ENMIENDA NÚM. 2

SUBASTA FORMAL 22J-04401
PARA LA ADQUISICIÓN E INSTALACIÓN DE GENERADOR ELÉCTRICO DE 2000KW/2500KVA PARA EL DEPARTAMENTO DE LA VIVIENDA DEL GOBIERNO DE PUERTO RICO

ASUNTO: VARIOS

Se notifica a los licitadores interesados en participar en la Subasta de referencia las siguientes enmiendas:

I. Se enmienda el **Título y el Alcance** de la Subasta Formal 22J-04401 para que lea como sigue:

"PARA LA ADQUISICIÓN E INSTALACIÓN DE GENERADOR ELÉCTRICO DE 2000KW/2500KVA PARA EL DEPARTAMENTO DE LA VIVIENDA DEL GOBIERNO DE PUERTO RICO"

II. Se adjunta **Anejo V** que contiene las Especificaciones sobre *Transfer Switch*.

Esta Enmienda forma parte del Pliego de Subasta y quienes interesen licitar, tendrán que considerarla al presentar su Oferta. Todos los demás términos, condiciones y especificaciones permanecen sin alterar.

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JUNTA DE SUBASTAS ASG GOBIERNO DE PUERTO RICO

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SECTION 26 14 12

1.0 GENERAL

1.1. Description

1.1.1. The following specifications cover the requirements for providing a freestanding medium voltage transfer switch containing circuit breakers, and control devices for a 5KV UL1008A automatic transfer (ATS) switch utilizing vacuum circuit breakers. The complete transfer switch shall be provided by one manufacturer, as specified in this section, and as shown on the drawings.

1.1.2. The 5KV automatic transfer switch shall be 3 phase, 3 wire.

1.1.3. The metal-clad switch shall be arranged for fully automatic or manual operation at the discretion of the operator. Each Section shall be complete and include the necessary voltage sensing circuitry, relaying, pilot lights, selector switches, and accessories as specified hereinafter.

1.1.4. Control power is taken from the draw-out style potential transformers and an external 48 VDC station battery source.

1.1.5. The automatic transfer switch covered by these specifications shall be listed for emergency use and labeled under UL1008A at the time of bid. The equipment shall be designed, tested and assembled in strict accordance with all applicable standards of ANSI, U.L., IEEE and NEMA.

1.1.6. To provide for unit responsibility each individual section of the switch, with all internal components mounted, shall be UL listed and labeled under the control manufacturer's name. Manufacturers not listed and labeled by U.L. 1008A for transfer switches over 600 volts shall not be acceptable.

1.1.7 Transfer Switch must be certified to to withstand seismic forces as per IBC 2018 and ASCE 7-16.

1.2. Related Work

1.2.1. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

1.2.2. Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY: Electrical coordination study of overcurrent protection devices.

1.2.3. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlet boxes.

1.2.4. Section 26 05 13, MEDIUM-VOLTAGE CABLES: High voltage cables.

1.2.5. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3. Transfer Switch Operation

1.3.1. The following sequence shall be coordinated with the sequence of operation of the

generator control sequence.

1.3.1.1. Provide with programmable Gen to Gen functions. ATS will be used as a Generator to Generator ATS. Utility power failure, sensed by the exisitng automatic transfer switch and a requirement for alternate power source, shall signal this ATS to start both electrical generator sets, leaving in operation and connected in service one of the generators and shut down the other. ATS shall have the capability to alternate generators each time at each power outage or as programmed by power. If the generator that is in service fails the ATS must be able to start the other in put it in service.

1.3.1.2. When utility power returns and after an adjustable time delay the ATS controller shall signal the alternate source circuit breaker to open and the normal source breaker to close transferring all load back to the normal source in an open transition mode. When selected, a closed transition operation shall provide a momentary (100ms) closed transition transfer when both sources are available. In the event that any malfunction should occur during the closed on normal, closed on alternate position, a signal shall be sent to shunt trip the normal source breaker. The retransfer to normal sequence may be selected for automatic or manual operation.

1.3.1.3. Closed transition load test may also be initiated at the ATS controller. This load test function shall allow transfer to alternate and back to normal in an approximately 100 milliseconds closed transition transfer operation as described above.

1.3.1.4. Closed transition operation will occur only after synchronization is checked with the normal through an automatic sync check function within the switch. Once synchronization is confirmed to be within the proper window of synchronization (+/-1hz) closed transition will be allowed.

1.4. Submittals

1.4.1. Submit all product documentation and technical data described below prior to order release. Documents shall be submitted in electronic format.

1.4.2. Shop Drawings:

1.4.2.1. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.

1.4.2.2. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawing or specifications, unless he has submitted in writing a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Engineer, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules.

1.4.2.3. Shop drawings shall include, but shall not be limited to, the following:

1.4.2.3.1. 5kV Automatic Transfer Switch

1.4.2.3.2. Distribution circuit breaker section

1.4.2.3.3. A 1/4" =1'-0" scale floor plan of the main electric room housing the equipment with dimensions, Code clearances, etc., shall be

submitted with the equipment shop drawings. Acceptance of these shop drawings shall be obtained prior to installation of conduits.

