter settings and startup up shall be done by manufacturers' field service representative.

1.3. Quality Assurance

1.3.1. The manufacturer shall have an ISO 9001 Quality Assurance Program with checks on incoming parts, modular assemblies, and final products. A final test procedure for the product shall include a check of all performance specifications and a minimum 12-hour "burn-in" for the entire system. An on-site test procedure shall include a check of system functional operation and battery operation after installation of the equipment.

1.4. Applicable Codes and Standards

1.4.1. ANSI/NFPA 70
1.4.2. NEC 2017
1.4.3. UL-1778
1.4.4. NEMA PE-1 & 5

1.5. Submittals

1.5.1. With Proposals - Catalog cuts and/or data sheets describing the proposed equipment shall be submitted with the proposal.

1.5.2. After Receipt of Order - A minimum of two sets of installation drawings showing outline dimensions, weights, connections and a one-line diagram of the ISS and chargers shall be sent to the purchaser to be used in planning the installation of the system.

1.5.3. After Construction of Equipment.

1.5.3.1. Two copies of drawings shall be furnished for each of the following:
1.5.3.1.1. Equipment installation outline including external cabling termination locations.
1.5.3.1.2. Equipment internal wiring diagram.
1.5.3.2. Two instruction manuals shall be furnished and shall include as a minimum the following:
1.5.3.2.1. Safety instructions
1.5.3.2.2. System description, specifications and controls
1.5.3.2.3. Installation planning
1.5.3.2.4. Operators guide
1.5.3.2.5. Control panel reference
1.5.3.2.6. Warranty and service information
1.5.3.3. At least one certified copy of the final test report shall be furnished with the equipment.

1.5.4. After Installation of Equipment - A signed field service report describing start-up and on-site testing shall be furnished with the invoice for the service trip.

1.6. Delivery, Storage and Handling

1.6.1. The equipment shall be shipped on a wooden pallet suitable for forklift handling. The equipment shall be covered with clear plastic sheeting to prevent dust and dirt from entering the cabinet during shipment and storage.

1.7. Site Conditions

1.7.1. The electronic equipment shall be suitable for installation indoors with ambient temperatures from 0 - 40° C. (32 - 104° F.) and relative humidity from 0 - 95%. Site altitude up to 1000 feet above sea level without de-rating.

1.8. Warranty

1.8.1. The manufacturer shall state their warranty of the equipment. In no case shall it be less than 12 months after start-up or 18 months after shipment, whichever occurs first.

1.9. Equipment Startup and Commissioning

1.9.1. Equipment parameter settings and startup shall be done by a field service representative from the equipment manufacturer. A signed field service report shall then be submitted after the equipment is operational.

1.10. Spare Parts and BOM

1.10.1. A list of manufacturer's recommended spare parts shall be submitted with the manuals as well as a detailed BOM

1.11. Existing Drawings.

1.11.1. See attachments at the end of this document.

1.12. Approved Manufactures

1.12.1. Ametek and ABB

2. Inverter Specifications

2.1. Electrical Characteristics

2.1.1. ISS Module Normal Source Input.
- 2.1.1.1. Voltage: 120VDC
- 2.1.1.2. Voltage Range: 105VDC – 140VDC without discharging the battery
- 2.1.1.3. DC input breaker

2.1.2. ISS Module Alternate Input.
- 2.1.2.1. Voltage: 120VAC 60 Hz, 1 Phase, 2 Wire + G
- 2.1.2.2. Frequency: 60 Hertz
- 2.1.2.3. Power Rating: 30 KVA
- 2.1.2.4. Alternate AC input breaker

