TECHNICAL SPECIFICATIONS

ELECTRICAL POWER GRID
FEMA PA DR-4339 PROJECT 95275
LOCAL REDEVELOPMENT AUTHORITY FOR ROOSEVELT ROADS

Issued for Equipment Procurement

Roosevelt Roads
Ceiba, Puerto Rico



August 17, 2026



CMA
ARCHITECTS &
ENGINEERS LLC

DOCUMENT 00 01 10

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IFEP = Issued for Equipment Procurement

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IFEP = Issued for Equipment Procurement

END OF DOCUMENT

SECTION 01 10 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of this Contract comprises the general construction for the Electrical Power Grid in Ceiba, Puerto Rico.

B. The Contractor shall use only tools and equipment which satisfies the requirements imposed by the general characteristics of the work areas.

C. The Contractor shall furnish all necessary materials, labor, supervision, and any other necessary incidentals required to complete the Scope of Work as described herein or as indicated on the drawings and specifications.

1.2 CONTRACT METHOD

A. Construct the Work under a lump sum contract.

1.3 RELATED DOCUMENTS AND SECTIONS

A. Division 1 - General Requirements.

B. Divisions 2 through 34 - Technical Specifications.

1.4 DEFINITIONS

A. For means of clarification and definition the following terms shall be used throughout these specifications:

1. Architect-Engineer: CMA Architects & Engineers LLC.

1.5 INTENT OF DRAWINGS

A. The drawings show the arrangement, general design, and extent of the systems.

B. The drawings are not intended to be scaled for rough-in measurements, nor to serve as shop drawings. Where drawings are required for these purposes, or shall be made from field measurements, they shall be prepared by the Contractor.

1.6 LAND FOR CONSTRUCTION PURPOSES

A. Contractor will be permitted to use available land belonging to Government, on or near the site of the Work, for construction purposes and for the storage of materials and equipment. The location and extent of the areas so used shall be as directed by the Contracting Officer. Contractor will be responsible for the safety of onsite materials and equipment stored at project site.

B. Contractor shall immediately move stored material or equipment if any occasion arises, as determined by the Contracting Officer, requiring access to the storage area. Materials or equipment shall not be placed on the property of the Government until the Contracting Officer has agreed to the location to be used for storage.

C. Contractor shall assume full responsibility for protection and safekeeping of products under this Contract.

1.7 OPERATION OF EXISTING FACILITIES

A. The existing facilities must be kept in continuous operation and production throughout the entire construction period. No interruptions will be permitted during normal production hours.

B. Contractor shall provide temporary facilities and make temporary modifications as necessary to keep the existing facilities in operation during the construction period. Refer to Specification 01 50 00 – Temporary Facilities and Controls.

1.8 UNFAVORABLE CONSTRUCTION CONDITIONS

A. During unfavorable weather, wet ground, unsuitable construction conditions, the Contractor shall confine his operations to work which will not be affected by such conditions. No portion of the work shall be constructed under conditions which would affect adversely the quality or efficiency thereof unless special means or precautions by Contractor to perform the work in a proper and satisfactory manner.

1.9 NOTICES TO OWNER

A. Contractor shall notify Contracting Officer via email when prosecution of the Work may affect the Government. Submit Project Schedule if affected by Work.

1.10 OWNER's ACCESS TO WORK AREA

A. The Contractor shall permit the Government, Contracting Officer, Owner Representative, and Inspector free and open access to all portions of the work area and shall obtain permission for each of these, either together or independently, to visit other locations where portions of this work is being carried out for the purpose of inspecting materials, workmanship and/or working conditions for compliance with all requirements set forth in this Contract.

1.11 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations. Contractor shall stay within project limits and shall not interfere with any Government's operation.

B. On-Site Work Hours: Limit work to between 7:00 a.m. to 5:00 p.m., Monday through Friday.

1. Weekend & Holliday Hours: Do not perform work.

2. Early Morning Hours: Secure Contracting Officer authorization.

3. Hours for Utility Shutdowns: Secure Contracting Officer authorization.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Contracting Officer not less than seven days in advance of proposed utility interruptions.

2. Obtain Contracting Officer written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Government occupancy.

1. Notify Contracting Officer not less than seven days in advance of proposed disruptive operations.

2. Obtain Contracting Officer written permission before proceeding with disruptive operations.

E. Employee Identification: Provide identification tags for Contractor personnel working on the facilities. Require personnel to use identification tags at all times. Name, photo, social security number and identification number shall be included in Employee Identification.

1.12 SMOKING

A. Smoking is not permitted anywhere in the project site. Anyone caught smoking will be permanently expelled from the job site.

1.13 APPLICABLE CODES

A. References in the Contract Documents to local codes mean the Puerto Rico Building Code, 2018 Edition.

B. Other standard codes which apply to the Work are designated the specifications.

1.14 REFERENCE STANDARDS

A. Reference to the standards of any technical society, organization, or association, or to codes of local or state authorities, shall mean the latest standard, code, specification, or tentative standard adopted or published at the date of receipt of bids, unless specifically stated otherwise.

SCOPE OF WORK
GENERAL

PART 2 - SCOPE OF WORK - GENERAL

2.1 GENERAL

A. The following is an outline of the general work requirements for the Electrical Power Grid in Ceiba, Puerto Rico. This outline is prepared as a guide only and is not to be considered as a complete description of the work requirements.

B. The Contractor shall construct the items listed below and the more specifically detailed in the drawings in strict accordance with the specifications listed elsewhere in the Contract Documents.

C. Where the Contractor’s work shall encounter existing construction, the Contractor shall verify the condition and dimensional accuracy before proceeding. Where the new construction, as specified, is in conflict with existing conditions the Contractor shall immediately bring it to the attention of the Owner for resolution.

D. All equipment and materials shall be installed in strict accordance with the instructions of the manufacturer, unless more stringent requirements are required by the Owner’s On Site Representative or are shown on the drawings.

E. Contractor shall notify and receive written approval from the Architect-Engineer for proposed deviations from Contract Documents. If proposed deviations are made without the Architect-Engineer's written approval, this shall be considered as just cause for dismantling and removal of said work at Architect-Engineer's discretion. Reconstruction and/or reinstallation of the work shall be at Contractor's expense.

F. Construction Manager, Owner Project Manager, Owner’s On Site Representative and/or his authorized representative, and Architect-Engineer shall have the right at all times to inspect and test the work and shall for this purpose have access to the work whenever it is in preparation or in progress. The Contractor shall provide necessary labor and proper facilities for such access, inspection and testing, and shall provide complete information concerning all materials entering into the work.

G. Contractor shall handle and haul all materials, equipment and tools from the designated storage area(s) to the work area.

H. Contractor shall provide all hoisting, scaffolding and/or shoring required for the complete installation of all materials included in this Scope of Work.

I. Contractor shall provide all required cutting, drilling, bolting, welding, patching, weatherproof, etc. necessary to complete the work under this Scope of Work.

J. Contractor shall furnish the services of all trades necessary to complete all items enclosed in this Scope of Work.

K. Contractor shall furnish material and labor necessary to correct at his expense, any items improperly installed.

L. Contractor shall receive, unload, store and provide necessary weather protection for all materials, equipment and tools which he furnishes and installs. These items shall be stored in areas within plant premises designated by the Construction Manager.

M. Contractor shall furnish, install and maintain all his temporary field offices required for this work, for the duration of this Contract.

N. Contractor shall furnish all field engineering services required to complete this work.

O. Contractor shall make all submittals and obtain all approvals as specified and required to complete this work.

P. Contractor shall provide all required guarantees and certification for items of work and systems installed under this contract.

Q. Rubbish and dirt resulting from the Contractor's work shall be removed by the Contractor daily or more frequently as necessary to prevent the accumulation thereof and shall be disposed of in a legal manner as directed by the Construction Manager. Failure of the Contractor to clean up and remove rubbish as called for, will be cause for the Construction Manager to order this work done by others at the expense of the Contractor.

R. The areas assigned for Contractor's use and areas in which he is doing construction work shall be cleaned thoroughly at least once daily. All construction debris shall be removed in a legal manner from the project site on a daily basis. Contractor is responsible for maintaining a high standard of housekeeping in his construction sites, storage areas, and around temporary buildings at all times. Contractor shall store materials in a safe and organized manner and dispose off site material containers and construction debris on a daily basis.

S. All construction trailers, office sheds and warehouses used by the Contractor during the execution of this work shall be placed at the place (authorized by the Construction Manager) within the plant premises.

T. When the work is being executed away from the premises, the Construction Manager shall be notified, in reasonable time, where such work is being done and when it will be ready for inspection, so that the Construction Manager, Owner Project Manager, Owner’s On Site Representative and/or his authorized representative, and Architect-Engineer may, if they should so desire, inspect the same from time to time before delivery.

U. Contractor shall take necessary actions to eliminate possible fire hazards and to prevent damage to any construction work, building materials, equipment, temporary field offices, storage sheds and all other property.

V. Contractor shall protect all existing materials and areas against damage during the performance of his Work. Any damage to roads, parking lots, structural steel, concrete slabs, walls, roof, piping, equipment, etc., inflicted by this Contractor will be repaired at his expense.

W. Contractor shall contact Construction Manager regarding safety and sanitary requirements and shall comply with said requirements for the entire duration of the Contract.

X. Contractor shall take reasonable measures to prevent unnecessary dust. Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels or similar equipment, shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

Y. The progress schedule will be monitored on a daily and/or weekly basis by the Construction Manager; if it becomes apparent during the monitoring of the progress that slippage has occurred, then the Construction Manager shall direct the Contractor to take all necessary steps to regain the slippage and maintain the additional manpower until such time that the progress agrees with the current schedule. This will be accomplished at no cost to Owner.

Z. The Contractor will be responsible for maintain the project with the maximum member of workers to achieve the completion dates indicated in the construction schedule. If the Contractor determines

that overtime and/or shift work is required to attain such dates, such costs shall be included in the Bid Proposal.

AA. Construction Manager will hire and pay for the services of a testing laboratory to perform inspection and tests required by the respective Specification Sections. Testing, because of faulty work, will be paid by the Contractor.

BB. During the construction, Contractor shall provide the quantity of filled or fully charged fire extinguishers and hose to meet safety and fire prevention practices established under NFPA 241.

CC. Welding, flame cutting or other operations involving the use of flame, arcs or sparking devices, will not be allowed without adequate protection. All combustible or flammable material shall be removed from the immediate working area or, if removal is impossible, all flammable or combustible materials shall be protected with suitable noncombustible shields to prevent spark, flames, or hot metal from reaching the flammable or combustible materials.

DD. Not more than one day's supply of flammable liquids such as oil, gasoline, paint or paint solvent shall be brought into the buildings at any one time. All flammable liquids having a flash point of one hundred ten degrees Fahrenheit (110°F) or below which must be brought into the building shall be confined in Underwriters' Laboratories labeled safety cans. If one day's supply requires quantities greater than a safety can will hold, one (1) fifty-five (55) gallon drum may be used. Drums are to be equipped with safety bungs and U.L. listed pumps. The bulk supply of all flammables shall be stored at least seventy-five feet (75'-0") from the building or other combustible materials. Spigots on drums containing flammable liquids are prohibited on the project site.

