GUAM POWER AUTHORITY
ATURIDÅT ILEKTRESEDÅT GUÅHAN
P.O.BOX 2977 • HAGÅTÑA, GUAM U.S.A. 96932-2977

August 07, 2025

AMENDMENT NO.: II

TO

INVITATION TO BID NO.: GPA-047-25

FOR

T-7 TRANSFORMER REPLACEMENT (DESIGN-BUILD)

Prospective Bidders are hereby notified of the following inclusions and response to inquiries received from Bidder No. 1 dated July 29, 2025:

INCLUSIONS:

* 1. Packing Detail List (ATTACHMENT A)

* 2. Transmission & Distribution Specification No. E-057, Rev. 0 - 600V Current Transformer and Test Switch (ATTACHMENT B)
Transmission & Distribution Specification No. E-029, Rev. 3 - 13.8kV Switchgear (ATTACHMENT B)
Transmission & Distribution Specification No. E-030, Rev. 5 - 34.5kV Switchgear (ATTACHMENT B)
Transmission & Distribution Specification No. E-001, Rev. 2 - 15 kV Underground Power Cable, Single Conductor with Concentric Neutral, Type MV-90, Extruded Tr-xple Insulation (ATTACHMENT B)

* 3. TP-7 Schematic Diagram (ATTACHMENT C)

* 4. Piti Substation Record Drawings (ATTACHMENT D)

* 5. Section 16051 – Owner-Furnished Equipment and Materials (ATTACHMENT E)
Section 16355 – Power Transformer 34.5/13.8 KV 30 MVA (ATTACHMENT E)
Transmission and Distribution Specification No. E-034, Rev. 6 - 34.5kV/13.8kV 18/24/30 MVA Power Transformer Outdoor Type (ATTACHMENT E)

RESPONSE:

QUESTION:

1. Project location is inside Piti Substation. Therefore, access is controlled by GPA. Will a GPA representative provide the contractor access at all times?

1.1 Will a GPA representative be onsite at all times?

1.2 Is this chargeable to the contractor?

1.3 What about for outside of normal hours?

ANSWER:

1. Yes. GPA representative will provide the contractor access as per requested scheduled date(s) and time duration.

1.1 Yes. GPA representative will be onsite at all times as scheduled accordingly.

1.2 No. It is not chargeable to the contractor for normal working hours.

1.3 The outside of normal hours is chargeable.

QUESTION:

2. We are requesting that GPA provide notice that the new T-7 is free of any damage that could delay the project. This includes bushings, gauges, marshalling cabinet, terminal blocks, etc.

2.1 Will GPA be responsible for any damages or missing parts that may occur and discovered during assembly and installation of the power transformer?

ANSWER:

2. The Owner Furnished T-7 Transformer is free from damage per our inspection on 12/30/2022. Refer to *INCLUSION NO. 1* above.

2.1 Yes. GPA shall be responsible.

QUESTION:

3. GPA informed that the nitrogen has been depleted from the main tank. Therefore, a leak has occurred and moisture may be present inside. What steps will GPA take to remedy this situation?

ANSWER:

GPA will not be taking any steps. The contractor will be performing dryout and heating/ degassing off oil. That is a step on installing oil onto transformer.

QUESTION:

4. Can GPA provide assistance for the vacuuming and oil filling of T-7 transformer?

ANSWER:

Yes. GPA can assist with the vacuuming and oil filling of the T-7 transformer; however, our vacuum equipment, pump, and oil storage tank are chargeable, including the labor.

QUESTION:

5. Please provide the specifications for the CT's power cables, control wires and terminal blocks/shorting blocks.

ANSWER:

Refer to *INCLUSION NO. 2* above.

QUESTION:

6. We are kindly requesting for a copy of the TP-7 breaker drawings to ensure that new CT's will fit to include the placement of terminal blocks.

6.1 Also request for any as built drawings for Piti Substation.

ANSWER:

6. GPA does not have a copy of TP-7 breaker/switchgear cubicle record drawing since it was only turnover by the Navy to GPA. GPA only has the TP-7 schematic diagram. Refer to *INCLUSION NO. 3* above.