2.1.3. ISS Module Output
- 2.1.3.1. Voltage: 120VAC 60 Hz, 1 Phase, 2 Wire + G
- 2.1.3.2. Frequency: 60 Hertz
- 2.1.3.3. Power Rating: 30 kVA @ 0.8 Power Factor
- 2.1.3.4. System output breaker,
- 2.1.3.5. Voltage Regulation: ± 1 % nominal for any one of the following conditions.
  - 2.1.3.5.1. No load to full load
  - 2.1.3.5.2. 1.0 to 0.8 lagging power factor
  - 2.1.3.5.3. Minimum to maximum DC input voltage (minimum batt voltage)
  - 2.1.3.5.4. 0 to 40° C. ambient temperature
- 2.1.3.6. Voltage Transient Response: ±5% upon application of 100% load with recovery to ± 1% within 50 milliseconds
- 2.1.3.7. Voltage Adjustability: ± 5% of nominal.

2.1.3.8. Harmonic Distortion: Maximum 5% RMS THD with non-linear loads (CF=3:1), 3% maximum for linear loads.
2.1.3.9. Frequency Stability: ± 0.1% free-running.
2.1.4.10 Frequency Slew Rate: 1.0 Hertz/second, adjustable
2.1.4.11 Frequency range for synchronization to alternate line: 58-62 Hz
2.1.4.12 Overload Capacity (on Static Bypass)
2.1.4.12.1 125% Continuous
2.1.4.12.2 150% for 10 minutes
2.1.4.12.3 200% for 1 minute
2.1.4.13 Overload Capacity (On Inverter): 125% of rated output power for 10 minutes. 150% for 1 minute.
2.1.4.14 Efficiency: The DC to AC efficiency of the ISS at nominal AC input line and floating battery shall be 87% minimum from 25% - 100% of full rated AC load.
2.1.4.15 Acoustic noise: less than 65-72 dba at 1.5 meter under full rated load.
2.1.4.16 ISS shall meet all of the above criteria with the battery disconnected

2.2 Inverter

2.2.4 The inverter shall consist of DC filter capacitors, DC surge protection, a solid-state pulse width modulated (PWM) inverter using digital signal processors, an output isolation transformer, ribbon cable or similar control wiring (for high Noise Immunity), and control circuitry to provide precise AC voltage regulation and electronically controlled current limiting.

2.2.5 Over-current Protection
2.2.5.10 The inverter input shall be protected by fast acting fusing to prevent damage to the solid-state devices in the inverter bridges.
2.2.5.11 The inverter output shall be electronically current limited.

2.2.6 DC Filter Capacitors
2.2.6.10 The input of the inverter shall have banks of filter capacitors.

2.2.7 DC Surge Protection
2.2.7.10 The inverter input shall have DC surge protection to assure proper operation in the event that there are surges or spikes on the inverter input. The inverter input shall be protected against a 4000 volt transient for 100 microseconds.

2.2.8 Pulse Width Modulated (PWM) Inverter
2.2.8.10 The inverter shall be a PWM type, DSP controls and shall use IGBT devices for increased reliability and improved transient response.

2.2.9 Output Transformer
2.2.9.10 The inverter shall be furnished with an isolation type output transformer with copper windings.

2.2.10 Output Filter
2.2.10.1 The inverter shall be provided with an active on-line PWM filter to maintain the total harmonic distortion (THD) of the output voltage to the specified limits as well as minimize switching transients.

2.2.11 Control Circuitry
2.2.11.1 The inverter shall be provided with DSP based control circuitry to provide constant AC voltage regulation as specified.
2.2.11.2 The control circuitry shall electronically current limit the output of the inverter by dropping the AC voltage when the output current exceeds a preset limit.
2.2.11.3 The circuitry shall provide a low voltage initial start-up of the inverter and ramp up to full voltage in approximately 5 seconds.
2.2.11.4 The control circuitry shall automatically synchronize and phase lock the inverter output to the alternate power source as long as the source is within 60 ± 0.5 to ± 2 Hertz, depending on user specification. If

the alternate power source is not within these limits, then the control circuitry shall break synchronization and lock to an internal oscillator.

2.2.11.5 The control circuitry shall interface with a DC low voltage sensor and turn off the inverter at the 105vdc volts level to prevent damage to the battery.