EE. Flammable building materials located inside the building shall be kept to an absolute minimum.

FF. Oil-soaked rags, papers, and other combustible debris shall be removed from the building at the close of each day's work. This material shall be stored in a suitable approved area away from all buildings and hauled away prior to reaching large accumulations.

GG. Burning of debris and rubbish on the site is not permitted.

HH. Materials and/or equipment stored within the building in cardboard cartons, wood crates or other combustible containers shall be stored in an orderly manner and accessibly located. Firefighting equipment of approved types shall be placed in the immediate vicinity of any materials or equipment stored in this type of crane or carton.

II. No gasoline, benzine or like combustible materials shall be poured into sewers, manholes, or traps.

JJ. The gases used for welding and cutting shall be purchased in cylinders. These cylinders shall be constructed and maintained in accordance with regulations of the U.S. Department of Transportation (DOT). The cylinders shall bear DOT markings and the contents of each cylinder shall be legibly marked in large letters.

KK. Cylinders of oxygen and acetylene inside buildings shall be stored in areas that are well ventilated and free from moisture and water. Flammable substances, such as oil and volatile liquids shall not be stored in the same area. The area assigned to cylinder storage shall be well protected by location from possible damage by other types of activity. Oxygen cylinders stored inside shall be separated by a fire-resistant partition from cylinders containing flammable gases.

LL. Cylinders of oxygen and acetylene are to be protected from the hot sun by such means as canopies and/or sheds.

MM. To avoid confusion, full cylinders and empty cylinders should be stored in separate groups. All empty cylinders shall be marked "Empty" or "MT."

NN. Flammable gas, such as acetylene, and other gases shall not be premixed with air or oxygen, prior to consumption, except at burner or in a cutting or welding torch designed for that purpose.

OO. Oxygen and acetylene shall be withdrawn from cylinders provided with regulators and/or pressure-reducing valves specifically designed for such purposes.

PP. All cylinders shall be set in a vertical position during storage at the job site and while in portable carts, when in use, and shall be fastened to insure against tipping.

QQ. Owner reserves the right to perform work related to the Project with its own forces, and to award separate contracts in connection with other portions of the Project or another work on the Project Site which are not part of the Work. Owner shall provide for the coordination of the work of its own and of each separate contractor with the Work of Contractor (Work of this Bid Package) who shall cooperate therewith as provided herewith. Contractor (this Bid Package) shall afford Owner and separate contractors reasonable opportunity for the introduction and storage of their materials and equipment and for the execution of their work. Contractor shall connect and coordinate the work with the work of Owner and separate contractors as required by the Contract Documents. If any part of the Work (this Bid Package) depends for proper execution or results upon the work of Owner or any other separate contractor, Contractor shall, prior to proceeding with Work, promptly report to the Construction Manager any discrepancies or defects that are reasonably discoverable which render such work unsuitable for proper execution and results. Failure of Contractor so to report shall constitute an acceptance of Owner's or separate contractor's work as fit and proper to receive the Work. Any costs caused by defective or ill timed work shall be borne by the party responsible therefore. Should Contractor (this Bid Package) cause damage to the work or property of Owner, or to other work or property on the Project site, Contractor (this Bid Package) shall promptly remedy such damages.

SCOPE OF WORK
ELECTRICAL POWER GRID

PART 3 - SCOPE OF WORK – ELECTRICAL POWER GRID

3.1 ELECTRICAL

A. Contractor shall furnish all specified electrical equipment, materials, factory installed components, accessories, controls, protective devices, hardware, documentation, testing, packaging, and delivery as shown on drawings and related specifications.

B. This procurement package is for furnishing equipment only. Unless specifically stated otherwise, installation and construction activities are not included.

C. Contractor shall provide complete, operable equipment assemblies suitable for the final installation for the LRA Power Grid Improvements project.

D. Equipment shall comply with the drawings, technical specifications, schedules, one-line diagrams, procurement documents, approved submittals, and applicable referenced codes and standards.

E. Contractor shall include all the required components for a complete equipment package, whether or not every component is individually identified on the drawings.

F. Execute the furnish of all the related electrical equipment including quantities, ratings, configurations, accessories, equipment schedules, procurement drawings and technical specifications, as applicable:

1. 38 KV oil filled power transformers.

2. 13.2 kV metal clad vacuum circuit breaker switchgear assemblies and related current, voltage and control power transformers, protective relays, metering devices, control switches, indicating devices, alarms, and auxiliary relays.

3. 38 kV service high voltage SF6 insulated circuit breakers.

G. Equipment shall be furnished complete, factory assembled, factory wired, and factory tested.

H. Contractor shall provide all components, accessories, auxiliary devices, terminal blocks, hardware, internal wiring, and special tools required for the equipment.

I. Contractor shall identify any equipment that must be shipped in sections or with components removed for transportation.

J. Equipment construction shall consider the coastal and corrosive environment of Roosevelt Roads and the environmental requirements contained in the Contract Documents.

K. Contractor shall be responsible for adequate preparation of all equipment for transportation to Puerto Rico and final delivery to the designated destination (Roosevelt Roads, Ceiba, PR) as shown on the project manual.

L. Equipment shall be packaged to prevent damage from moisture, salt exposure, vibration, impact, dirt, corrosion, and normal transportation and handling conditions.

M. Components removed for shipment shall be individually protected, tagged, and clearly cross-referenced to the associated equipment.

N. Transformer accessories susceptible to shipping damage shall be removed and packaged separately where required by the specification.

O. Switchgear shall be furnished with appropriate shipping skids, protective wrapping, and approved shipping splits.

P. SF6 circuit breakers shall be prepared and shipped in accordance with the manufacturer's requirements and the technical specifications.

Q. Contractor acknowledges that the project is federally funded through FEMA Public Assistance/Hazard Mitigation funding.

R. Contractor shall comply with all FEMA, COR3, Owner, and other applicable funding requirements expressly incorporated into the Procurement Documents and Contract.

S. Contractor shall comply with all applicable federal contract provisions and requirements included in the bidding and procurement documents.

T. Contractor shall provide supporting procurement and equipment documentation reasonably required by the Owner for FEMA/COR3 reimbursement, audit, closeout, or grant compliance purposes.

U. Documentation shall include, as applicable, itemized invoices, equipment descriptions, quantities, manufacturer information, serial numbers, shipping documentation, factory test reports, certifications, approved substitutions, change documentation, and evidence of delivery.

3.2 ATTACHMENT

A. Procurement BOM is herein attached.

END OF SECTION

PROCUREMENT BOM

CMA
1509 F.D. ROOSEVELT AVE. GUAYNABO, PR 00968-2612

CMA ARCHITECTS & ENGINEERS LLC

LRA Electrical Power Grid - FEMA PA DR-4339 Project 95275					
Item #	Equipment	FEMA Resilience and Hazard Mitigation (406)			Remarks
		Obligated (HMP Versioning)	Resiliency	Future Improvement	
Main 38KV Switchyard					
1	46KV, SF6 Gas Insulated Circuit Breaker (138-30 GCB)		X		For complete equipment rating refer to the Issued for Equipment Procurement electrical drawings and specification package
2	46KV, SF6 Gas Insulated Circuit Breaker (138-40 GCB)		X		
3	46KV, SF6 Gas Insulated Circuit Breaker (55-30 GCB)		X		
4	46KV, SF6 Gas Insulated Circuit Breaker (55-40 GCB)		X		
Main India Substation					
5	46KV, SF6 Gas Insulated Circuit Breaker (50-3)	X			For complete equipment rating refer to the Issued for Equipment Procurement electrical drawings and specification package
6	Oil Filled, 3PH, 60HZ, ONAN, Transformer 10/12.5MVA, 38KV Delta (Primary), 13.2/7.6KV WYE (Secondary)	X			
7	India 13.2KV Switchgear with four (4) vacuum breakers and protection relays	X			
Main Charlie Substation					
8	46KV, SF6 Gas Insulated Circuit Breaker (50-2)		X		For complete equipment rating refer to the Issued for Equipment Procurement electrical drawings and specification package
9	Oil Filled, 3PH, 60HZ, ONAN, Transformer 10/12.5MVA, 38KV Delta (Primary), 13.2/7.6KV WYE (Secondary)		X		
10	India 13.2KV Switchgear with four (5) vacuum breakers and protection relays		X		
Main Delta Substation					
11	46KV, SF6 Gas Insulated Circuit Breaker (50-1)			X	For complete equipment rating refer to the Issued for Equipment Procurement electrical drawings and specification package
12	Oil Filled, 3PH, 60HZ, ONAN, Transformer 10/12.5MVA, 38KV Delta (Primary), 13.2/7.6KV WYE (Secondary)			X	
13	India 13.2KV Switchgear with four (4) vacuum breakers and protection relays			X	
13.2KV Distribution Switchgear					
14	MVSWG-I1 - 13.2KV Switchgear with five (5) vacuum breakers and protection relays	X			For complete equipment rating refer to the Issued for Equipment Procurement electrical drawings and specification package
15	MVSWG-I2 - 13.2KV Switchgear with four (4) vacuum breakers and protection relays	X			
16	MVSWG-C1 - 13.2KV Switchgear with five (5) vacuum breakers and protection relays		X		
17	MVSWG-C2 - 13.2KV Switchgear with five (5) vacuum breakers and protection relays		X		
18	MVSWG-C3 - 13.2KV Switchgear with five (5) vacuum breakers and protection relays		X		
19	MVSWG-D1 - 13.2KV Switchgear with four (4) vacuum breakers and protection relays			X	
20	MVSWG-D2 - 13.2KV Switchgear with five (5) vacuum breakers and protection relays			X	

SECTION 26 12 13.13

LIQUID-FILLED POWER TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Section includes procurement, engineering, factory assembly, factory testing, documentation, packaging, and delivery of an outdoor, three-phase, liquid-filled apparatus substation transformer and associated accessories.

B. This Section is limited to equipment procurement. Foundations, installation labor, field assembly, grounding conductors, external power and control wiring, field testing, insulating-liquid processing at the site, and commissioning are by others unless specifically identified in the purchase order.

C. Basis-of-design equipment is an ABB Inc. outdoor apparatus substation transformer having a 38 kV delta primary winding, 13.2Y/7.6 kV secondary winding, and ONAN/ONAF cooling, as indicated by the submitted transformer outline drawing.