6.1 Refer to *INCLUSION NO. 4* above.

QUESTION:

7. Will power outage requests with Navy or Navy contractors be required?

7.1 Is the winning contractor responsible for coordination and payment of charges?

ANSWER:

7. Power outage requests with the Navy maybe required which will be depends on the contractor's safety work assessment.

7.1 Yes. It is the winning contractor that is responsible for coordination and payment of the Charges with the Navy

QUESTION:

8. Are GPA power outages chargeable to the winning contractor?

ANSWER:

Yes. GPA power outages request are chargeable to the winning contractor only if extended the regular working hours.

QUESTION:

9. Forwarded herewith is a copy of Exemption letter from the Secretary of the Navy, we would like to know if this waiver of the UXO and MEC investigation is applicable to this project.

ANSWER:

The UXO and MEC exemption is not applicable. Please refer to *Appendix V - Exhibit 1, Page 461 of 1042* for more details. The contractor will be responsible to coordinate with Navy in regards to this matter.

QUESTION:

10. In your Item 11L of Technical Specifications TS-4, page 109 or 1042, you have indicated Owner-Furnished Equipment and Materials, Section 16051 Owner-furnished Equipment and Materials – Can you please let us know what are these equipment and materials?

ANSWER:

Refer to *INCLUSION NO. 5* above.

QUESTION:

11. Does GPA plans to install air-conditioning unit on the substation building? Will this be part of this project?

ANSWER:

No. Air Conditioning installation is not part of the project.

All other Terms and Conditions in the bid package shall remain unchanged and in full force.

JOHN M. BENEVANTE, P.E.
General Manager

ATTACHMENT A.

PACKING DETAILS

PKG NO	DESCRIPTION	WEIGHT (kG)		DIMENSION (mm)				Q'TY	REC'D
		NET	GROSS	L	W	H	CBM		
1	Main Body	42,500	42,500	6650	3670	3250	79.32	1	12/29/2022 GOOD CONDITION
2	HV Bushing	254	409	1800	1800	800	2.59	3	12/30/2022 BATCH 1
	LV Bushing							4	
3	HV Cable Box	685	1,016	2300	1600	2250	8.28	1	12/30/2022 BATCH 2
4	LV Cable Box	465	711	1950	1200	2100	4.91	4	12/30/2022 BATCH 2
5	Conservator	900	1,258	3680	1800	1800	11.92	1	BATCH 2
	Breather Pipe							1	
	Radiator Support							1	
6	Radiator	1,050	1,336	2300	1480	2100	7.15	3	12/30/2022 BATCH 1
7	Radiator	1,050	1,336	2300	1480	2100	7.15	3	12/30/2022 BATCH 3
8	Radiator	700	956	2300	1480	1500	5.11	2	12/30/2022 BATCH 3
9	Cooling Fan	150	415	2100	2100	1200	5.29	6	12/30/2022 BATCH 2
10	Oil Drum	1,809	2,074	2000	2100	1200	5.00	9	12/30/2022 BATCH 4
11	Oil Drum	1,809	2,074	2000	2100	1200	5.00	9	12/30/2022 BATCH 1
12	Oil Drum	1,809	2,074	2000	2100	1200	5.00	9	12/30/2022 BATCH 3
13	Oil Drum	1,809	2,074	2000	2100	1200	5.00	9	12/30/2022 BATCH 1
14	Oil Drum	1,809	2,074	2000	2100	1200	5.00	9	12/30/2022 BATCH 3
15	Oil Drum	1,809	2,074	2000	2100	1200	5.00	9	12/30/2022 BATCH 1
16	Oil Drum	1,809	2,074	2000	2100	1200	5.00	9	12/30/2022 BATCH 4
17	Oil Drum	1,809	2,074	2000	2100	1200	5.00	9	12/30/2022 BATCH 4
18	Oil Drum	1,809	2,074	2000	2100	1200	5.00	9	12/30/2022 BATCH 1
19	Oil Drum	1,809	2,074	2000	2100	1200	5.00	9	12/30/2022 BATCH 4
20	Oil Drum	1,608	1,873	2000	2100	1200	5.00	8	12/30/2022 BATCH 3
21	Accessory	1,600	1,794	1800	1220	860	1.89	1	12/30/2022 BATCH 2

SEE ADDITIONAL LIST

NGAGER [illegible] 12/30/22
GPA ENGINEERING (PRINT / SIGN / DATE)

12/30/22
BENSON OFFICIAL (PRINT / SIGN / DATE)

JERALD PATINO 12/30/22
GPA T&D SUBSTATION (PRINT / SIGN / DATE)