2.2.11.6 Test points and on board LED indicators shall be provided to facilitate diagnosis. All parameters of the ISS operation shall be accessed from the front digital control panel.

2.2.11.7 Provisions shall be made for easily testing logic circuitry without operating the power circuits (software based test-programs can be used to allow immediate testing).

2.2.11.8 On board diagnostics shall be placed on the circuits for verification of operation.

2.3 Static Transfer Switch

2.3.11 The static transfer switch shall consist of two pairs of Silicon Controlled Rectifiers (SCR's) per phase with each pair connected in inverse parallel (back to back). One set of SCR's shall be connected to the inverter while the other set of SCR's is connected to the alternate, or bypass, power source. The outputs of the two sets of SCR's are connected together and furnish power to the critical loads.

2.3.12 Inverter Failure - If the inverter is out of normal limits due to under-voltages or over-voltages, the static transfer switch shall turn on the alternate source SCR's to provide power to the loads from the alternate power source. At the same time, the inverter side shall be turned off to prevent the alternate power source from back-feeding power to the inverter. If the alternate power source is not within normal voltage limits, or not in phase synch, then the transfer can be inhibited at the operator's option. The control shall also have the capability of allowing unconditional transfers to the alternate line if the operator selects that programmed option. All such transfers shall block any instantaneous cross current connections between the inverter and the alternate line which could damage the inverter or clear alternate line fuses.

2.3.13 Retransfer to Inverter - The static transfer switch shall be capable of automatically retransferring the load back to the inverter after the inverter has returned to normal voltage and stabilized for a programmed period of time. Retransfer shall not occur, whether initiated manually or automatically, if the two sources are not in phase or the inverter has not recovered nominal output voltage.

2.3.14 Overload - If an AC current overload is detected, the static transfer switch shall operate as described in 2.04.B. and C. above. For up to 125 % overload the inverter shall keep supplying the load for 10 minutes at 40° C, and thereafter transfer to alternate line if the overload still exists.

2.3.15 Surge Protection - The static transfer switch shall have surge protection on the alternate source side.

2.3.16 Transfer Conditions

2.3.16.1 The static transfer switch shall transfer from the inverter to the alternate power source for the following conditions:

a. Inverter under voltage
   - 90% of nominal, programmable

b. Inverter overvoltage
   - 110% of nominal, programmable

c. Inverter overload

d. Manual signal from operator control panel

2.1.1.2. The static transfer switch shall inhibit transfer to the alternate source for the following conditions by default:

a. Alternate source under voltage
   - Less than 90% of nominal

b. Inverter & Alternate Source not in phase

2.1.2. Automatic Retransfer Conditions - The system shall automatically retransfer the load to the inverter provided all of the following conditions are met:

2.1.2.1. The inverter and the alternate source are in phase.

2.1.2.2. Inverter voltage is within ± 10% of nominal for more than five seconds on all phases.

2.1.2.3. Manual retransfer mode has not been selected.

2.1.3. Transfer Sensing Time - Maximum transfer sensing time for loss of inverter voltage shall be 1/4 cycle maximum.

2.1.4. Transfer Time - Maximum transfer time to switch from inverter to alternate power source shall be 100 microseconds.

2.4 External Maintenance Bypass Switch

2.4.11 A manually operated external maintenance bypass switching arrangement shall be provided which permits bypassing the critical loads to the alternate AC power source without interruption of power to those loads, and at the same time, electrically isolates the static transfer switch and inverter from the alternate power source. This switch is a single switch that allows foolproof switching and eliminates the need for any interlocks.

2.5 Display

2.5.11 The Inverter/Static Switch (ISS) shall be provided with microprocessor based Touch Screen LCD display and control panel. ISS system power flow diagram (Mimic) with all the switchgear, fusing and accessories shall be displayed on the color LCD. The Control panel will be Menu driven to select and display status of any submodules of the system or the system as a whole. All the metering and event display shall be real time and true RMS with a 1% accuracy of metering functions. All operator controls and monitoring shall be accessible through the Touchscreen on the front door. The alarms and metering shall be displayed in color-coded alphanumeric display.