1.2 REFERENCES

A. Equipment shall comply with the applicable requirements of the following standards and authorities, as referenced by the purchase order and approved drawings:

1. ANSI - American National Standards Institute.

2. IEEE C57.12.00 - General requirements for liquid-immersed distribution, power, and regulating transformers.

3. IEEE C57.12.10 - Requirements for liquid-immersed power transformers.

4. IEEE C57.12.70 - Standard terminal markings and connections for distribution and power transformers.

5. IEEE C57.12.90 - Test code for liquid-immersed distribution, power, and regulating transformers.

6. IEEE C57.13 - Requirements for instrument transformers, when current transformers are furnished.

7. IEEE C57.91 - Guide for loading mineral-oil-immersed transformers and step-voltage regulators.

8. IEEE C57.106 - Guide for acceptance and maintenance of insulating mineral oil in electrical equipment.

9. NEMA TR 1 - Transformers, regulators, and reactors.

10. ASTM - Applicable insulating-liquid and material test standards.

11. NEC - National Electrical Code, for equipment interface requirements.

12. LUMA Energy and Puerto Rico Electric Power Authority requirements applicable to equipment interconnected with the utility system.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer catalog data identifying transformer construction, insulating liquid, cooling class, ratings, losses, impedance, sound level, accessories, bushings, surge arresters, control devices, and deviations from this Section.

B. Certified Outline Drawings: Show overall and shipping dimensions, terminal arrangement and phase markings, bushing centerline spacing, minimum electrical clearances, radiator and fan arrangement, control-cabinet location, junction boxes, conduit entrances, lifting points, jacking pads, pulling and rolling provisions, center of gravity, foundation footprint, anchor locations, and ground-pad locations.

C. Weights and Shipping Data: Submit core-and-coil weight, tank-and-fittings weight, insulating-liquid quantity and weight, total assembled weight, shipping weight, heaviest loose-shipped component, shipping configuration, and required unloading and storage precautions.

D. Electrical Drawings: Submit nameplate diagram, winding connection and vector relationship, tap-changer schedule, control schematics, elementary diagrams, connection diagrams, terminal-block schedules, device contact ratings, fan-control logic, alarm points, and external interface requirements.

E. Accessory Schedule: Identify each gauge, valve, relay, bushing, arrester, fan, radiator, cabinet, terminal box, ground pad, and loose-shipped component by manufacturer, type, rating, quantity, and drawing reference.

F. Current-Transformer Data: When current transformers are required, submit quantity, location, ratios, accuracy class, thermal rating factor, polarity, excitation curves, and terminal-block arrangement.

G. Loss and Performance Data: Submit guaranteed no-load loss, load loss, total loss, exciting current, impedance, sound level, temperature rise, efficiency, and auxiliary power requirements at each specified rating.

H. Deviations: Submit a clause-by-clause exception schedule. Silence shall be interpreted as full compliance with this Section.

1.4 CLOSEOUT SUBMITTALS

A. Certified Drawings: Submit final as-manufactured outline, foundation, nameplate, schematic, elementary, connection, terminal-block, bushing, arrester, tap-changer, control-cabinet, and accessory drawings.

B. Factory Test Reports: Submit certified routine test reports traceable to the transformer serial number and certified reports for specified design tests.

C. Operation and Maintenance Data: Submit instructions covering receiving, unloading, storage, assembly of loose-shipped components, insulating-liquid handling, filling, vacuum processing, energization, operation, inspection, maintenance intervals, alarm settings, fan controls, tap changing, troubleshooting, and recommended replacement parts.

D. Insulating-Liquid Documentation: Submit oil test certificates, quantity shipped in the main tank and separate containers, safety data sheets, PCB-free certification, and procedures for sampling and field processing.

E. Spare Parts: Submit a priced list of recommended commissioning spares and spare parts for five years of operation.

F. Warranty: Submit the manufacturer warranty options, with a minimum option of 12 months period after equipment is energized and identify its commencement date, duration, exclusions, storage requirements, and service-contact information.

1.5 QUALIFICATIONS

A. Manufacturer: Company regularly engaged in the manufacture of outdoor liquid-filled power transformers of comparable voltage and capacity, with not less than tenth years of documented experience.

B. Service Support: Manufacturer or authorized representative shall maintain access to trained service personnel, replacement bushings, gauges, fans, controls, gaskets, and other parts for the supplied transformer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Manufacturer shall be responsible for preparation, blocking, bracing, weather protection, and packaging adequate for transportation to the delivery point without damage.

B. Ship transformer factory assembled and liquid filled to the maximum practical extent. Bushings, surge arresters, radiators, fans, or other components removed for shipment shall be individually tagged and packaged with all hardware, gaskets, and installation instructions.

C. Before shipment, pressure test the transformer tank and liquid system for leaks in accordance with the manufacturer approved procedure. Submit the test record with shipping documents.

D. When insulating liquid or radiator liquid is shipped separately, provide sealed, weatherproof containers identified with transformer serial number, liquid type, quantity, and installation location. Maintain the transformer under dry gas pressure when required by the shipping configuration.

E. Provide impact recorders when required by the purchase order. Record shipping gas pressure, liquid level, and condition before release to the carrier.

F. Provide durable shipping tags showing purchase-order number, equipment number, serial number, gross weight, center of gravity, approved lifting points, and storage requirements.

1.7 MAINTENANCE MATERIALS

A. Provide one labeled container of finish coating for touch-up after delivery.

B. Provide special tools and adapters required for normal maintenance and operation that are not commercially available.

C. Provide one complete set of transformer gaskets, one high-voltage bushing of each type, one low-voltage bushing of each type, and recommended spare fan and control components.

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers: As indicated on Drawings.

B. Product Description: ANSI/IEEE C57.12.00; three phases, liquid filled, self-cooled/fan-cooled (OA/FA) transformer unit.

C. Cooling and Temperature Rise: IEEE C57.12.10; Class OA/FA 65ºC. Transformer designed for continuous self-cooled/fan-cooled operation. A thermally upgraded insulation system shall be provided allowing continuous loading at 112 percent of the 55ºC kVA rating with winding temperature rise not exceeding 65ºC, hottest spot temperature rise not exceeding 80ºC. The 65ºC rise rating shall be so indicated on the transformer nameplate.

D. Insulating Liquid: Insulating liquid shall be certified to contain no detectable PCB's at the time of shipment and the tank shall be so labeled. Certification shall also be provided that the transformer

and components have not been contaminated with PCB's prior to shipment. As indicated on Drawings insulating liquid shall be:

1. Oil conforming to IEEE C57.106

2. Silicone conforming to IEEE C57.111

3. The transformer insulated liquid shall meet or exceed the requirements of the appropriate ANSI and ASTM fluid Standards. The transformer liquid shall be tested for dielectric breakdown and moisture content just prior to the time of shipment.

E. Fan Cooling: Provide a complete fan cooling system. The increase in capacity shall be not less than 15 percent on units 750 through 2000 kVA and 25 percent on units 2500 kVA and over.

F. Capacity as indicated on Drawings. kVA ratings are continuous: 55ºC self-cooled / 55ºC fan-cooled / 65ºC fan-cooled. The transformer shall be designed to carry out time emergency loads in accordance with ANSI C57.92 and NEMA TR 98 as applicable. Duration and magnitude of designed withstand capability shall be as outlined in ANSI C57.12 and the latest draft of the IEEE Short Circuit Test Code.

G. Primary Voltage: 38 kV, Delta

H. Secondary Voltage: As indicated on Drawings:

1. 13.2Y/7.62 kV (Wye solidly grounded)

I. Taps: Except as otherwise indicated on Drawings the transformer shall have four 2-1/2 percent taps: 2 above and 2 below rated primary voltage. These taps shall be available by means of an externally operated manual tap changer for operation only when transformer is de-energized. Provision for padlocking the tap changer is required.

J. Basic Impulse Level: Shall be as follows or as per latest PREPA standard:

Rated Voltage	Insulation Class (kV)	BIL (kV)
38 kV	46	250
13.2 kV	15	95

K. Impedance: The transformer total impedance shall be standard (unless otherwise indicated) and shall be noted on initial information. (Impedance and manufacturer's variation).

L. Nameplate: Diagrammatic nameplate showing all ratings, tap-changing information, serial number, impedance and operating conditions. The nameplate shall be made of stainless steel.

2.2 ACCESSORIES

A. Provide the following accessories and features:

1. Pressure-vacuum gage

2. Magnetic liquid-level gage with alarm contacts

3. Dial-type oil thermometer with alarm contacts

4. Pressure vacuum bleeder

5. Globe-type combination drain and lower filter valve with sample device. The drain valve and the oil sampling valve will be located as so to allow draining or sampling from the bottom surface of the tank.

6. Globe-type upper filter valve.

7. Two ground pads with tapped holes for tank grounding.

8. Lifting eyes for cover only

9. Facilities for lifting core and coil assembly from tank.

10. Lifting lugs for lifting complete transformer.

11. One or more handholes or manholes in the cover.

12. Cover-mounted mechanical pressure relief device with automatic resealing-resetting operation and mechanical signal for indication of device operation.

13. Winding-temperature unit, including snap-action switches for cooling fans.

B. Optional auxiliary equipment, when specified may include:

1. Sudden-pressure relay.

C. The Control Cabinet shall be NEMA Type 4X. The cabinet shall have provisions for padlocking.

D. Wiring:

1. All devices mounted on the transformer, including current transformers secondary circuits, shall be wired to the control cabinet.

2. All control wiring shall be a minimum of No. 14 AWG SIS and No. 12 AWG for current transformers. Wiring between gauges and the control box can be No. 14 AWG SO cables.

3. Wiring shall be terminated with ring-type insulated compression lugs.

4. Current transformer terminals blocks shall be the shorting type

5. Each wire shall be identified with a wire marker.

2.3 SURGE ARRESTERS

A. When ***indicated on Drawings*** provide surge arresters:

1. Primary Side: 36 kV station type. The surge arresters mounting location shall be in close proximity to the primary bushings.

2. Secondary Side: Intermediate class arresters. Voltage as indicated below. The surge arresters mounting location shall be in close proximity to the secondary bushings.

3.

1. Rated Voltage	2. Arrester
3. 13 kV	4. 10 kV

2.4 2.4 TANK AND BASE

A. The transformer tank shall be made of high-grade, low-carbon steel which assures excellent forming and welding qualities.

B. Gaskets must withstand exposure to hot dielectric liquids, sunlight, ozone attack and changes in operating temperatures and pressures.

C. Assemblies shall be designed to accommodate moving by rollers, skidding, sliding, towing, or hoisting. The base of the tank shall be raised from normal foundation surface to prevent rusting of the tank. Manufacturer shall undercoat the base of the tank.

D. All pressure welding shall be free from imperfections such as cracks of any type, hollow craters or crater cracks, extensive undercuts (1/32-inch max.), surface slag inclusions (slag removal between passes required), and lack of penetration. The deposited weld metal shall have properties equal to, or better than, the base material.

E. Tank shall be equipped with a copper or stainless-steel grounding pad with standard NEMA hole size, tapping, and spacing.

2.5 BUSHING AND TERMINALS

A. High voltage bushings shall be rated 46 kV (250 kV BIL), cover mounted, and interchangeable on transformer. Each high voltage bushing shall be provided with a flexible terminal connector to 1-inch IPS copper tubing.