Docusign Envelope ID: 507C9428-2E3E-4CDB-82F7-4B3A3BFFA427

ACCESSORY

ITEM NO.	DESCRIPTION	Q'TY	REC'D
1	ANCHOR BOLTS CAME IN W/MAIN TANK	4	12/29/2022
2	1 LITER TRANSFORMER OIL	2	
3	TERMINAL PAD BHDSF50-030CP	3	
4	HYDRAN SENSOR W/ ACCESSORIES	1	
5	HYDRAN SENSOR	1	
6	RECTANGULAR GACKET	2	
7	HDGF14-1 TERMINAL PAD (THREADED)	2	
8	LARGE & WIDE ROUND GASKET	5	
9	LARGE & THIN ROUND GASKET	3	
10	MEDIUM & THIN " "	4	
11	SMALL & THIN " "	1	
12	EXTRA SMALL & THIN	1	
13	DOUBLE EX SMALL & THIN	5	
14	HV BUSHING	2	
15	LV BUSHING	2	
16	LVN BUSHING	1	
17			
18			
19			
20			

01212TP

01/30/2022 BATCH 2.

NANETTE G. KLEGER 12.30.22
GPA ENGINEERING (PRINT / SIGN / DATE)

JORGE TALAVERA 12/30/22
GPA T&D SUBSTATION (PRINT / SIGN / DATE)

MONITO S. CO 12/30/22
BENSON OFFICIAL (PRINT / SIGN / DATE)

*PENDING
1. HEATERS (HV + LV CABS)
2. ARRESTERS (HV + LV CABS)
3. BREATHER (CONS. + OLTC)
4. TERMINALS (only 3ea + Zea)
5. MANUALS, INSTRUCTIONS, DOCUMENTATION.
6. AS-BUILT DRAWINGS

Excerpt from Email 7/31/2025
Re: July 23, 2025: Pre-Bid/Site Visit for GPA-047-25, T-7 Transformer Replacement (Design-Build)

For the pending parts, they were later found in the existing crates. Manuals and drawings were also provided. There were hardcopy manuals and soft files of the drawings. The hardcopy set was in a small box. See the I drive for the drawings and soft file manuals. Thanks,
Nan

ATTACHMENT B.

GUAM POWER AUTHORITY
P.O. BOX 2977
AGANA, GUAM 96932

TRANSMISSION & DISTRIBUTION SPECIFICATION

SPECIFICATION NO. E-057

FOR

600V CURRENT TRANSFORMER AND TEST SWITCH

EFFECTIVE DATE: 5-15-25	ISSUED:	APPROVED:

600V CURRENT TRANSFORMER AND TEST SWITCH

TABLE OF CONTENTS

1.0 SCOPE

1.1 This specification covers GPA's requirement for high-accuracy current transformers, which come in main ratings of 600A, 1000A, and 2000A and are rated 600V with 10 kV BIL at 60 Hz for watt-hour metering in both indoor and outdoor environments.

1.2 This specification also includes requirements for high-accuracy 10-Pole test switch designed for metering, and relay panel applications. The test switch type specified here is suitable for integration into GPA's transmission and distribution systems, supporting reliable metering and protective applications.

2.0 CONFORMANCE TO SPECIFICATIONS

2.1 APPLICABLE DOCUMENTS

The most recent revisions of the following regulations and standards specify all pertinent requirements that current transformer and test switch must achieve or exceed:

2.1.1 IEEE C57.13-2016 – Standard Requirements for Instrument Transformer.

2.1.2 ANSI C12.11-2006 – Instrument Transformer for Revenue Metering, 10kV BIL through 350kV BIL.

2.1.3 IEC 61869-2 - Instrument Transformers - Part 2: Additional Requirements for Current Transformers.

2.1.4 ANSI C12.20 – American National Standard for Electricity Meters – Accuracy Classifications.

2.1.5 NEMA SG-4 – Instrument Transformers for Revenue Metering Applications.

2.2 ACCEPTANCE REQUIREMENTS

Equipment purchased under this specification will be accepted under the requirements specified herein.

2.3 DEVIATIONS AND NONCONFORMANCE REQUIREMENTS

2.3.1 Deviations from this specifications or changes in the material or design after the purchase order has been placed must be approved by the GPA Engineering Department and acknowledged by an addendum to the specification which shall be issued by a Purchase Order Amendment.