1.4.2.3.4. Provide certified fabrication details of anchorages and attachments to structures.

1.4.2.4. The ATS manufacturer shall submit the following information with each submittal:

1.4.2.4.1. Master drawing index.

1.4.2.4.2. Front view elevation.

1.4.2.4.3. Floor plan.

1.4.2.4.4. Top view.

1.4.2.4.5. Single line.

1.4.2.4.6. Control schematics and wiring diagrams.

1.4.2.4.7. Nameplate schedule.

1.4.2.4.8. Component list/bill of material.

1.4.2.4.9. Conduit entry/exit locations.

1.4.2.4.10. Assembly ratings including:

- Short circuit rating.
- Information regarding series short circuit ratings.
- Voltage.
- Continuous current.
- Basic Impulse level for equipment over 600 volts.
- KVA.

1.4.2.4.11. Major component ratings including:

- Voltage.
- Continuous current.
- Interrupting ratings.

1.4.2.5. Cable terminal sizes.

1.4.2.6. Manufacturer's catalog data sheets.

1.4.2.7. The following product information shall be submitted:

1.1.1.1.1. Descriptive bulletins.

1.1.1.1.2. Product sheets.

1.1.1.1.3. Test reports.

1.4.3. Manuals

1.4.3.1. After final acceptance of the equipment by the customer or within 45 days after the conclusion of the equipment start-up, whichever occurs first, the ATS Manufacturer shall submit to the Owner complete, bound copies of the installation, operation and maintenance instructions for each item of equipment to be furnished. All final Operating and Maintenance Manuals by the ATS Manufacturer shall be applicable to the equipment furnished and shall be specifically identified.

1.4.4. Certificates:

1.4.4.1. Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer:

1.1.1.1.1. Certification by the Contractor that the transfer switches have been properly installed, adjusted, and tested.

1.1.1.1.2. Certified copies of all of the factory design and production tests, field test data sheets, and reports for the ATS.

1.1.1.1.3. As-built information.

1.5. Applicable Publications

1.5.1. Publications listed below (including amendments, addenda, revisions, supplements, and errata), form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

1.5.2. American Concrete Institute (ACI): ACI 318-02 .....Building Code Requirements for Structural Concrete

1.5.3. American Society for Testing and Materials (ASTM):

1.5.3.1. D3487-00.....Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus

1.5.4. NEMA

1.5.4.1. SG-4

1.5.4.2. SG-5

1.5.5. National Fire Protection Association (NFPA): 70

1.5.6. National Electrical Code (NEC)

1.5.7. IEEE

1.5.8. ANSI 37.20.2

1.5.9. UL 1008

1.6. Delivery, Storage, And Handling

1.6.1. Manufacturer's directions shall be followed completely in the delivery, storage, protection and installation. Promptly notify the Resident Engineer in writing of any conflict between any requirements of the Contract Documents and the manufacturer's directions. Obtain the written instructions before proceeding with the work. Should Contractor perform any work that does not comply with the manufacturer's directions or written instructions from the Resident Engineer, he shall bear all costs arising in

correcting any deficiencies that should arise.

1.6.2. Equipment and materials shall be delivered to the site and stored in original sealed containers, suitably sheltered from the elements, but readily accessible for inspection by the Resident Engineer until installed. All items subject to moisture damage such as controls shall be stored in dry, heated spaces.

1.6.3. The Contractor shall be responsible to fully inspect all shipments for damage and report damage to the manufacturer and the Resident Engineer.

1.6.4. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, equipment and materials shall be cleaned and polished thoroughly and turned over to the Owner in a condition satisfactory to the Architect. Damage or defects that develop before acceptance of the work shall be made good at the Contractor's expense.

1.6.5. The Contractor shall make necessary field measurements to ascertain space requirements, for equipment and connections to be provided under his respective Trade and shall furnish and install such sizes and shapes of equipment to allow for the final installation to conform to the drawings and specifications.

1.6.6. The ATS being stored prior to installation shall be stored maintained in a clean and dry condition. If stored outdoors, indoor ATS(s) shall be covered and heated, and outdoor ATS(s) shall be heated.

2.0 PRODUCTS

2.1. Transfer Switch Controller

2.1.1. The transfer switch shall be equipped with a Microprocessor Controller with a Power Supply Module, CPU and I/O Modules for all voltage and ampere ratings. The controller shall be capable of both Serial and Ethernet communications.

2.1.2. The controller shall contain voltage sensing modules capable of direct single phase or three phase sensing of each source from 120 VAC to 600 VAC. The Power Supply Module shall accept a 24 VDC external power source allowing controller communications in the event of a power outage.

2.1.3. Voltage sensing shall be true RMS type and accurate to +/- 1% of nominal voltage. Frequency sensing shall be accurate to +/- 0.05Hz. The operating temperature range shall be –20 to +50 degrees C and storage from –40 to +90 C.

2.1.4. The controller shall connect to the transfer switch through an interconnecting wiring harness. Interfacing relays shall be provided to isolate the controller from abnormal voltages applied to any and all customer input and output wiring terminals.

2.1.5. All customer interface connections shall be wired to a common DIN rail Cage Clamp terminal block. Sufficient space shall be provided to allow for future modifications and upgrades.