B. Medium voltage bushings shall be rated in accordance with BIL table (2.1.J), mounted on the transformer sidewall in ANSI segment 1 (except as otherwise indicated) in an air terminal chamber (ATC).

C. ATC that will contain medium voltage cable terminations shall be of a size to allow for adequate terminating distance for the shielded cables. The bending radius of the cables cannot be less than 12 times the diameter of the individual cable and 40 inches is required for the installation of the stress cones.

2.6 BUSHING CURRENT TRANSFORMERS

A. Provide bushing current transformers when indicated on Drawings.

B. Bushing current transformer of Class C400 relay accuracy, multi-ratio, per ANSI accuracy class shall be mounted on the transformer high and neutral voltage bushings (two per bushing on the high and one per bushing on the neutral). The ratio shall be as indicated on Drawings.

C. All connections of current transformers, including all taps of multi-ratio current transformers, shall terminate on barrier and shorting type terminal blocks located in the control equipment compartment. The terminal blocks shall accommodate all wire sizes from #12 AWG through #6 AWG.

2.7 COOLING EQUIPMENT

A. All motors for fans and other cooling equipment shall be for operation from 230 volts, single phase, 60 Hertz source.

B. The equipment for automatic control of the cooling system shall consist of the thermal operated control device responsive to top oil temperature and which device shall be provided with independent contacts for (a) start fans, (b) alarm, and (c) shutdown. A manually operable switch shall also be provided for the cooling equipment.

C. All motors shall be individually fused or thermally protected.

2.8 SOUND LEVEL

A. The Substation Transformer and auxiliary cooling equipment shall be designed and constructed to minimize the audible noise generated with the transformer energized at rated voltage and with all auxiliary cooling equipment in operation. The acceptable noise level shall be in accordance with NEMA TR1. The measurement procedure shall be as specified in ANSI C57.12.90.

2.9 GROUNDING PROVISIONS

A. Provide four stainless-steel ground pads with standard two-hole NEMA drilling, located to permit grounding from either side of the transformer.

B. Provide high- and low-voltage arrester ground bars and grounding cables as part of the transformer assembly.

C. Exterior hardware shall be Type 316 stainless steel with silicon-bronze nuts, consistent with the submitted basis-of-design drawing.

D. Provide welded anchoring provisions, lifting devices, jacking provisions, and provisions for rolling and moving the transformer. Submit allowable handling loads and approved handling procedures.

E. The transformer design shall withstand specified transportation, handling, wind, and seismic loads. Submit manufacturer calculations or qualification documentation when required by the purchase order.

2.10 FACTORY FINISHING

A. Clean, prepare, prime, and finish carbon-steel surfaces with the manufacturer outdoor corrosion-resistant coating system. Final color shall be ANSI 70 light gray.

B. Radiators identified as unpainted galvanized components on the basis-of-design drawing may remain galvanized. Repair damaged galvanized or painted surfaces before shipment.

C. Undercoat the tank base and other surfaces exposed to the foundation or inaccessible after installation.

2.11 SOURCE QUALITY CONTROL AND TESTS

A. Perform routine factory tests on the complete transformer in accordance with IEEE C57.12.90. Tests shall include, at a minimum:

1. Resistance of all windings at rated connection and all tap positions.

2. Voltage ratio at rated voltage and all tap positions.

3. Polarity and phase relationship.

4. No-load loss and exciting current at rated voltage and frequency.

5. Load loss and impedance voltage at the specified rating.

6. Applied-potential and induced-potential dielectric tests.

7. Insulation power-factor tests for windings to ground and winding to winding.

8. Insulating-oil dielectric breakdown, moisture content, and other shipment-release tests required by the manufacturer.

9. Tank pressure, leak, and vacuum integrity tests.

10. Functional tests of gauges, alarm contacts, tap changer, fans, controls, terminal wiring, and accessories.

11. Current-transformer ratio, polarity, excitation, and secondary wiring tests when CTs are provided.

B. Provide certified design-test reports for temperature rise, impulse withstand, short-circuit capability, and sound level for the proposed design or an electrically and mechanically duplicate design when requested by the purchase order.

C. Notify the Purchaser sufficiently in advance of factory testing when witness testing is required. Do not ship until required tests are satisfactorily completed and reports are available.

PART 3 - PROCUREMENT REQUIREMENTS

3.1 SUPPLIER SCOPE

A. Furnish the complete transformer, insulating liquid, cooling equipment, bushings, surge arresters, accessories, loose-shipped components, special tools, documentation, and services identified in this Section and the purchase order.

B. Coordinate transformer quantity, equipment identification, terminal orientation, phase sequence, tap range, auxiliary voltages, alarm contacts, current-transformer requirements, conductor terminals, and interface points before release for manufacture.

C. Installation labor, field foundations, anchor installation, grounding conductors, external cabling, field oil processing, protective relays, field acceptance testing, and commissioning are excluded unless specifically listed in the purchase order.

3.2 FACTORY INSPECTION

A. Provide the Purchaser and Engineer the opportunity to review certified drawings before manufacture and to witness factory testing when required by the purchase order.

B. Do not release the transformer for shipment until required submittals have been accepted and factory testing has been satisfactorily completed.

3.3 PACKAGING AND SHIPMENT

A. Package and ship the transformer using manufacturer-approved blocking, bracing, weatherproofing, shock protection, and moisture-control methods.

B. Provide a detailed packing list identifying the main transformer, removed bushings and arresters, radiator assemblies, fan assemblies, insulating-liquid containers, hardware, gaskets, tools, manuals, and accessories.

C. Protect all open flanges and connections with weatherproof covers. Seal valves and provide tamper-resistant caps. Maintain specified gas pressure and liquid level during shipment and storage.

D. Repair or replace equipment damaged before acceptance at the delivery point at no additional cost to the Purchaser.

E. Delivery Point: Supplier shall consider shipment and delivering up to the Local Redevelopment for Roosevelt Roads facility in Ceiba, Puerto Rico. Final location at the facility to be determined by Owner.

3.4 MANUFACTURER SERVICES

A. Provide separate pricing for a qualified manufacturer field-service representative to inspect the transformer after delivery, review storage conditions, supervise assembly of loose-shipped components, verify gas pressure and liquid level, support vacuum filling or oil processing when required, and assist with initial functional checks.

B. Provide separate pricing for operator and maintenance training covering transformer operation, alarms, cooling controls, tap changer, insulating-liquid sampling, inspection, and maintenance.

C. Manufacturer field services are not included in the base equipment price unless specifically identified in the purchase order.

3.5 DELIVERY DOCUMENTS

A. At delivery, provide the packing list, shipping-condition record, impact-recorder report when used, gas-pressure record, insulating-liquid certificates, safety data sheets, certified drawings, factory test reports, instruction books, warranty documents, and recommended spare-parts list.

END OF SECTION

SECTION 26 13 26

HIGH VOLTAGE SF6-INSULATED CIRCUIT BREAKER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes procurement, factory assembly, factory testing, documentation, packaging, and delivery of outdoor, three-pole, dead-tank, sulfur hexafluoride (SF6) insulated high-voltage circuit breakers and associated equipment for use on 38 kV systems.

B. This Section is limited to equipment procurement. Site installation, foundations, grounding connections, field control wiring, field testing, and commissioning are by others unless a manufacturer service is specifically identified in the purchase order.

1.2 REFERENCES

A. Equipment shall comply with the applicable requirements of the following standards and authorities, as referenced by the purchase order and approved drawings:

1. ANSI - American National Standards Institute.

2. IEEE C37 series - High-voltage circuit-breaker ratings, design, and testing.

3. ANSI/IEEE C37.09 - Standard test procedure for AC high-voltage circuit breakers.

4. IEEE C57.13 - Requirements for instrument transformers.

5. IEEE 693 - Seismic design and qualification of substation equipment.

6. IEC 62271-100 - High-voltage alternating-current circuit breakers, when specified.

7. NEMA - National Electrical Manufacturers Association.

8. OSHA - Occupational Safety and Health Administration.

9. LUMA Energy and Puerto Rico Electric Power Authority requirements applicable to equipment interconnected with the utility system.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer catalog data identifying the proposed circuit-breaker type, model, ratings, interrupting medium, operating mechanism, control voltages, accessories, and deviations from this Section.

B. Shop Drawings: Submit certified outline and arrangement drawings showing overall and shipping dimensions, bushing terminal orientation, minimum electrical clearances, control-cabinet location, lifting points, center of gravity, operating and shipping weights, base and anchor-bolt pattern, ground-pad locations, conduit entrances, and recommended foundation reactions.

C. Electrical Drawings: Submit elementary diagrams, connection diagrams, terminal-block schedules, auxiliary-switch contact development, control-circuit loading, alarm contacts, interlock details, and current-transformer wiring and tap schedules.

D. Current-Transformer Data: Submit ratios, tap connections, polarity, accuracy class, thermal rating factor, excitation curves, ratio-correction-factor curves, phase-angle curves, and short-time mechanical and thermal ratings.

E. Bill of Materials: Identify all equipment, accessories, spare parts, special tools, loose-shipped components, and items specifically excluded from the supplier scope.

F. Deviations: Submit a clause-by-clause exception schedule. Silence shall be interpreted as full compliance with this Section.

1.4 FINAL DOCUMENTATION

A. Certified Drawings: Submit final as-manufactured outline, foundation, schematic, elementary, connection, terminal-block, nameplate, and current-transformer drawings.

B. Factory Test Reports: Submit certified production-test reports after satisfactory completion of testing.

C. Operation and Maintenance Data: Submit the manufacturer instruction book covering receiving, storage, lifting, SF6 gas handling, inspection, adjustments, normal operation, maintenance intervals, contact wear, lubrication, troubleshooting, and recommended replacement parts.

D. Spare Parts: Submit a priced list of recommended commissioning spares and recommended spare parts for five years of operation.

E. Warranty: Submit the manufacturer warranty options, with a minimum option of 12 months period after equipment is energized and identify its commencement date, duration, exclusions, and service-contact information.

1.5 QUALIFICATIONS

A. Manufacturer: Company regularly engaged in the manufacture of outdoor SF6 high-voltage circuit breakers of ratings comparable to those specified and with a minimum of tenth years of documented experience.

B. Service Support: Manufacturer or authorized representative shall maintain access to trained service personnel, replacement parts, and SF6 handling support for the supplied equipment.

1.6 DELIVERY, STORAGE AND HANDLING

A. Manufacturer shall be solely responsible for the adequacy of preparation, blocking, bracing, weather protection, and packaging for shipment.

B. Ship circuit breaker factory assembled to the maximum extent practicable. Identify all components removed for shipment and provide complete reassembly instructions.

C. Maintain SF6 shipping pressure in accordance with manufacturer requirements. Provide a shipping-pressure record and sufficient new SF6 gas for initial topping-off, when required.

D. Provide durable shipping tags identifying equipment number, purchase-order number, gross weight, lifting points, center of gravity, and storage requirements.

E. Protect control cabinets, bushings, terminals, gauges, wiring, finishes, and loose accessories from impact, corrosion, moisture, and contamination during shipment and storage.