2.5.12 Additional features of the monitoring system shall include:
- 2.5.12.1 Real time clock (time and date stamp)
- 2.5.12.2 Alarm History with time and date stamp
- 2.5.12.3 Battery backed up, non-volatile memory
- 2.5.12.4 Metering of multiple points in the ISS system
- 2.5.12.5 All set-points and thresholds are set / monitored digitally
- 2.5.12.6 Service Notebook
- 2.5.12.7 Configuration and hardware setup

2.6 Control Wiring

2.6.11 All communications and/or control wiring in the Inverter/Static Switch shall be ribbon type or Fiber Optic to ensure high level of noise immunity and EMI/RFI protection

2.7 Indicators

2.7.11 The ISS shall have a full color Touchscreen LCD panel which displays alarms, events history, system parameters etc.

2.8 Alarm Contacts (Form C relays DPDT)

2.8.11 The following functions shall have alarm contacts (relay contacts shall be rated no less than 1 amp at 48VDC) available for connection to DCS. These alarms shall not be latched and clear as conditions return to normal. Up to 10 other customer defined alarm contacts can be added as options. An additional relay board which offers 14 customer-defined contacts can be optionally added as well. All alarms shall be landed on the normally open (NO) contacts.
- 2.8.11.1 Alternate AC power source Hi/Lo alarm. Contact closes on +/-10 of nominal voltage
- 2.8.11.2 Inverter fan failure
- 2.8.11.3 Inverter failure
- 2.8.11.4 Manual bypass alt contact
- 2.8.11.5 Inverter over temperature
- 2.8.11.6 Inverter static switch on alternate source
- 2.8.11.7 Plant inverter source not in synch
- 2.8.11.8 Input fuse blown
- 2.8.11.9 DC Ground fault
- 2.8.11.10 Load on Inverter

2.9 Enclosure Dimensions

2.9.11 The ISS enclosure shall not be larger than 80”H x 75”W x 36”D

2.10 Communications

2.10.11 Modbus Communications for remote monitoring of the ISS shall be standard via an RS-232 communications port. The following system information shall be downloaded to a remote terminal:

2.10.11.1.1 Metering Menu

2.10.11.1.2 Status/Alarms

2.10.11.1.3 Event Log

2.11 Design

2.11.11 Life - The system shall use components of adequate rating to provide an expected service life of twenty years continuous duty and 8 years without component replacement, excluding fans and batteries. The system shall contain no continuously moving parts other than cooling fans which shall have permanently lubricated bearings.

2.11.12 Maintenance - Provisions shall be provided for testing the control circuits while the critical loads are bypassed to one of the power sources. All adjustments shall be possible without the use of a volt-ohm-mill ampere meter and oscilloscope. Test points and diagnostic lights shall be provided to allow easy monitoring of the controls. Control circuits shall be mounted on etched multi-layer circuit boards with surface mount technology to improve reliability through reduced component count.

2.12 Construction

2.12.11 Enclosure - The ISS electronics shall be housed in a code gauge steel, NEMA 1 enclosure requiring access from the front only for all servicing adjustments and connections. Access shall be through a hinged door. The frame shall be 12 GA and the doors and panel 14 GA. The enclosure shall be primed and painted inside and outside with a suitable semi-gloss enamel. The enclosure shall be a free-standing floor mount design with removable side & back panels to provide flexibility of installation configuration. Enclosure shall be installable with back to wall and with equipment adjacent to either or both sides except for bottom cable entry option where side access is necessary.

2.12.12 Layout - Modules and subassemblies shall be mounted in open construction style so that each may be easily replaced. Slide-out modules are preferable the equipment shall be constructed so that each power component can be replaced without a soldering iron or special tools. Cable and conduit connections shall be through the top of the cabinet.