2.1.6. The controller shall meet or exceed the requirements for Electromagnetic Compatibility as follows:

2.1.6.1. EN55022 (CISPR11) Conducted and Radiated emissions, Class B

2.1.6.2. EN61000-4-2 (Level 4) ESD immunity test ENG6100-4-3 (ENV50140) Radiated RF EN61000-4-4 Electrical fast transient/burst immunity test

EN61000-4-5 IEEE C62.41 Surge immunity test EN61000-4-3

2.1.6.3. (ENV50141) Conducted immunity test EN61000-4-11 Voltage dips and interruption immunity

2.1.6.4. IEEE 472 (ANSI C37.90A) Ring wave immunity

2.1.7. Controller Display and Keypad

2.1.7.1. 1. A color, ¼ VGA minimum, graphical display shall be provided for viewing data and setting operational parameters. Parameters shall also be available for viewing remotely and limited control through a front accessible USB communications port.

2.1.7.2. The Controller shall provide high intensity LED's for the following:

2.1.7.2.1. Source Availability - Indicates the source voltage and frequency are within preset parameters.

2.1.7.2.2. Source Connected - Indicates the source main contacts closed and the load being served from the source.

2.1.7.2.3. XFER Inhibit - Indicates that the ATS is being inhibited from Automatic operation to the unconnected source.

2.1.7.2.4. Alarm – Indicates an alarm condition is active.

2.1.7.2.5. TD Active – Indicates that a transfer switch time delay is actively timing.

2.1.7.3. For ease of navigation, the display shall include the following:

2.1.7.3.1. Soft Keys – Change function based on user location in the menu structure.

2.1.7.3.2. Dedicated Navigational Keys – Home, Scroll Up, End, Escape and Enter.

2.1.7.3.3. Dedicated Pushbuttons for Alarm Reset, Test, Control and Information.

2.1.8. Voltage, Frequency and Phase Rotation Sensing

2.1.8.1. Programmable voltage and frequency sensing of both sources capable of detecting single or three phase losses. The Controller shall have adjustable pickup and dropout settings for each source. Set point ranges as follows:

Parameter	Sources	Dropout/Trip	Pickup/Reset
Undervoltage	N+E, 3phase	72 to 100%	70 to 98%
Overvoltage	N+E, 3phase	100 to 108%	102 to 110%
Underfrequency	N+E, 3phase	45.1 to 60.0 HZ	45.0 to 59.9 HZ
Overfrequency	N+E, 3phase	50.0 to 69.7 HZ	50.1 to 69.8 HZ

2.1.8.2. The controller shall monitor phase rotation of both sources and inhibit transfer if both sources are not the same phase rotation. (ABC or CBA)

2.1.8.3. Settings shall be adjustable in 1% increments either through the keypad, USB

port or remotely via communications.

2.1.8.4. A single source status screen shall be provided to allow for viewing of the status of both sources including three phase voltage, power and frequency.

2.1.9. Time Delays

2.1.9.1. The controller shall include an adjustable time delay of 0 to 10 seconds to momentarily override normal source power outages. The time delay shall be expandable up to 60 minutes if an external 24 VDC power supply is provided for ATS control.

2.1.9.2. The controller shall include an adjustable 0 to 60-minute time delay on transfer to alternate, factory set at 3 seconds.

2.1.9.3. The controller shall include a time delay on retransfer to the preferred source adjustable 0 to 259 minutes, factory set at 5 minutes.

2.1.9.4. The controller shall include a timer to control the transfer time from neutral to the non-preferred source, adjustable 0 to 10 minutes, factory set at 3 seconds.

2.1.9.5. The controller shall include a timer to control the time delay from neutral to the preferred source, adjustable 1 to 10 minutes, factory set at 3 seconds.

2.1.9.6. Include a Failure to synchronize time delay fixed at 60 seconds, for failure to synchronize Source 1 and Source 2 prior to closed transition transfer.

2.1.9.7. Switches shall include a two stage, back-up time delay system, independent of the Microprocessor Controller, for protection against extended paralleling of both sources beyond 100 milliseconds. Should this time delay expire while in parallel, a contact is provided to facilitate the tripping of a remote source circuit breaker to ensure extended parallel time does not exceed 100 milliseconds.

2.1.9.8. All time delays shall be adjustable in 1second increments. All time delays shall be adjustable via the graphical display, the front USB port or configuration software using the USB, serial or Ethernet communications port.

2.1.10. Additional Features

2.1.10.1. Test Switch – The controller shall be provided with a two position, password protected test switch to simulate a normal source failure. The test mode shall be configurable for Test Without Load or Test with Load functionality. The Test function shall be activated via the pushbutton on the display or remotely via a dry contact, voltage signal or a network signal.

2.1.10.2. Source connected contacts rated 10 amps at 120 VAC shall be provided to signal when the ATS is connected to each source.

2.1.10.3. Source Connected LED's – The controller shall include LED's to indicate when the ATS is connected to each source.

2.1.10.4. Source Availability LED's – The controller shall include LED's to indicate the availability of each source.

2.1.10.5. Commit/No-Commit Transfer Selector – The controller shall include a programmable selector to configure the controller to commit to transferring the load to alternate (or not) in the event the normal source returns prior to the alternate source accepting load.

2.1.10.6. Inhibit Transfer Signals – The controller shall be capable of accepting transfer control inputs that inhibit transfer of the ATS to either source.

2.1.10.7. Auto/Manual Selector – The controller shall include a programmable function to select either Automatic or Manual operation.

2.1.10.8. Diagnostics – The controller shall contain self and system diagnostic screens for the purpose of detecting and troubleshooting abnormal system events.