2.3.2 Units received with deviations or non-conformances which are not acknowledged as specified in subparagraph 2.3.1 are subject to rejection. The supplier of units rejected in this paragraph is responsible for any corrective action including but not limited to materials, labor, and transportation necessary to dispose of, or make the units conform to the specifications.

2.3.3 Notification of defective units discovered before or after installation that are believed to be inherent to manufacturing problems or workmanship shall be made and forwarded to the Supplier. The description information, disposition and/or follow-up (as appropriate) that GPA expects from the Supplier will be specified. The Supplier's response shall be made within thirty (30) days unless an extension is acknowledged and approved in writing by the GPA Manager of Engineering.

3.0 DEFINITIONS

3.1 Current Transformer (CT)
A current transformer (CT) is an electrical device used to measure alternating current (AC). By lowering high voltage currents, it makes it possible to securely operate relays, measuring devices, and other equipment. Application for CTs include protective relays and metering.

3.2 Accuracy Class (e.g., 0.15% Accuracy)
This indicates how well the transformer converts main current to secondary current. An accuracy of 0.15% guarantees extremely high precision even at low load levels, which is essential for metering applications, since the measurement error will not surpass 0.15% of the full-scale value.

3.3 Basic Impulse Level (BIL)
Typically measured in kilovolts (kV), BIL is the highest impulse voltage that the equipment can tolerate without failing. A transformer with a 10kV BIL rating is capable of withstanding impulse voltages of up to 10kV without suffering damage.

3.4 Burden
The load connected to a CT's secondary winding is referred to as burden. It directly impacts the transformer's accuracy and is measured in volt-amperes (VA). The CT is intended to function precisely under a given load.

3.5 Primary and Secondary Windings

3.5.1 Primary Winding: The winding connected to the high-current circuit that needs to be measured.

3.5.2 Secondary Winding: The winding connected to the measuring or protective device, where the current is scaled down. Typically rated at 5A to be compatible with standard metering equipment.

3.6 Window-Type Transformer
A CT with an open core through which a conductor passes.

3.7 Rating Factor
The rating factor indicates the transformer's overload capability. For example, a rating factor of 2.0 means the transformer can handle twice its nominal current without exceeding its rated accuracy. It allows the CT to maintain accuracy even when current temporarily exceeds the rated level.

3.8 Metering Core
The core of the transformer optimized for accuracy at low currents, crucial for billing purposes. The core reduces magnetic loss, thus ensuring precise measurements.

3.9 Short Circuit Device (Shorting Clip)
A safety feature in the secondary terminals of a CT. When the secondary circuit is open (no load connected), the shorting clip ensures no dangerous voltage is generated, which could otherwise lead to electric shocks or damage to equipment.

3.10 Insulating Material
The material used to encapsulate the core and coil assembly, enhancing the CT's durability and resistance to environmental factors.

3.11 Frequency Rating
The operating frequency of the CT, usually 60 Hz for North American power systems. The transformer is designed to perform accurately at this specified frequency.

4.0 SUBMITTALS

4.1 The Bidder shall provide the following data with their bid submittal for Current Transformer:

a) Nameplate Data (including Manufacturer Name, Voltage, Ratings, etc.)
b) Connection Diagrams
c) Guaranteed Accuracy Class and Burden Ratings
d) Guaranteed Basic Impulse Level (BIL) Performance
e) Shop Drawings
f) Certificates of Testing & Inspection
g) Completed Appendix A – CURRENT TRANSFORMER INFORMATION SHEET

4.2 The Bidder shall provide the following data with their bid submittal for Test Switch:

a) Guaranteed Voltage Rating (600V AC) and Current Rating (30A Continuous)
b) Guaranteed Mechanical & Electrical Performance, including:
   - Make-Before-Break (MBB) shorting feature for CT circuits
   - Automatic CT secondary shorting when the switch is opened
   - Test Jack functionality for current measurements
   - Terminal compatibility (#14 to #6 AWG)
c) Shop Drawings
d) Completed Appendix B – TEST SWITCH INFORMATION SHEET

4.3 Failure to submit the required data for Current Transformers (CTs) and Test Switches as specified shall result in automatic disqualification from the bid. All bidders must ensure that every required document and specification detail is included in their submission, as no post-submittal clarifications or corrections will be permitted.