2.12.13 Material and Workmanship

2.12.13.1.1 Workmanship shall be first class in every aspect

2.12.13.1.2 All materials shall be new and of best commercial grade

2.12.13.1.3 Brackets and securing hardware shall be electroplated/galvanized with corrosion resistant materials.

2.12.13.1.4 Internal wiring conductors shall be combined into cable or bundles and shall be tied securely together.

2.12.14 Cooling

2.12.14.1.1 Cooling shall be done by forced air fans.

2.12.15 RFI/EMI Susceptibility

2.12.15.1.1 The ISS operation, metering and critical AC load shall not be affected by the Operation of a 5 watt RF power portable radio in either the 150-160 megahertz band or the 460 - 470 megahertz band when the radio is operated in transmit or receive mode at 0.1 meters from the closed cabinet enclosure of the ISS

3. Battery Chargers

3.1. AC Input

3.1.1. Input Voltage: 480VAC, 3-phase, 60Hz, 3-wire + G
3.1.2. Input Voltage Tolerance: +/- 10%
3.1.3. Input Frequency Tolerance: +/-5%
3.1.4. Power Factor: Not less than 0.75 lagging
3.1.5. Efficiency: 85 – 90% at 50-100% load
3.1.6. Internal or External 3% line reactor

3.2. DC Output

3.2.1. DC Output Voltage: 120VDC
3.2.2. Plant Charger Output Current: 600A
3.2.3. EBOP Charger Output Current: 400A
3.2.4. Current limit: 115%
3.2.5. Output ripple w/battery: >0.1%
3.2.6. Output ripple wo/battery: >2%

3.3. Standard Features

3.3.1. 1% Digital LED Meter for VDC, ADC, Timer Hours and Alarm Settings
3.3.2. AC On Indicating Light
3.3.3. AC Input and DC Output Circuit Breakers
3.3.4. Float/Equalize Selector Switch with Indicating Light
3.3.5. Manual Equalize Timer (0-255HR) with Indicating Light
3.3.6. AC Line Failure Automatic Equalize Timer (0-255HR) with Indicating Light
3.3.7. Self-Diagnostics
3.3.8. Local or Remote Voltage Sense with Redundancy to protect against Remote Sense Failure
3.3.9. High DC Voltage Shutdown
3.3.10. Front Panel Controls can be disabled for security
3.3.11. MOV Surge Suppressors, Input and Output
3.3.12. I/O Compression Lugs
3.3.13. Switchboard Wiring 105 Degrees C
3.3.14. Membrane Front Panel
3.3.15. ANSI 61 Gray Finish, Baked Epoxy Paint
3.3.16. Alarm Assembly with Local LEDs and Summary Relay Contact for the following:
    3.3.16.1. >AC Failure
    3.3.16.2. >DC Failure
    3.3.16.3. >High VDC
    3.3.16.4. >Low VDC
    3.3.16.5. >Positive Ground Fault
    3.3.16.6. >Negative Ground Fault
3.3.17. Redundant Control Loops for Higher Reliability
3.3.18. Redundant Analog Circuit for LVDC Alarm, totally independent of the Microprocessor
3.3.19. Over Temperature Alarm
3.3.20. UL 1564 Standards for Industrial Battery Chargers

3.4. Included Optional Features

3.4.1. Opt. 182 Charger output breaker
3.4.2. Opt. 082 65kaic charger input breaker
3.4.3. Opt. 183 20kaic charger output breaker
3.4.4. Opt. 029 Blocking diode w/0.1% ripple filter with battery connected
3.4.5. Opt. 111 Input power metering
3.4.6. Opt. 026 AC input failure relay
3.4.7. Opt. 068 Low AC input relay
3.4.8. Opt. 188 AC input monitoring package
3.4.9. Opt. 003 Neg/Pos to ground detection
3.4.10. Opt. 120 Charger fan failure relay
3.4.11. Opt. 193 Charger bridge over temp relay