2.1.10.9. Communications Interface – The controller shall be capable of interfacing via Ethernet TCP/IP communications ports integral to the controller. All communications parameters (baud rate, parity, IP Address, etc.) shall be accessible and programmable via the front keypad. Both serial and Ethernet communication shall be Modbus open protocol. Event Logger – The controller shall have the ability to log data and to maintain the last 256 events, even in the event of a power failure. Time and date stamping of events will be accurate to 1 ms. Controller shall be capable of synchronizing its date/time setting with a main PC via Network Time Protocol over an Ethernet TCP/IP network connection.

2.1.10.9.1. The following events shall be time and date stamped:

- Last Primary Source Failure
- Last reason for transfer.
- Last transfer to alternate source
- Last retransfer to primary source
- Time load is without power
- Time ATS powered up
- Total time on source 1
- Total time on source 2
- Total number of primary source failures
- Total number of transfers

2.1.11. Communications Modules

2.1.11.1. Serial Communications: Controller shall support RS485 communications port to enable serial communications at baud rates up to and including 115.2Kbps and be user configurable. The serial communications shall be capable of a direct connect or multi-drop configured network.

2.1.11.2. Ethernet Communications: Controller shall be capable of supporting Ethernet TCP/IP communications via an internally mounted and self powered communications card. Ethernet shall be 10/100 Mbit, auto sensing and include a RJ45 network connector. Open Protocol: Both serial and

Ethernet communications shall be Modbus protocol. Proprietary communications protocols shall not be acceptable.

2.1.11.3. External Power Supply: The controller shall be capable of being connected to an external 24 VDC power supply to permit full operation and communications of the controller when both sources are de-energized.

2.1.11.4. Auto Load Shed: The controller shall be capable of being programmed to automatically shed the connected load in the event of a user configurable under frequency condition.

2.1.11.5. Customer Configurable Alarms – The controller shall be capable of being configured to display customer configured alarm points. Alarms shall be capable of being reset via a remote contact or the front panel RESET pushbutton.

2.1.11.6. Switches shall include the ability to select between open and closed transition operation either through the main controller.

2.1.11.7. Transfer switches shall include a digital synch scope for display of phase difference, in electrical degrees, between the two sources. Synch scope data must be displayed in real time and accessible from the transfer switch main controller.

2.1.12. Power Quality Metering

2.1.12.1. The ATS shall include metering for current, voltage, real power, reactive power, energy use, power factor and frequency. Metering shall be true RMS type, 1% accuracy for voltage and 0.5% for currents with a 5-amp secondary current transformer.

2.1.12.2. The following parameters shall be provided:

2.1.12.2.1. Phase current: Ia, Ib, Ic, In and average current (Iavg)

2.1.12.2.2. Phase voltage: Va, Vb, Vc, Vab, Vac, Vbc

2.1.12.2.3. Voltage and Current unbalance

2.1.12.2.4. Hz, PF, W, Var, VA

2.1.12.2.5. Wh, VAh, VARh

2.1.12.2.6. Voltage and Current Harmonics (% THD up to 8^{th} order)

2.1.12.2.7. Phase Rotation Sensing

2.1.12.2.8. Synchroscope (lead/lag)

2.1.12.3. The ATS shall be capable of monitoring and capturing waveform data in the event of a utility power outage or other user specified event.

2.1.12.3.1. A total of 10 active channels of waveform capture may be user configured.

2.1.12.3.2. Each channel shall be capable of capturing up to 256 cycles of waveform information.

2.1.12.3.3. Analog channels may be configured for 4, 8, 16 or 32

samples/cycle.

2.1.12.3.4. Digital channels shall be configured for 1 sample/cycle.

2.1.12.3.5. Waveform data shall be stored in industry standard COMTRADE format for broadest compatibility and ease of downloading to a PC.

2.1.12.4. The controller shall be capable of logging digital and analog measured parameters and storing the data in non-volatile memory.

2.1.12.4.1. The controller shall contain a 10 channel Data Logger. Each channel shall be capable of being configured to monitor a digital on/off or analog measured parameter.

2.1.12.4.2. The sampling rate of each channel shall be configurable form 1 cycle to 60 minutes per sample. The data shall be stored in non-volatile memory in a first in, first out method.

2.1.12.5. The power metering system shall provide for an Ethernet connection to a SCADA system.

2.2. 5KV Automatic Transfer Switch

2.2.1. The 5kV automatic transfer switch shall be UL listed 1008A. No other switchgear assemblies will be accepted.

2.2.2. One normal / alternate circuit breaker cubicle, metal-clad Stainless Steel NEMA 3R, shall be furnished with the following basic components, and any additional equipment necessary to provide for a complete and dependable system.

2.2.2.1. Two (2) 5KV, vacuum circuit breakers, 3 phase, 1200 amperes, stored energy, draw out type, arranged for operation on 48VDC control power, with 25 KA. (500MVA) 3 phase, interrupting rating.

2.2.2.2. Two (2) sets of (3) surge arresters, fully rated for system voltage

2.2.2.3. Two (2) separate back-lit LED annunciators for the following circuit breaker status indications:

2.2.2.3.1. Circuit breaker opened

2.2.2.3.2. Circuit breaker closed

2.2.2.3.3. Circuit breaker drawn out

2.2.2.4. Electrical Interlocks to prevent inadvertent simultaneous closing of normal and emergency breakers

2.2.2.5. Two (2) Schweitzer 751A Feeder Protection Relays

2.2.2.6. Control wiring, alarmed dc control voltage circuit breakers, terminals, nameplates, etc as required. All wiring shall to be labeled at both ends. Wiring labels match manufacturer's drawings.