1.7 MAINTENANCE MATERIALS

A. Provide the following as separately identified procurement line items, unless included in the equipment schedule:

1. One fully charged SF6 gas cylinder compatible with the supplied breaker.

2. SF6 filling and recovery connection device, hoses, fittings, and DILO-type quick-disconnect adapters required for the breaker.

3. Portable SF6 gas-leak detector.

4. Portable SF6 moisture or dew-point measuring device.

5. High-voltage and current-test adapters required for the supplied breaker and bushing current transformers.

6. Complete set of special tools not commercially available.

B. Special tools shall be new, packaged in a dedicated storage case, and permanently identified with the purchase-order number and applicable equipment number.

PART 2 - PRODUCTS

2.1 GENERAL

A. Product Description: Outdoor, three-pole, dead-tank, SF6 gas-insulated circuit breaker, complete with steel support frame, porcelain bushings, stored-energy operating mechanism, weatherproof control cabinet, bushing current transformers, gas-monitoring system, control and alarm devices, terminal blocks, nameplates, and specified accessories.

B. Basis-of-Design Product: Siemens Energy Type SPS2-48.3-40-1. Subject to compliance with this Section, an equivalent product may be submitted only when accepted by the Owner and Engineer.

C. Circuit breaker shall be completely factory assembled and wired, except for components that must be removed for safe shipment.

2.2 RATINGS

A. The circuit breaker and associated equipment shall comply with the following minimum ratings:

1. System Service Voltage: 38 kV, three phase, 60 Hz.

2. Rated Maximum Voltage: 48.3 kV.

3. Rated Voltage Range Factor: 1.0 K.

4. Rated Continuous Current: 3000 A.

5. Rated Short-Circuit Current: 40,000 A symmetrical.

6. Rated Interrupting Time: 3 cycles.

7. Rated Full-Wave Impulse Withstand: 250 kV.

8. Rated Out-of-Phase Current: 10,000 A.

9. Capacitance Current Switching Ratings:

a. Overvoltage Factor: 2.0.

b. Line-Charging Current: 100 A.

c. Isolated Capacitor-Bank Switching Current: 250 A.

d. Back-to-Back Capacitor-Bank Switching Current: 250 A.

e. Inrush Peak Current: 20,000 A at 6800 Hz.

10. Control and Auxiliary Voltages:

    a. Closing Circuit: 125 Vdc nominal; operating range 90 to 140 Vdc.

    b. Trip Circuits: 125 Vdc nominal; operating range 70 to 140 Vdc.

    c. Spring-Charging Motor: 120 Vac or 125 Vdc.

    d. Cabinet Heaters, Lighting, and Receptacle: 120 Vac, single phase, 60 Hz.

11. Seismic Qualification: IEEE 693 High Seismic Level, supported by manufacturer qualification documentation for the proposed configuration.

2.3 CIRCUIT BREAKER CONTROL

A. Trip Circuit Requirements:

1. Provide two independent trip coils.

2. Provide individual protective disconnecting devices for each trip circuit.

3. Provide trip-coil supervision and terminals for remote trip-circuit monitoring.

B. Closing Circuit Requirements:

1. Provide a protective disconnecting device for the closing circuit.

2. Provide anti-pump and electrically trip-free control logic.

3. Provide local and remote close-control provisions and a local close control in the control cabinet.

C. Control and Alarm Functions:

1. Local hand-trip device, Device 69, mechanically capable of tripping all three poles without an external power source.

2. Provision for a key interlock at the manual trip device.

3. Breaker open and closed position indication visible from outside the cabinet.

4. Mechanical operations counter visible from outside the cabinet.

5. Spring-charged indication and low-spring-charge alarm contact.

6. Low SF6 pressure alarm and redundant low SF6 pressure cutout contacts.

7. Loss-of-voltage alarms for DC close, DC trip circuits, DC motor supply, and AC heater supply.

D. Auxiliary Switches:

1. Provide multi-contact breaker auxiliary switches with at least ten electrically isolated spare contacts available for Purchaser use after completion of the manufacturer internal wiring.

2. Wire spare contacts to terminal blocks and identify contact state for breaker open and breaker closed positions.

2.4 BREAKER WIRING

A. All control, alarm, auxiliary-switch, and current-transformer circuits required for the complete breaker shall be factory wired to terminal blocks in the control cabinet.

B. Current-transformer secondary circuits shall terminate on grounded, short-circuiting-type terminal blocks. CT wiring shall be No. 12 AWG minimum.

C. Control wiring shall be No. 14 AWG minimum, type SIS or manufacturer standard suitable for the voltage, temperature, and service.

D. Use ring-tongue terminals for field-accessible screw-type terminal blocks. Terminal blocks shall accept No. 10 AWG field conductors.

E. Provide durable sleeve-type wire markers at both ends of each conductor and identify all terminal blocks to correspond with final connection diagrams.

F. Provide not less than 20 percent spare terminals in each terminal-block group and not less than four consecutive spare terminals for Purchaser interface wiring.

2.5 CONTROL CABINET

A. Provide an outdoor weatherproof NEMA 4X control cabinet with lift-off or hinged doors, door-hold-open provisions, three-point latching, and padlocking provisions.

B. Locate controls, terminal blocks, protective disconnects, relays, auxiliary circuits, and current-transformer secondary terminals for safe and convenient access.

C. Provide thermostatically controlled strip heaters to prevent condensation.

D. Provide door-operated internal cabinet lighting and one 120 Vac, 20 A, GFCI duplex receptacle.

E. Provide separately protected disconnecting devices for close, Trip 1, Trip 2, AC motor, DC motor, heaters, lighting, and receptacle circuits as applicable to the approved control design.

2.6 CURRENT TRANSFORMERS

A. Provide twelve bushing current transformers, two per bushing, unless otherwise indicated on the equipment schedule. Current transformers shall be multi-ratio type with a maximum ratio of 1200:5.

B. Current-transformer taps shall include, 400:5, 450:5, 500:5, 600:5, 800:5, 1000:5 and 1200:5.

C. Current transformers shall conform to IEEE C57.13 and have an ANSI accuracy class of C400 at the 1200:5 full ratio.

D. Continuous Thermal Rating Factor: 2.5 at all taps.

E. Provide permanently marked polarity, terminal identification, ratio nameplates, and complete characteristic curves for each CT design.

2.7 OPERATING MECHANISM

A. Provide a spring-stored-energy operating mechanism, Siemens Type FA2.20 for the basis-of-design breaker, or approved equivalent.

B. Mechanism shall be electrically and mechanically trip free and shall include anti-pump control.

C. Provide a universal AC/DC spring-charging motor rated 120 Vac/125 Vdc and an automatic transfer scheme that transfers to DC upon loss of AC motor power.

D. Provide motor protective disconnects, spring-charge limit switches, spring-charged indication, and low-spring-charge alarm.

2.8 BUSHINGS AND TERMINALS

A. Provide outdoor porcelain bushings rated 3000 A with a minimum bushing insulation level of 350 kV BIL and minimum effective creepage distance of 73 inches.

B. Porcelain color shall be ANSI 70 gray.

C. Provide aluminum line terminals with a four-hole NEMA drilling pattern. Submit terminal material and plating for approval and coordinate with the Purchaser conductor connectors.

D. Design bushings and terminals for the published mechanical terminal loads and provide certified allowable loading data.

2.9 SF6 GAS SYSTEM

A. Provide a common gas system connecting the three pole units through individual check valves and a lockable shutoff valve.

B. Provide a temperature-compensated density gauge, pressure switch assembly, bleed valve, DILO-type quick-disconnect fill point, and rupture disc for each pole unit.

C. Nominal pressure settings at 68 degrees F (20 degrees C) shall be:

1. Rated Fill Pressure: 65 psig.

2. Low-Pressure Alarm: 57 psig.

3. Low-Pressure Cutout and Minimum Operating Pressure: 51 psig.

D. Rupture-disc burst pressure shall be 154 psig, plus or minus 5 percent.

E. Approximate SF6 gas quantity for the basis-of-design breaker is 33 lb. Supplier shall state the exact factory charge on the certified nameplate and shipping documents.

F. All piping, fittings, gauges, valves, and connections shall be factory leak tested and arranged for low-maintenance service.

2.10 FRAME, GROUNDING, AND FINISH

A. Mount all three pole units and the control cabinet on a freestanding steel support frame suitable for bolting to a concrete foundation.

B. Provide lifting lugs and permanently mark the center of gravity and approved lifting method.

C. Provide two NEMA two-hole ground pads on opposite sides of the breaker frame.

D. Clean, prepare, and finish exterior steel surfaces with the manufacturer corrosion-resistant outdoor coating system. Final color shall be ANSI 70 light gray.

E. Provide an anchor-bolt template, base reactions, and recommended anchor-bolt size. Anchor bolts are by others unless specifically included in the purchase order.

2.11 NAMEPLATES

A. Provide a corrosion-resistant breaker nameplate containing at least the following information:

1. Manufacturer name and manufacturing location.

2. Breaker type, model, serial number, and date of manufacture.

3. Rated nominal and maximum voltage, voltage range factor, frequency, continuous current, short-circuit current, interrupting time, BIL, and out-of-phase rating.

4. SF6 fill pressure, minimum operating pressure, alarm pressure, cutout pressure, gas quantity, and breaker weight.

5. Capacitance-current switching ratings.

6. Applicable instruction-book and drawing references.

B. Provide an operator nameplate identifying closing voltage and current, trip voltage and current for each trip coil, spring-charging motor voltage and current, control-diagram number, and instruction-book number.

C. Provide a nameplate for each current-transformer design identifying ratios, tap connections, polarity, accuracy class, thermal rating factor, part number, and applicable characteristic-curve drawing.

2.12 FACTORY QUALITY CONTROL

A. Perform routine production tests in accordance with ANSI/IEEE C37.09 and the manufacturer approved test procedures.

B. Factory tests shall include, at a minimum:

1. Mechanical operation and timing checks for opening and closing operations.

2. Power-frequency withstand test on the completely assembled three-pole breaker.

3. Main-circuit resistance measurement.

4. Complete control-wiring continuity, insulation, functional, alarm, interlock, and auxiliary-contact checks.

5. Verification of trip-coil, close-coil, motor, heater, lighting, and receptacle circuits at specified control voltages.

6. SF6 gas-system pressure, density-switch setting, leak, alarm, and cutout checks.

7. Current-transformer ratio, polarity, excitation, and secondary-circuit verification.

C. Submit certified test reports traceable to the breaker serial number and current-transformer identification.

PART 3 - PROCUREMENT REQUIREMENTS

3.1 SUPPLIER SCOPE

A. Furnish the complete circuit breaker, accessories, loose-shipped components, special tools, documentation, and services identified in this Section and the purchase order.

B. Coordinate breaker quantities, equipment identification, current-transformer quantities and ratios, terminal assignments, control voltages, auxiliary contacts, and accessory requirements with the equipment schedule and approved drawings before release for manufacture.