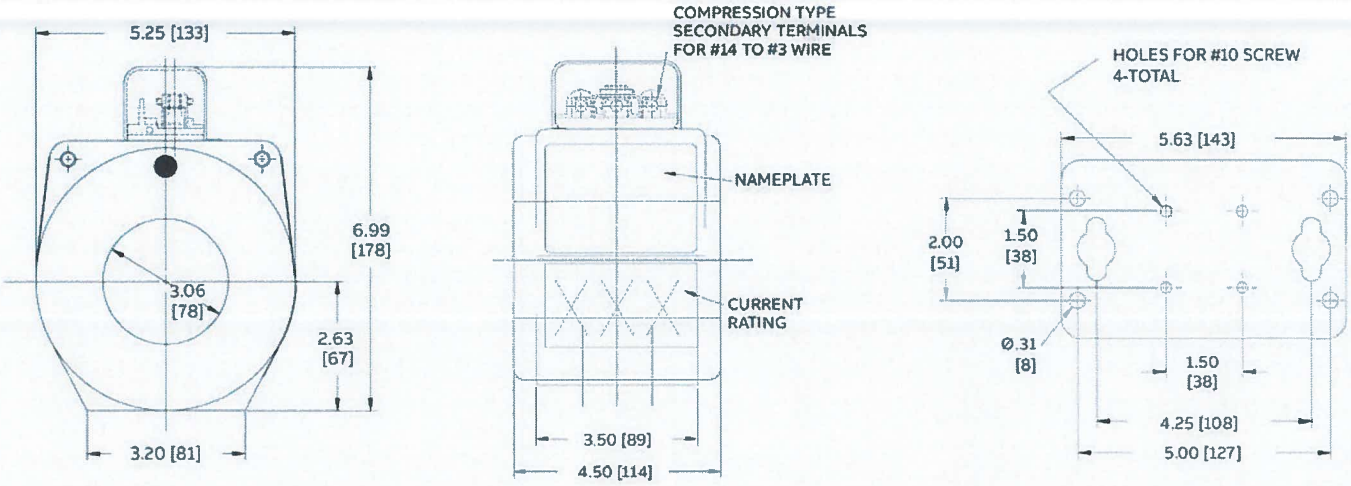
4.4 Once the bid is awarded, the vendor must submit final shop drawings to GPA for review and approval. GPA will have two (2) weeks to review and approve these documents without impacting the shipping schedule. Any delays in delivery caused by disapproved drawings during this review period will be the responsibility of the vendor/supplier.

4.5 Documents returned to the vendor/supplier with approval will serve as authorization to proceed with the work. GPA's approval does not waive any of the specification requirements