2.2.2.7. One set of, three phase, 1200 ampere insulated copper bus.

2.2.2.8. One (1) set of compression type lugs for customer's normal source

connections.

2.2.2.9. One (1) set of compression type lugs for customer's alternate source connections.

2.2.3. One metal-clad- Stainless Steel NEMA -3R, Transfer Control & PT cubicle shall be furnished with the following basic components, and any additional equipment necessary to provide for a complete and dependable system.

2.2.3.1. Control switches shall be provided for the following operations:

2.2.3.1.1. ATS Control Switch (Break-No Break)

- ATS Control switch to the Break position- Transfers between all breakers will occur in break before make, open transition mode.
- ATS Control switch to the No Break position- Transfers between emergency or normal breakers will occur in a make before break, 100 ms, closed transition mode.

2.2.4. Preferred Source Selector Switch (Normal-ALT)

Preferred Source Selector Switch to the Normal position:

When the switch is in the source-1 position, the transfer switch will transfer to source-1 if connected to source-2. Upon loss of source-1 the transfer switch will transfer to source-2. When source-1 becomes available again, the transfer switch will retransfer back to the source-1 position.

Preferred Source Selector Switch to the Alt position:

When the switch is in the source-2 position, the transfer switch will transfer to source-2 if connected to source-1. Upon loss of source-2 the transfer switch will transfer to source-1. When source-2 becomes available again, the transfer switch will retransfer back to the source-2 position.

2.2.5. Two (2) sets of (2) potential transformers, draw out type, with 5KV primary and 120-volt secondary.

2.2.5.1. Control wiring, alarmed dc control voltage circuit breakers, terminals, nameplates, etc. as required. All wiring shall to be labeled at both ends. Wiring shall match the manufacturer's drawings.

2.2.6. Ratings

2.2.6.1. The ATS described in this specification shall be designed for operation on a 5 kV, three phase, 3 wire, Resistance grounded, 60-hertz system.

2.2.6.2. Each circuit breaker shall have the following ratings:

2.2.6.2.1. Maximum Voltage: 5 kV

2.2.6.2.2. Basic Impulse Level 95 kV

2.2.6.2.3. Continuous Current: 1200 Amperes

2.2.6.2.4. Short Circuit Current at rated maximum kV: 18 kA RMS

2.2.6.2.5. Three Second Rating: 25 kA RMS

2.2.6.2.6. Closing and Latching Capability: 62 kA Crest

2.2.6.2.7. Nominal 3 Phase MVA Class 500 MVA

2.2.6.2.8. Rated Interrupting Time: Three cycles

2.2.7. Construction

2.2.7.1. The ATS shall consist of individual vertical sections housing various combinations of circuit breakers and auxiliaries, bolted to form a rigid metal-clad ATS. Metal side sheets shall provide grounded barriers between adjacent structures and solid removable metal barriers shall isolate the major primary sections of each circuit. Hinged rear doors, complete with provisions for padlocking, shall be provided.

2.2.7.2. The stationary primary contacts shall be silver-plated and recessed within insulating tubes. A metallic shutter shall automatically cover the stationary primary disconnecting contacts when the breaker is in the disconnected position or out of the cell.

2.2.8. Bus

2.2.8.1. The main bus shall be copper and have fluidized bed epoxy flame retardant and track-resistant insulation. The bus supports between units shall be flame-retardant, track-resistant, glass polyester for 5 kV class. The ATS shall be constructed so that all buses, bus supports and connections shall withstand stresses that would be produced by currents equal to the momentary ratings of the circuit breakers. A set of 1200 ampere insulated copper main bus shall be provided and have provisions for future extension. All bus joints shall be plated, bolted and insulated with easily installed boots. The bus shall be braced to withstand fault currents equal to the close and latch rating of the breakers. The temperature rise of the bus and connections shall be in accordance with ANSI standards and documented by design tests.

2.2.8.2. A copper ground bus shall extend the entire length of the switchgear.

2.2.9. Circuit Breakers

2.2.9.1. The circuit breakers shall be horizontal draw-out type, capable of being withdrawn on rails. The breakers shall be operated by a motor-charged stored energy spring mechanism, charged normally by a universal electric motor and in an emergency by a manual handle. The primary disconnecting contacts shall be silver-plated copper.

2.2.9.2. Each circuit breaker shall contain three vacuum interrupters separately mounted in a self-contained, self-aligning pole unit which can be removed easily. The vacuum interrupter pole unit shall be mounted on glass polyester supports for 5 kV class. A contact wear gap indicator for each vacuum interrupter, which requires no tools to indicate available contact life, shall be easily visible when the breaker is removed from its compartment. The breaker front panel shall be removable when the breaker is withdrawn for ease of inspection and maintenance.

2.2.9.3. The secondary contacts shall be tin plated and shall automatically engage in the breaker operating position, which can be manually engaged in the breaker

test position.

2.2.9.4. Interlocks shall be provided to prevent closing of a breaker between operating and test positions, to trip breakers upon insertion or removal from housing and to discharge stored energy mechanisms upon insertion or removal from the housing. The breaker shall be secured positively in the housing between and including the operating and test positions.