C. Installation labor, foundations, anchor-bolt installation, grounding conductors, external power and control cabling, protective relays, and site acceptance testing are excluded unless specifically listed in the purchase order.

3.2 FACTORY INSPECTION

A. Provide the Purchaser and Engineer the opportunity to review certified drawings before manufacture and to witness factory testing when required by the purchase order.

B. Do not ship equipment until required submittals have been accepted and factory testing has been satisfactorily completed.

3.3 PACKAGING AND SHIPMENT

A. Package and ship the equipment using manufacturer-approved lifting, blocking, bracing, weatherproofing, and shock-protection methods.

B. Provide a detailed packing list and identify all loose-shipped items, SF6 gas containers, special tools, manuals, and accessories.

C. Repair or replace equipment damaged before acceptance at the delivery point at no additional cost to the Purchaser.

D. Delivery Point: Supplier shall consider shipment and delivering up to the Local Redevelopment for Roosevelt Roads facility in Ceiba, Puerto Rico. Final location at the facility to be determined by Owner.

3.4 MANUFACTURER SERVICES

A. Provide separate pricing for a qualified manufacturer field-service representative to inspect the equipment after delivery, verify reassembly and gas pressure, assist with initial functional checks, and provide operating and maintenance instruction.

B. Manufacturer field services are not included in the base equipment price unless specifically identified in the purchase order.

3.5 DELIVERY DOCUMENTS

A. At delivery, provide the packing list, shipping-pressure record, SF6 gas data, certified drawings, factory test reports, instruction books, warranty documents, and recommended spare-parts list.

END OF SECTION

SECTION 26 13 29
MEDIUM VOLTAGE METAL CLAD VACUUM CIRCUIT BREAKER SWITCHGEAR

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes procurement, engineering, factory assembly, factory wiring, factory testing, documentation, packaging, and delivery of 15 kV-class indoor metal-clad vacuum circuit-breaker switchgear for operation on a 13.2 kV nominal system.

B. This Section is limited to equipment procurement. Foundations, installation labor, field power and control cabling, grounding conductors, field testing, relay-setting development, programming, commissioning, and energization are by others unless specifically included in the purchase order.

1.2 REFERENCES

A. Equipment shall comply with the latest adopted editions of applicable codes and standards, including the following:

1. NFPA 70 - National Electrical Code.

2. OSHA - Occupational Safety and Health requirements.

3. IEEE C37.04 - Rating Structure for AC High-Voltage Circuit Breakers.

4. IEEE C37.06 - Preferred Ratings and Related Required Capabilities for AC High-Voltage Circuit Breakers.

5. IEEE C37.09 - Test Procedure for AC High-Voltage Circuit Breakers.

6. IEEE C37.20.2 - Metal-Clad Switchgear.

7. IEEE C37.20.7 - Internal Arcing Fault Testing, when arc-resistant equipment is indicated.

8. IEEE C37.90 series - Relays and Relay Systems Associated with Electric Power Apparatus.

9. IEEE C57.13 - Instrument Transformers.

10. NEMA SG 5 - Power Switchgear Assemblies.

11. NETA ATS - Acceptance Testing Specifications, for reference to field tests by others.

12. Applicable LUMA Energy requirements and accepted utility standards.

1.3 SYSTEM AND DESIGN BASIS

A. Nominal System Voltage: 13.2 kV, three phase, three wire, 60 Hz.

B. Equipment Voltage Class: 15 kV, with 15.0 kV maximum design voltage and 95 kV basic impulse level.

C. System Grounding: As indicated on the project one-line diagram. Basis-of-design arrangement is a solidly grounded system; the Supplier shall coordinate surge arrester ratings, ground-sensor application, and relay functions with the final grounding method.

D. Lineup Arrangement: Main, tie, feeder, auxiliary, voltage-transformer, and future sections as indicated on the project one-line diagram and equipment schedule.

1.4 SUBMITTALS

A. General: Submit project-specific documents in searchable PDF format. Provide native editable CAD files for arrangement and wiring drawings when required by the purchase order. Drawings shall be legible at full-size print scale and shall use consistent device tags, wire numbers, terminal numbers, and cross-references.

B. Drawing Transmittal Record: Include a drawing index identifying document title, drawing number, sheet number, revision, status, date transmitted, and approval disposition. Identify each document as preliminary, approval, certified, as-built, or reference-only.

C. Approval Drawing Package: Submit a complete coordinated package before release for manufacture. At a minimum, include every drawing type and diagrams as follows:

1. Drawing transmittal record and complete document index.

2. General arrangement drawings showing the project one-line diagram, front elevation, floor plan, section arrangement, shipping splits, overall dimensions, clearances, door swings, breaker withdrawal space, cable-entry locations, top and bottom cutouts, conduit spaces, and future-extension provisions.

3. Foundation and anchoring drawings showing sill channels, anchor-bolt locations, base details, floor-level tolerances, seismic anchorage requirements, equipment weights, shipping weights, centers of gravity, and foundation reactions.

4. Side-view and sectional drawings showing breaker cells, bus compartments, cable compartments, voltage-transformer compartments, current-transformer locations and polarity, surge arresters, cable supports, lug pads, ground studs, ground bus, barriers, shutters, and available termination space.

5. Electrical bill of materials identifying quantity, device tag, description, manufacturer, model, catalog number, order code, and manufacturer part number for primary equipment, secondary devices, relays, communication equipment, and accessories.

6. General-information drawings including symbol list, engineering notes, shop notes, phase sequence, bus arrangement, compartment region assignments, wire types, wire sizes, terminal-lug types, wire-marker conventions, drawing-status definitions, and cross-reference conventions.

7. Nameplate and engraving schedule showing each nameplate location, text, size, material, color, character height, mounting method, equipment rating, circuit designation, and device tag.

8. Panel-arrangement drawings showing the exact location and orientation of protective relays, control switches, test switches, lockout relays, indicating lights, communication equipment, mimic bus, meters, and auxiliary devices on each door and panel.

9. 125 Vdc control-power-bus diagram showing source terminals, protective devices, conductor sizes, section-to-section distribution, disconnecting means, and load assignments.

10. Space-heater circuit diagram showing the 120 Vac source, branch protective devices, heater ratings, thermostat locations, conductor sizes, section loads, and terminal points.

11. Communication diagrams showing managed Ethernet-switch connections, relay port assignments, media type, fiber and copper cable types, customer interface ports, alarm contacts, network grounding, and spare ports.

12. Time-synchronization diagram showing the satellite-synchronized clock, antenna, surge protection, grounding, IRIG-B or approved time-distribution method, cable types, connectors, and relay connections.

13. Arc-sensing fiber-loop diagram showing loop routing by compartment and section, relay optical inputs, current-supervision inputs, high-speed trip outputs, trip destinations, loop identification, and operating philosophy.

14. Complete ac and dc elementary or schematic diagrams for every main, tie, feeder, auxiliary, voltage-transformer, and common-control circuit, including breaker control, trip, close, spring charging, local-remote selection, lockout, interlocks, alarms, indicating lights, relay inputs and outputs, test switches, MOC and TOC contacts, and customer interface points.

15. Three-line diagrams for each switchgear section showing phase connections, bus connections, breaker ratings, CT and VT locations, ratios, polarity, accuracy class, relay and metering circuits, surge arresters, ground sensors, fuses, cable terminals, and equipment grounds.

16. Point-to-point wiring diagrams for every section, panel, door, compartment, terminal block, and inter-unit connection. Show source and destination for each conductor, wire number, wire size, insulation type, terminal number, device terminal, cable identification, shield termination, and grounding point.

17. Circuit-breaker internal schematics and secondary-disconnect terminal assignments for each breaker rating and mechanism type.

18. Current-transformer data including quantity, physical location, core designation, ratio and selected tap, accuracy class, thermal rating, polarity, excitation curves, resistance, burden, terminal-block arrangement, and certified test reports.

19. Voltage-transformer data including quantity, location, primary and secondary ratings, ratio, connection, BIL, accuracy class, burden, primary-fuse rating, secondary protection, drawout arrangement, and certified test reports.

20. Protective-relay data including complete order codes, front-panel and rear-terminal diagrams, power-supply requirements, CT and VT input assignments, binary input and output assignments, communication ports, arc-flash inputs, trip matrix, interlock matrix, and a functional logic narrative.

21. Device schedules for control switches, lockout relays, test switches, MOC switches, TOC switches, auxiliary contacts, indicating lights, circuit breakers, fuses, and terminal blocks, including contact development and cross-references.

22. Network architecture and communication-port schedule identifying the managed switch, time source, relay ports, protocols, physical media, connector types, customer connection points, and spare capacity.

23. Seismic qualification documentation, structural calculations when required, enclosure bracing details, anchorage loads, and certification for the specified installation location.

24. Factory-test procedure, inspection checklist, and proposed certified-test-report format for switchgear, circuit breakers, CTs, VTs, relays, communication equipment, and arc-sensing system.

25. Receiving, unloading, lifting, storage, assembly, installation, operation, and maintenance instructions, including handling of shipping splits and breaker lift equipment.

E. Protection Coordination Information: Submit guaranteed breaker operating times, CT data, VT data, relay hardware order codes, and device burdens in sufficient detail for the Engineer or others to complete short-circuit, coordination, arc-flash, and relay-setting studies.

F. Deviations: Submit a clause-by-clause exception schedule. Clearly identify proposed alternatives and their effect on dimensions, ratings, delivery, testing, and price.

1.5 DRAWING REVIEW AND DOCUMENT STATUS

A. Approval drawings are required before release for manufacture. Supplier shall not release material or begin fabrication based on preliminary drawings.

B. Engineer review does not relieve the Supplier of responsibility for equipment ratings, dimensions, quantities, coordination, code compliance, or complete operation.

C. Revise and resubmit the complete affected drawing set after review comments. Cloud or otherwise clearly identify revisions and maintain consistent revision indices across all cross-referenced drawings.

D. After approval, issue certified drawings reflecting the final design released for manufacture. Only certified drawings shall be used for equipment interfaces and construction coordination.

E. After factory completion, issue as-built drawings incorporating all manufacturing changes, final terminal assignments, final bill of materials, final wire numbers, and final device settings furnished by the Supplier.

1.6 FINAL DOCUMENTATION

A. Submit the complete as-built drawing package, not only revised sheets. The final package shall contain all drawings listed under Paragraph 1.4 and shall be organized under a final drawing transmittal record.

B. Submit certified factory test reports traceable to the switchgear lineup, breaker serial numbers, CT identification, VT identification, relay identification, and communication equipment.

C. Submit operation and maintenance manuals covering receiving, storage, lifting, assembly of shipping splits, breaker racking, electrical racking, operation, inspection, maintenance, lubrication, troubleshooting, replacement parts, relay hardware, communication equipment, and arc-sensing components.

D. Submit manufacturer warranty options, with a minimum option of 12 months period after equipment is energized and identifying commencement date, duration, exclusions, required storage conditions, and service contact information.