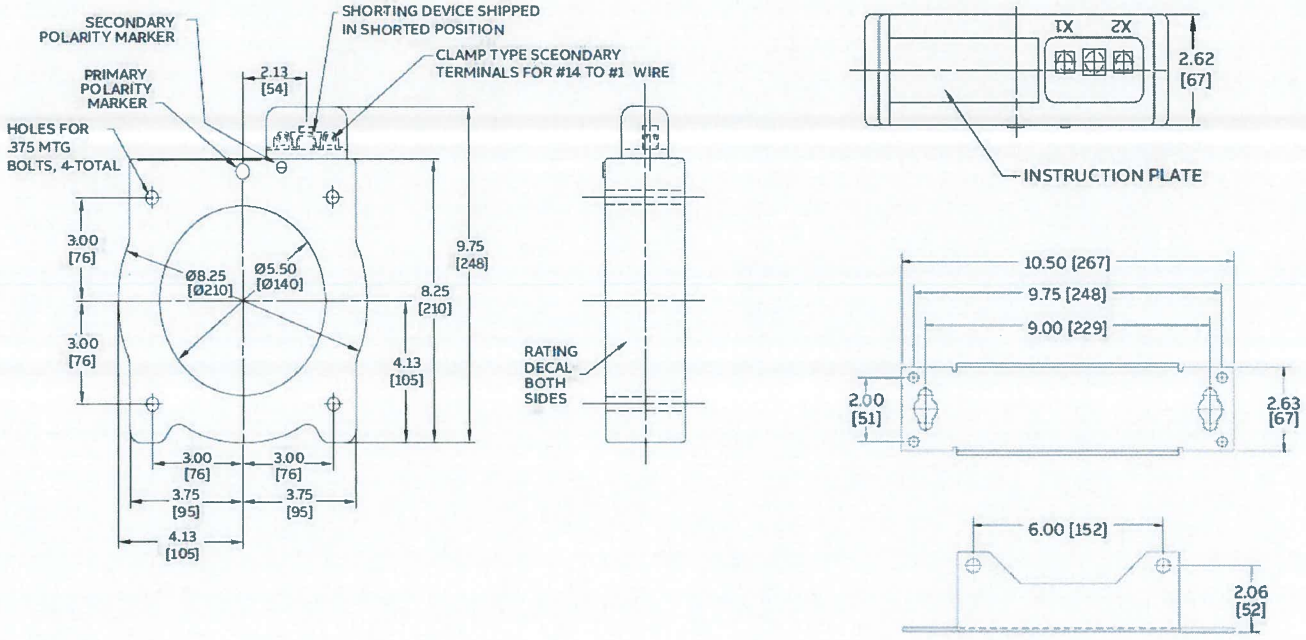
5.0 CURRENT TRANSFORMER DESIGN

5.1 ILLUSTRATION

5.1.1 CT 600:5, CT 1000:5, Flat Mounting Plate



5.1.2 CT 2000:5



One-piece base

TYPE:	MINUMUM WINDOW (in)	MAXIMUM HEIGHT (in)
CT600:5	3	7.5
CT1000:5	3	7.5
CT2000:5	5.5	11

5.2 CURRENT TRANSFORMER RATING AND CAPABILITIES

5.2.1 Voltage Rating: Rated for 600V AC, designed for both indoor and outdoor environments.

5.2.2 Basic Impulse Level (BIL): 10kV, providing resilience under high-impulse voltage conditions.

5.2.3 Frequency: Operates at 60 Hz, compatible with standard North American power systems.

5.2.4 Accuracy Class: Ensures precision with a 0.15% accuracy level from 1% of nominal current through the rated factor, supporting reliable metering.

5.2.5 Current Ratings and Rating Factors:

A. 600A Unit: Rating factor of 2.0 at 30°C and 1.5 at 55°C.

B. 1000A Unit: Rating factor of 2.0 at 30°C and 1.5 at 55°C.

C. 2000A Unit: Rating factor of 2.5 at 30°C and 1.75 at 55°C.

5.3 CURRENT TRANSFORMER OPERABILITY

5.3.1 The current transformers shall be designed for accurate metering in both indoor and outdoor low voltage applications up to 600V.

5.3.2 Units shall support use with watt-hour meters, with or without additional thermal demand attachments, and shall provide stable performance under variable load conditions.

5.3.3 The transformers shall feature a flat-base design suitable for mounting on standard metering panels, brackets, cabinet, or flat surfaces as required.

5.3.4 Secondary terminals on the CT shall be equipped with a transparent snap-on cover that enables visual inspection while protecting against accidental contact.

5.3.5 The CT's secondary terminals shall be compatible with industry-standard conductor sizes, specifically supporting #14 to #6 AWG wire, to facilitate a range of metering applications.

5.3.6 Terminal spacing and layout shall support both direct and looped connections, providing flexibility for diverse metering setups

5.3.7 The CT shall be compatible with standard metering and testing tools, enabling efficient testing, sectionalizing, and load monitoring.

5.3.8 Terminal covers and mounting hardware shall be accessible without specialized tools, allowing quick installation, inspection, or replacement as necessary.

5.4 CURRENT TRANSFORMER TESTING REQUIREMENTS

5.4.1 All units shall undergo dielectric testing in accordance with IEEE standards to verify they meet the rated Basic Impulse Level (BIL) of 10kV. This testing must confirm the insulation's ability to withstand impulse voltages, ensuring reliability in operational environments.

5.4.2 Each unit must be tested to meet the 0.15% accuracy class across the specified load range, from 1% of nominal current through the rating factor. This testing shall confirm the unit's precision for accurate metering under varying load conditions.

5.4.3 Temperature rise tests shall be conducted to ensure that each unit operates within safe temperature limits at full load conditions at both 30°C and 55°C. This testing must verify that the units maintain accuracy without overheating, supporting long-term performance.

5.4.4 Each unit shall undergo short-circuit withstand testing to assess structural integrity and insulation performance under fault conditions. This testing must confirm that the units can handle temporary overloads and short circuits safely, without compromising insulation or mechanical stability.