2.2.9.5. The breakers shall be electrically operated by control voltages of 48-volt DC Close and Charge. Each breaker shall be complete with red and green indicating lights to indicated breaker contact position.

2.2.9.6. The control voltage shall be from a 48 VDC station battery system as furnished for the ATS. The NiCad station battery shall be installed on a freestanding, outdoor, seismic rated, battery enclosure.

2.2.9.6.1. Operation shall be completely automatic with the charger maintaining the battery fully charged under all normal service conditions. Cooling shall be by convection.

2.2.9.6.2. The battery charger enclosures shall be equipped with the following:

2.2.9.6.3. A DC voltmeter, DC ammeter, float-charged indicator and high-rate charge indicator shall be mounted on the front of the panel.

2.2.9.6.4. The enclosure shall contain a potentiometer for adjusting float charge voltage and a potentiometer for adjusting the high-rate voltage. These controls shall be equipped with AC and DC fuses and an AC and DC failure alarm relay.

2.2.9.6.5. An automatic, 24-hour timer shall be installed within the console cabinet. Following an AC power failure longer than 8 to 12 seconds, the timer shall automatically switch the charger to the high-rate mode. After the preset interval, the timer shall return the battery to float charge.

- The storage batteries shall be a sealed lead-antimony or selenium, alkaline type, manufactured by Exide, C&D or ALCAD.
- The battery shall be designed for nominal 48-volt DC service and shall be capable of delivering 55-ampere-hour capacity at the 8-hour rate.
- The battery chargers shall be of the constant-potential, two-rate type with a regulated output voltage stability of +/- 1% from zero to full nominal current rating, over an input voltage variation of 10%. Input shall be 120 volts, 60 Hertz, single phase, AC. Nominal output shall be 25 amperes and 48 volts DC.

2.2.10. Auxiliary Devices

2.2.10.1. Ring type current transformers shall be furnished as required. The thermal and mechanical ratings of the current transformers shall be coordinated with the circuit breakers. Their accuracy rating shall be equal to or higher than

ANSI standard requirements. The standard location for the current transformers on the bus side and line side of the breaker units shall be front accessible to permit adding or changing current transformers without removing high-voltage insulation connections. Shorting terminal blocks shall be furnished on the secondary of all the current transformers.

2.2.11. Accessories

2.2.11.1. The manufacturer shall furnish accessories for the metal clad Stainless Steel NEMA 3R ATS for test, inspection, maintenance and operation, including:

2.2.11.1.1. Maintenance tool for manually charging the breaker closing spring and manually opening the shutter

2.2.11.1.2. Levering crank for moving the breaker between test and connected positions

2.2.11.1.3. Breaker lifting yoke, floor mounted on rollers used for attachment to breaker for lifting breaker on or off compartment rails

2.2.12. Wiring/Terminations

2.2.12.1. On the medium voltage ATS, one two-hole NEMA pad per phase shall be provided for attaching compression, crimp type cable terminal suitable for copper cable lugs for the number and sizes of conductors as indicated on the drawings. Sufficient space shall be supplied for Contractor supplied electrical stress relief termination devices.

2.2.12.2. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided.

2.2.12.3. All control wire shall be type SIS. Wire bundles shall be secured with nylon ties and anchored to the assembly with the use of pre-punched wire lances. All current transformer secondary leads shall first be connected to conveniently accessible short circuit terminal blocks before connecting to any other device. Four shorting screws with provisions for storage shall be provided.

2.2.12.4. All groups of control wires leaving the ATS shall be provided with terminal blocks with suitable numbering strips. Wago cage clamp terminals shall be provided for all control connections. Provide wire markers at each end of all control wiring. Plug in terminal blocks shall be provided for all shipping split wires.

2.2.12.5. Small wiring, necessary control voltage circuit breakers, and terminal blocks within each vertical section shall be furnished as required. Control components mounted within the assembly, such as control voltage circuit breakers, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2.2.13. Enclosures

2.2.13.1. The ATS described in these specifications shall be outdoor Stainless Steel

NEMA-3R construction, with devices arranged as shown on contract drawings.

2.2.14. Nameplates

2.2.14.1. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits. Nameplates shall be laminated plastic, black characters on white background, and secured with screws. Characters shall be 3/16-inch-high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating.

2.2.14.2. Furnish master nameplate giving ATS designation, voltage ampere rating, short circuit rating, manufacturer's name, general order number and item number.

2.2.14.3. Control components mounted within the assembly, such as control voltage breakers, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's drawings and/or wiring diagrams.

2.2.15. FINISH

2.2.15.1. Prior to assembly, all enclosing steel shall be thoroughly cleaned and phosphatized. A powder coating shall be applied electrostatically, then fused on by baking in an oven. The coating is to have an average thickness of not less than 3.0 mils. The finish shall have the following properties:

2.2.15.1.1. Impact resistance (ASTM D-2794): 60 Direct/60 Indirect

2.2.15.1.2. Pencil Hardness (ASTM D-3363): H

2.2.15.1.3. Flexibility (ASTM D-522): Pass 1/8-inch mandrel

2.2.15.1.4. Salt Spray (ASTM B117-85 [20]): 600 hours

2.2.15.1.5. Color: ANSI 61 Gray

3.0 EXECUTION

3.1 Cooperation and Work Progress

3.1.1 The Electrical work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Contractor shall cooperate with the Architect, General Contractor, all other Subcontractors and equipment suppliers working at the site. The Contractor shall coordinate the work and proceed in a manner so as not to delay the progress of the project.