E. Submit a priced list of recommended commissioning spares and spare parts for five years of operation.

1.7 QUALIFICATIONS

A. Manufacturer: Company regularly engaged in manufacturing metal-clad vacuum circuit-breaker switchgear of comparable voltage, current, and fault ratings, with not less than ten years of documented experience.

B. Service Support: Manufacturer or authorized representative shall maintain trained service personnel and replacement parts for the supplied switchgear, breakers, mechanisms, relays, and accessories.

1.8 DELIVERY, STORAGE AND HANDLING

A. Supplier shall be responsible for adequate preparation, blocking, bracing, moisture protection, and packaging for shipment to the delivery point without damage.

B. Ship equipment in approved shipping splits. Individually identify each section, breaker, loose component, accessory, and hardware package with purchase-order and equipment numbers.

C. Provide shipping covers, skids, lifting points, center-of-gravity markings, gross weights, and approved lifting instructions. Protect relays, meters, shutters, primary disconnects, bus joints, cable terminals, and finishes from impact and contamination.

D. Energize space heaters during storage when external power is available. Clearly mark temporary heater connection points and required voltage.

1.9 MAINTENANCE MATERIALS AND ACCESSORIES

A. Furnish a complete set of manufacturer-specific tools and accessories required for normal operation and maintenance, including:

1. Circuit-breaker lift truck sized for the supplied breakers and cubicle arrangement.

2. Manual levering or racking crank.

3. Manual spring-charging and slow-closing tool.

4. Remote motor-operated electrical racking device with control and power cords of adequate length.

5. Circuit-breaker test cabinet and required secondary test plugs.

6. Grounding and test device when indicated on the purchase order.

7. Accessory storage cabinet.

8. Special tools not commercially available.

PART 2 - PRODUCTS

2.1 GENERAL

A. Product Description: Indoor, 15 kV-class, non-arc-resistant, metal-clad switchgear consisting of horizontal drawout vacuum circuit breakers and auxiliary units assembled into a rigid, self-supporting lineup. Breakers of identical ratings shall be interchangeable.

B. Basis-of-Design Manufacturer and Product: Siemens GM-SG metal-clad switchgear with vacuum circuit breakers, or approved equivalent complying with this Section.

C. Provide a complete factory-assembled and factory-wired lineup including breakers, main bus, ground bus, CTs, VTs, protective relays, control devices, test switches, communication equipment, time synchronization, arc-sensing components, terminal blocks, heaters, nameplates, and specified accessories.

2.2 ELECTRICAL RATINGS

A. Ratings:

1. Nominal Operating Voltage: 13.2 kV.

2. Rated Maximum Voltage: 15.0 kV.

3. Frequency: 60 Hz.

4. Phases and Wires: Three phase, three wire.

5. Basic Impulse Level: 95 kV minimum.

6. Power-Frequency Withstand: 36 kV rms for one minute minimum.

7. Main Bus Continuous Current: 1,200 A, unless a higher rating is indicated on the drawings.

8. Feeder Breaker Continuous Current: 1,200 A minimum, or as indicated on the drawings.

9. Main and Tie Breaker Continuous Current: 2,000 A minimum, or as indicated on the drawings.

10. Rated Short-Time Withstand Current: 50 kA rms symmetrical for two seconds.

11. Circuit-Breaker Interrupting Rating: 50 kA rms symmetrical at 15 kV class.

12. Peak Withstand and Close-and-Latch Capability: Not less than the value required by IEEE for the specified 50 kA rating.

13. Rated Interrupting Time: Five cycles maximum.

14. Control Voltage for Trip, Close, Spring Charging, Relays, and Control Bus: 125 Vdc unless otherwise indicated.

15. Space-Heater Supply: 120 Vac, single phase, 60 Hz.

B. Supplier shall submit certified ratings for the proposed 15 kV-class product. A lower short-circuit rating or reduction from the ratings above is not permitted without written approval.

2.3 ENCLOSURE AND COMPARTMENTATION

A. Enclosure: Indoor NEMA Type 1, ventilated as required, with ANSI 61 gray corrosion-resistant powder-coat finish on interior and exterior surfaces.

B. Provide metal barriers separating each section into breaker, main-bus, instrument and relay, CT, VT or auxiliary, and cable compartments in accordance with IEEE C37.20.2.

C. Provide grounded metal shutters that automatically cover stationary primary disconnects when a breaker or drawout VT is withdrawn from the connected position.

D. Provide hinged front doors or panels with padlocking provisions and bolted or hinged rear access covers as indicated on accepted drawings. Bond each hinged door with a flexible braided copper conductor.

E. Provide filters, insect and rodent screens, and dust-resistant construction consistent with the reference arrangement.

F. Provide modular construction and provisions for future extension, including prepared bus ends, removable end covers, secondary terminal blocks, and space for future control wiring where indicated.

G. Provide seismic-qualified construction and anchorage provisions for the project location. Submit equipment weights, centers of gravity, and anchorage loads.

2.4 MAIN BUS AND GROUND BUS

A. Main bus and runbacks shall be high-conductivity copper. Plate bus joints and primary-disconnect contact surfaces with silver.

B. Insulate the main bus and connections in accordance with IEEE C37.20.2. Provide flame-retardant, track-resistant supports suitable for 15 kV-class equipment and the specified short-circuit forces.

C. Main bus shall be rated 2,000 A continuously and braced for 50 kA rms symmetrical for two seconds.

D. Provide a continuous copper ground bus not smaller than 1/4 inch by 2 inches, rated not less than 600 A, extending through the complete lineup. Silver plate joints and provide NEMA two-hole connection pads at both ends for 4/0 AWG copper grounding conductors.

E. Provide ball-type ground studs and grounding provisions within cable compartments where indicated.

2.5 PRIMARY CABLE COMPARTMENTS AND TERMINATIONS

A. Provide top-entry or bottom-entry cable compartments as indicated on the project drawings. Maintain the specified 15 kV cable bending radius and termination clearances.

B. Provide adequate space for shielded 15 kV cable terminations, stress cones, surge arresters, CTs, ground sensors, cable supports, and grounding conductors without interference.

C. Provide silver-plated copper terminal pads with NEMA two-hole drilling. Unless specifically included in the purchase order, field cable lugs are by others.

D. Provide cable supports, removable cable guides, cable-lug boots, ground studs, and access openings. Show all dimensions and available cable space on certified drawings.

2.6 LOW-VOLTAGE CONTROL POWER AND WIRING

A. Provide continuous, isolated 125 Vdc control-power buses and 120 Vac heater buses through the lineup. Terminate external sources on identified, accessible terminal blocks and provide branch protective devices by function.

B. Use flame-resistant 600 V Type SIS stranded copper control wire, No. 14 AWG minimum. Use No. 12 AWG minimum for CT and VT secondary circuits, No. 10 AWG minimum for heater-bus circuits, and conductor sizes suitable for dc control-bus loading.

C. Use ring-tongue terminals for CT and VT circuits and fork or ring-tongue terminals for control circuits as approved. Identify each wire at both ends with permanent source-and-destination sleeve markers.

D. Provide screw-type, 600 V terminal blocks with barriers, marker strips, and not less than 20 percent spare terminals. Provide shorting-type terminal blocks for CT circuits and disconnecting or test facilities for VT circuits.

E. Do not connect more than two conductors to one side of a terminal. Provide external links where additional common connections are required.

F. Leave CT tap leads and relay leads of sufficient length to permit selection of any approved CT ratio without splicing.

2.7 VACUUM CIRCUIT BREAKERS

A. Provide horizontal drawout, stored-energy, three-pole vacuum circuit breakers rated for 15 kV class and the continuous-current and interrupting ratings indicated.

B. Provide 1,200 A feeder breakers, main and tie breakers unless otherwise indicated. Breakers of the same rating shall be interchangeable.

C. Provide three independent vacuum interrupters, motor-charged spring mechanism, manual spring charging, manual trip, anti-pump control, trip-free operation, mechanical position indication, and operation counter.

D. Breaker positions shall include connected, test, and disconnected. Provide mechanical and electrical interlocks preventing racking while closed, operation between defined positions, and closing with incomplete secondary connections.

E. Provide automatic secondary disconnects, MOC and TOC switches with the quantity of contacts required by the approved schematics, and not less than the spare contacts shown in the reference package.

F. Provide padlocking provisions in the test and disconnected positions and provisions for remote motor-operated electrical racking.

G. Breaker internal wiring and secondary-disconnect assignments shall be shown on project-specific schematics and wiring diagrams.

2.8 CURRENT TRANSFORMERS

A. Provide 5 A secondary, multi-ratio current transformers in the quantity, location, ratio, and accuracy class required by the one-line diagram and protection study.

B. Final ratios and selected taps shall be approved before manufacture.

C. Protection accuracy shall be C400 minimum. Provide separate metering cores when required.

D. Provide window-type ground sensors, where residual or sensitive ground-fault protection is indicated.

E. Wire every CT secondary lead and available multi-ratio tap to front-accessible shorting terminal blocks. Provide one intentional secondary grounding point per circuit.

2.9 VOLTAGE TRANSFORMERS

A. Provide drawout, 15 kV-class voltage transformers with current-limiting primary fuses and accessible secondary protective devices.

B. Provide line and bus VTs in the quantity and arrangement indicated. Select primary and secondary ratings and winding connections to provide the required 120 V secondary values for protection, metering, synchronism-check, and control functions on the 13.2 kV system.

C. Coordinate VT ratio, accuracy class, burden, ferroresonance considerations, neutral grounding, and secondary fusing with the protective relays and metering equipment.

D. Provide automatic shutters or grounded barriers over primary contacts when VT units or fuse trays are withdrawn.

2.10 PROTECTION, CONTROL, AND METERING

A. Provide protection relays, or approved equal, for each breaker requiring protection and control, as indicated on the one-line diagram.

B. Relay hardware shall support, as applicable, phase and ground instantaneous and time overcurrent, directional overcurrent, breaker failure, voltage, frequency, synchronism-check, trip-circuit monitoring, breaker control, metering, event records, oscillography, and arc-flash detection.

C. Provide relay voltage and current inputs, binary inputs, standard outputs, high-speed outputs, communication ports, arc-flash optical inputs, and power supply suitable for the approved schematics and logic.

D. Provide hand-reset lockout relay with not less than eight normally open and eight normally closed contacts for each protected breaker when indicated.

E. Provide local-remote selector switch, trip-close control switch, green breaker-open light, red breaker-closed light, white lockout-tripped light, and test switches for current, voltage, trip, and control circuits.

F. Provide complete metering within the relay for phase currents, phase voltages, real and reactive power, apparent power, power factor, frequency, energy, demand, and peak demand as supported by the selected relay hardware.

G. Supplier shall provide hardware, factory wiring, I/O mapping, trip matrix, interlock matrix, and logic narrative. Final relay settings and project programming are by others unless specifically included in the purchase order.

2.11 COMMUNICATIONS AND TIME SYNCHRONIZATION

A. Provide a managed industrial Ethernet switch, basis-of-design SEL-2730M, with sufficient copper and fiber ports for all protective relays, time equipment, customer interface, and not less than 20 percent spare port capacity.