3.1.2 The Contractor shall coordinate his work with the progress of the building and other Trades so that he will complete his work as soon as conditions permit and such that interruptions of the building functions will be at a minimum. Any overtime hours worked or additional costs incurred due to lack of or improper coordination with other Trades or the Owner by the Contractor shall be assumed by him without any additional cost to the Owner.

3.1.3 The Contractor shall furnish information on all equipment that is furnished under this Section but installed under another Section to the installing Subcontractor as specified

herein.

3.1.4 The Contractor shall provide all materials, equipment and workmanship to provide for adequate protection of all electrical equipment during the course of construction of the project. This shall also include protection from moisture and all foreign matter. The Contractor shall also be responsible for damage which he causes to the work of other Trades, and he shall remedy such injury at his own expense.

3.1.5 Waste materials shall be removed promptly from the premises. All material and equipment stored on the premises shall be kept in a neat and orderly fashion. Material or equipment shall not be stored where exposed to the weather. The Contractor shall be responsible for the security, safekeeping and damages, including acts of vandalism, of all material and equipment stored at the job site.

3.1.6 The Contractor shall be responsible for unloading all electrical equipment and materials delivered to the site. This shall also include all large and heavy items or equipment which require hoisting. Consult with the General Contractor for hoisting/crane requirements. During construction of the building, the Contractor shall provide additional protection against moisture, dust accumulation and physical damage of automatic transfer switches. This shall include furnishing and installing temporary heaters within these units, as approved, to evaporate excessive moisture and ventilate it from the room, as may be required.

3.1.7 It shall be the responsibility of the Contractor to coordinate the delivery of the transfer switch equipment to the project prior to the time installation of equipment will be required; but he shall also make sure such equipment is not delivered too far in advance of such required installation, to ensure that possible damage and deterioration of such equipment will not occur. Such equipment stored for an excessively long period of time (as determined in the opinion of the Architect) on the project site prior to installation may be subject to rejection by the Architect.

3.1.8 The Contractor shall erect and maintain, at all times, necessary safeguards for the protection of life and property of the Owner, Workmen, Staff and the Public.

3.1.9 Prior to installation, the Contractor has the responsibility to coordinate the exact mounting arrangement and location of electrical equipment to allow proper space requirements as indicated in the NEC. Particular attention shall be given in the field to group installations. If it is questionable that sufficient space, conflict with the work of other Subcontractors, architectural or structural obstructions will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, the Contractor shall immediately notify the Architect / Engineer and not proceed with this part of the Contract work until definite instructions have been given to him by the Architect or Engineer.

3.1.10 The Contractor shall not allow any equipment or piping foreign to the electrical installation to be installed or pass through any room in which electrical systems or equipment are located, such as electric rooms, electric closets, telephone or data closets. The Contractor shall notify the Architect of such violations and request immediate removal.

3.2 Installation

3.2.1 General

3.2.1.1 Unless specifically noted or indicated otherwise, all equipment and material specified in Part 2 of this specification or indicated on the drawings shall be installed under this Contract whether or not specifically itemized herein. This Section covers particular installation methods and requirements peculiar to certain items and classes or material and equipment.

3.2.1.2 The Contractor shall obtain detailed information from manufacturers of equipment provided under Part 2 of this specification as to proper methods of installation.

3.2.1.3 The Contractor shall obtain final roughing dimensions and other information as needed for complete installation of items furnished under other Sections or furnished by the Owner.

3.2.1.4 The Contractor shall keep fully informed of size, shape and position of openings required for material and equipment provided under this and other Sections. Ensure that openings required for work of this Section are coordinated with work of other Sections. Provide cutting and patching as necessary.

3.2.1.5 All miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws and other such items, shall be of a galvanized or zinc plated finish or of another approved rust-inhibiting coating.

3.2.2 Concrete Housekeeping Pads

3.2.2.1 Concrete pads shall be installed for all freestanding equipment.

3.2.2.2 The General Contractor shall provide the concrete work. Contractor shall supervise and coordinate concrete work to ensure that proper grounding cable, rods, conduit, etc., are located as detailed and as required. The Contractor shall also ensure that the concrete is level to within manufacturers published tolerances.

3.2.2.3 All concrete housekeeping pads shall extend a minimum of 6" on each side from the equipment mounted on it. Mounting height of each overcurrent/disconnect device in the above equipment shall not exceed 6'-6" above finished floor. If overcurrent devices exceed 6'-6" above finished floor as a result of the housekeeping pad, the pad shall extend in front of the gear a minimum of 4'-0".

3.2.3 Electrical Distribution Equipment

3.2.3.1 The Contractor shall install the equipment per the manufacturer's recommendations and the Contract Drawings.

3.2.3.2 The installation of all equipment, including working space requirements, shall conform to all NEC and local codes.

3.2.3.3 All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.2.3.4 Floor mounted assemblies shall be installed on concrete housekeeping pads and shall be provided with adequate lifting means. Floor mounted assemblies

shall be capable of being moved into installation position and bolted directly to the floor without the use of floor sills. The Contractor shall ensure the floor is level to 1/8 inch per 3-foot distance in any direction.

3.2.3.5 All electrical equipment shall be installed such that the handle of the highest circuit breaker does not exceed 6'-6" above finished floor.

3.2.3.6 The location of all electrical distribution equipment installed in mechanical or plumbing equipment rooms shall be coordinated with the respective Subcontractor.

3.2.3.7 The equipment shall be installed and checked in accordance with the manufacturer's recommendations prior to first energization. This shall include but not limited to:

3.2.3.7.1 Checking to ensure that the pad location is level to within .125 inches.

3.2.3.7.2 Checking to ensure that all bus bars are torqued to the manufacturer's recommendations.

3.2.3.7.3 Assemble all shipping sections, remove all shipping braces and connect all shipping split mechanical and electrical connections.

3.2.3.7.4 Secure assemblies to foundation or floor channels.

3.2.3.7.5 Measure and record megger readings phase-to-phase, phase-to-ground, and neutral-to-ground (four-wire systems only).

3.2.3.7.6 Inspect and install all circuit breakers, components, etc. in their proper compartments.

3.2.3.8 Identification shall be provided for all ATS equipment. The electrical system identification shall clearly describe the equipment connected. Method of identification shall be by laminated nameplate made of Bakelite or similar material with engraved letters at least 1/4" high and securely attached to the equipment with galvanized screws. Adhesives or cements shall not be used. A list of nameplates shall be submitted to the Architect for approval prior to fabrication.

3.2.3.9 Control wiring shall be provided as required. Interface all local and remote-control wiring and operational systems for each load.

3.3 Materials and Workmanship

3.3.1 All materials and equipment shall be new and unused and shall meet requirements of the latest Standards of NEMA, UL, ANSI and IEEE. Equipment shall have components required or recommended by OSHA, applicable NFPA documents and shall be UL listed and labeled.

3.3.2 Despite references in the specifications or on the drawings to materials or pieces of equipment by name, make or catalog number, such references shall be interpreted as establishing standards of quality for materials and performance.

3.3.3 Finish of materials, components and equipment shall not be less than Industry good practice. When material or equipment is visible or subject to corrosive or atmospheric conditions, the finish shall be as approved by the Architect.

3.3.4 Provide proper access to material or equipment that requires inspection, replacement, repair or service. If proper access cannot be provided, confer with the Architect as to the best method of approach to minimize effects of reduced access.

3.3.5 All work shall be installed in a neat and workmanlike manner and shall be done in accordance with all Local and State Codes.

3.3.6 The Owner will not be responsible for material, equipment or the installation of same before testing and acceptance.

3.4 Factory Testing

3.4.1 The following standard factory tests shall be performed on the primary equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

3.4.2 Medium voltage ATS switchgear

3.4.2.1 The following standard factory tests shall be performed on the circuit breaker element provided under this section. All tests shall be in accordance with the latest version of ANSI standards.

3.4.2.1.1 Alignment test with master cell to verify all interfaces and interchangeability.

3.4.2.1.2 Circuit breakers operated over the range of minimum to maximum control voltage.

3.4.2.1.3 Factory setting of contact gap.

3.4.2.1.4 One-minute dielectric test per ANSI standards.

3.4.2.1.5 Final inspections and quality checks.

3.4.2.2 The following production test shall be performed on each breaker housing.

3.4.2.2.1 Alignment test with master breaker to verify interfaces.

3.4.2.2.2 One-minute dielectric test per ANSI standards on primary and secondary circuits.

3.4.2.2.3 Operation of wiring, relays, and other devices verified by an operational sequence test.

3.4.2.2.4 Final inspection and quality check.

3.4.2.3 Factory tests as outlined above shall be witnessed by the Owner's representative.

3.4.2.3.1 The manufacturer shall notify the Owner two (2) weeks prior to the date the tests are to be performed.

3.4.2.3.2 The manufacturer shall include the cost of transportation and lodging for up to three (3) Owner's representatives. The cost of meals and incidental expenses shall be the Owner's responsibility.

3.4.2.3.3 The manufacturer shall provide three (3) certified copies of factory test reports. 3.5 FIELD

3.5 Settings

3.5.1 The Contractor shall perform field adjustments of the circuit breakers as required to place the equipment in final operating condition. The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

3.5.2 For transformers, adjust taps to deliver appropriate voltage and measure primary and secondary voltage to confirm proper setting.

3.6 Field Quality Control

3.6.1 Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and start-up of the equipment specified under this section. The manufacturer's representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

3.7 Manufacturer's Certification

3.7.1 A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, and tested in accordance with the manufacturer's recommendations.

3.7.2 The Contractor shall provide three (3) copies of the manufacturer's representative's certification before final payment is made.

3.7.3 A certified test report of all standard production tests shall be available to the Engineer upon request.

3.8 Training

3.8.1 The Contractor shall provide a training session for Owner's representatives at a jobsite location determined by the Owner.

3.8.2 The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation of the assembly, circuit breakers, and major components within the assembly.

3.8.3 The training program shall include the following:

3.8.3.1 Review of the project one-line drawings and schedules.

3.8.3.2 Review of the factory record shop drawings.

3.8.3.3 Review of all equipment in the electrical distribution system.

3.8.3.4 Review of the maintenance program.

3.8.3.5 Provide three ring binders to participants complete with copies of drawings and other course material covered.