B. Provide a satellite-synchronized clock, basis-of-design SEL-2407, with GNSS antenna, antenna mounting kit, coaxial cable, surge protection, common-point grounding, and sufficient IRIG-B outputs for all relays.

C. Provide Ethernet patch cables, fiber-optic cables, coaxial cables, connectors, adapters, terminal interfaces, and internal wiring shown on the approved communication diagrams.

D. Clearly identify the customer network connection point, available ports, supported protocols, and external cabling by others.

2.12 ARC-SENSING SYSTEM

A. Provide point or fiber-loop optical arc sensors integrated with the protective relays for switchgear compartments indicated on the approved arc-sensing diagram.

B. Route and identify fiber loops by bus zone and compartment. Coordinate current supervision, high-speed relay outputs, lockout logic, and trip destinations with the approved protection philosophy.

C. Factory test optical continuity, sensor response, relay input operation, high-speed output operation, and trip-circuit continuity. Final system logic and settings are by others unless included in the purchase order.

2.13 SPACE HEATERS

A. Provide 240 V rated space heaters operated at 120 Vac, arranged by section and controlled by one nonadjustable thermostat per section.

B. Provide heater branch circuit breakers or fuses, continuous heater bus, identified external source terminals, and total watts and current for each section on the heater schematic.

C. Locate heaters to minimize condensation and permit service without exposure to primary live parts where practical.

2.14 SURGE PROTECTION

A. Provide three metal-oxide surge arresters at each incoming or outgoing cable circuit indicated on the drawings.

B. For the basis-of-design solidly grounded 13.2 kV system, provide 10 kV rated arresters with 8.4 kV MCOV, or the manufacturer-recommended rating confirmed by the final system-grounding study.

C. Arresters shall be distribution, intermediate, or station class as indicated by the equipment schedule and shall have 15 kV-class insulation, mounting brackets, grounding leads, and clearances.

2.15 NAMEPLATES, LABELS, AND MIMIC BUS

A. Provide white lamacoid nameplates with black core for external equipment identification and durable labels for internal components. Use black lettering and mechanical attachment on external doors.

B. Identify each lineup, section, cell, breaker, circuit destination, bus, CT, VT, relay, control switch, test switch, lockout relay, indicating light, fuse, circuit breaker, terminal block, communication device, and customer connection point.

C. Provide nameplates on both sides of doors or panels when devices are mounted through the panel.

D. Provide black tape mimic bus on the front panels unless another material or color is indicated on the approved nameplate and panel-arrangement drawings.

2.16 ACCESSORIES

A. Provide the complete accessory package listed in Paragraph 1.9 and shown in the approved bill of materials.

B. Provide instruction manuals for the switchgear, circuit breakers, protective relays, managed Ethernet switch, time clock, and arc-sensing components.

C. Provide UL labels when available for the complete switchgear assembly and supplied components.

2.17 FACTORY QUALITY CONTROL AND TESTS

A. Perform production tests on the complete switchgear in accordance with IEEE C37.20.2, including power-frequency withstand, mechanical operation, interlock verification, wiring continuity, control-circuit operation, polarity, phase sequence, and sequence tests.

B. Perform routine certified tests on each circuit breaker in accordance with IEEE C37.09. Provide serial-number traceable test certificates.

C. Provide certified ratio, polarity, excitation, resistance, and accuracy test reports for each CT and certified ratio, polarity, accuracy, and dielectric test reports for each VT.

D. Functionally test protective relays, trip and close circuits, lockout relays, local-remote controls, MOC and TOC contacts, indication, alarms, dc control bus, heater circuits, communication links, time synchronization, and arc-sensing circuits.

E. Verify every point-to-point wire against approved wiring diagrams. Correct drawings before shipment to match the as-manufactured equipment.

F. Notify the Purchaser in advance of factory testing when witness testing is required. Do not ship until tests are satisfactorily completed and required reports are available.

PART 3 - PROCUREMENT REQUIREMENTS

3.1 SUPPLIER SCOPE

A. Furnish the complete switchgear lineup, circuit breakers, protective relays, instrument transformers, surge arresters, control devices, communication equipment, time-synchronization equipment, arc-sensing system, accessories, special tools, documentation, testing, packaging, and delivery required by this Section and the purchase order.

B. Coordinate equipment quantities, section arrangement, breaker designations, normal positions, bus ratings, CT and VT requirements, terminal assignments, control voltages, interlocks, communication interfaces, and accessory requirements before release for manufacture.

C. Installation labor, foundations, anchor installation, external grounding conductors, external primary cables, external control and communication cables, battery and charger, relay-setting study, final programming, field acceptance testing, and commissioning are excluded unless specifically listed in the purchase order.

3.2 DRAWING REVIEW AND RELEASE FOR MANUFACTURE

A. Submit the complete approval drawing package required by Paragraph 1.4 as one coordinated submittal. Partial arrangement drawings without schematics, wiring, bills of material, and device information are not acceptable for final approval.

B. Do not release the switchgear for manufacture until the required approval drawings have been accepted in writing.

C. Incorporate all accepted comments into the certified drawing package and maintain full cross-reference consistency among the one-line, schematics, three-lines, wiring diagrams, panel arrangements, nameplates, and bill of materials.

3.3 FACTORY INSPECTION

A. Provide the Purchaser and Engineer access to review the equipment during manufacture and to witness factory testing when required by the purchase order.

B. Provide final test procedures and test schedules in advance. Correct deficiencies before shipment at no additional cost.

3.4 PACKAGING AND SHIPMENT

A. Package each shipping split and loose component using manufacturer-approved skids, bracing, weather protection, moisture control, shock protection, and corrosion protection.

B. Provide a detailed packing list identifying switchgear sections, breakers, lift truck, electrical racking device, accessory cabinet, test cabinet, test plugs, loose bus links, hardware, manuals, and spare parts.

C. Repair or replace equipment damaged before acceptance at the delivery point at no additional cost to the Purchaser.

D. Delivery Point: Supplier shall consider shipment and delivering up to the Local Redevelopment for Roosevelt Roads facility in Ceiba, Puerto Rico. Final location at the facility to be determined by Owner.

3.5 MANUFACTURER SERVICES

A. Provide separate pricing for a qualified manufacturer field-service representative to inspect the equipment after delivery, review storage conditions, supervise assembly of shipping splits, verify bus and control connections, assist with initial mechanical and electrical checks, and support energization.

B. Provide separate pricing for operator and maintenance training covering breaker operation and racking, electrical racking, interlocks, relays, communication equipment, arc-sensing system, heaters, inspections, and maintenance.

C. Manufacturer field services are not included in the base equipment price unless specifically identified in the purchase order.

3.6 DELIVERY DOCUMENTS

A. At delivery, provide the packing list, shipping records, complete certified drawing package, factory test reports, breaker test certificates, CT and VT test reports, relay and communication manuals, warranty documents, and recommended spare-parts list.

B. Submit the complete as-built drawing package within the time required by the purchase order. Final payment may be withheld until all required as-built drawings and test reports have been received and accepted.

PART 4 – DESIGN PHILOSOPHY

Protection Design Philosophy

Protection Trips will be divided into two categories. This will be determined in the trip matrix and relay program file.

- **Light Fault** – Breaker opens but it is not locked out. Resettable by operations, probably caused by mis-operation and not necessarily causing equipment damage. I.e. Time Overcurrent, Unbalance, voltage, etc. To be determined later, a relay output may block the reclosure of the breaker until the trip is acknowledged in the relay.
- **Heavy Fault** – Breaker Opens and Lockout is tripped. Requires an engineering investigation before it can be reset and returned to operations. The lockout relay blocks the reclosure of the breaker.

Operation of these feeders will be local for now, but they are likely to be incorporated into a centralized control room screen in the future.

A Local-Remote selector switch (43LR) will be implemented to make it ready for this future implementation.

- **43LR–Local** – The breaker control switch 52CS, and relay outputs associated to trip/close buttons on the relay, may be used to operate the breaker. Remote commands are blocked.
- **43LR-Remote** - Addressable remote open and close relay contacts may be used to operate the breaker.
- Blocking contacts still block any close operation in any mode.

Direct Breaker Control Switch 52CS

- 52CS will only operate in local mode. Setting the 43LR to the remote can prevent accidental operation (Clothes or backpack latching on the pistol grip handle).
- **Choice** 52CS-O may be wired to operate in remote mode by moving a jumper.
- A **Breaker Test Feature** will bypass both the 86T trips and the block close feature if the breaker is drawn out to test position.

Delayed action breaker operation to mitigate Arc Flash Risk

- The **OPEN & CLOSE buttons on the relay** will be programmed to operate the breaker after an adjustable delay.
- An indicating light will flash indicating the impending operation.
- The delay can be 5 to 15 seconds to be determined before the relay file is generated.
- Delayed action breaker operation will be implemented to operate only in local mode and not in remote mode. Another relay output would needs to be assigned to open and close in local mode.

Output Segregation for testing. Basic operation functions will be routed separately from advanced protection and control functions so that test switches can be used to isolate them during testing and troubleshooting and testing.

- **Two outputs for Light Fault**. One may be assigned to basic OC functions and the other for remote operation or other non-essential protection elements.
- **Two Outputs for Heavy Fault**. One may be used for Instantaneous OC (52 trip 1 and trip 2) and the other for Transformer differential or any other advanced protection feature (86 trip 1 and trip 2).
- One of the Light Fault contacts may be wired to **Fail Safe Operation** or not by changing the position of a jumper (Out 3 in SEL-751).

The following external conditions will be monitored and recorded in the Sequence of Events. (10 Inputs)

- 52MOC-a Bkr Closed
- 52MOC-b Bkr Open
- 52TOC-b Breaker out of cell
- 43LR-L Local Control

- 43LR-R Remote Control
- 52CS-T Manually Opened
- 52CS-C Manually Closed
- 86T-b Locked Out
- 52TCM Breaker Trip Coil Monitor
- 86TCM Lock Out Relay Trip Coil Monitor

Outputs (7 Outputs)

- Light Fault Trip 1 – 52 open (Selectable Fail Safe) ANSI 51 OC
- Light Fault Trip 1 - 52 Open (UV/OV, Load Shed, Transfer, etc.)
- Heavy Fault 1 - 86 trip (ANSI 50)
- Heavy Fault 2 – 86 Trip (Non overcurrent functions)
- Breaker Close Block
- Remote Breaker Close
- Remote Breaker Open
- Local Breaker Close
- Local Breaker Open

Hardware Controls

- 43LR Local Remote Selector Switch
- 52CS Breaker Control Switch
- 86LR Lockout Relay

Indicating lights

- 86LR Locked Out (Trip Coil Monitor)
- 52 Closed
- 52 Open (Trip Coil Monitor)

Isolation Switches (2xFlexitest)

- 8 AC currents
- 4 AC voltage
- Relay Power Input
- 2 Light Fault
- 2 Heavy Fault

END OF SECTION