5.4.5 Units shall be subjected to salt fog and other environmental tests to confirm resistance to corrosion in challenging environments. This testing must ensure that the units remain operational and maintain accuracy in outdoor applications and corrosive conditions.

5.4.6 Mechanical tests, including pressure and impact tests, must be performed on components such as the insulating material and base to confirm durability under physical stress. Each unit shall demonstrate sufficient mechanical strength for installation and in-field use.

5.5 CONSTRUCTION AND INSULATION

5.5.1 The insulating material is molded and permanently bonded to the core and coil assembly, enhancing durability, mechanical strength, and dielectric performance.

5.5.2 Engineered for consistent metering accuracy across varying loads, reducing magnetic losses and maintaining high precision.

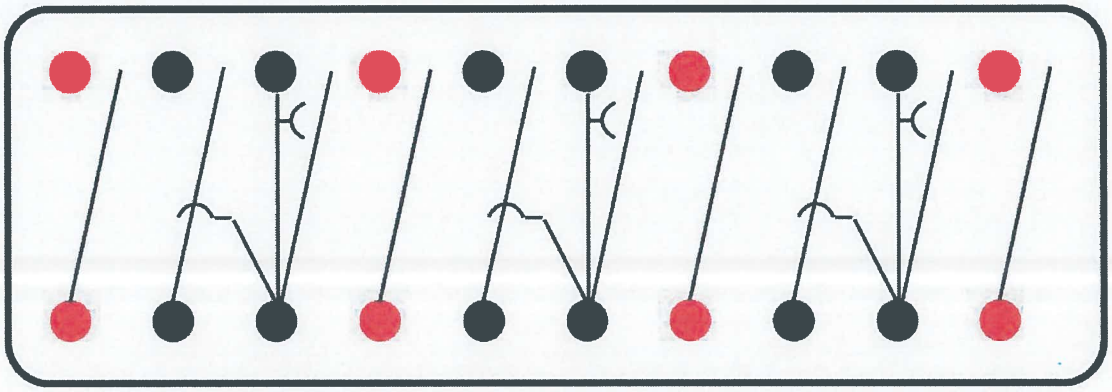
5.5.3 All units are built with a flat, corrosion-resistant aluminum base to ensure stability and long-term durability in diverse environments.

5.5.4 The composition of all materials used shall be described and must be approved by GPA Engineering prior to acceptance by GPA.

6.0 TEST SWITCH DESIGN

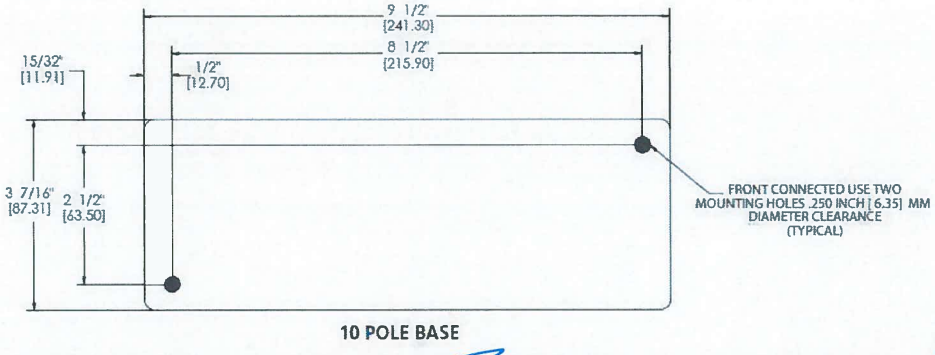
6.1 ILLUSTRATION

6.1.1 10-Pole Test Switch Arrangement



RED / BLACK / BLACK / RED / BLACK / BLACK / RED / BLACK / BLACK / RED

6.2 FRONT-BASED CONNECTEDSWITCH



10 POLE BASE

6.3 TEST SWITCH RATINGS AND CAPABILITIES

6.3.1 The test switch shall be designed to meet the operational and safety needs of metering and relay systems within GPA's infrastructure.

6.3.2 The test switch shall meet the following ratings and performance capabilities:

A. Voltage Rating: 600V AC

B. Current Rating: 30A continuous

C. Ambient Operating Temperature: Up to 40°C (104°F)

D. Wire Size Compatibility: Terminals shall support wire sizes from #14 to #6 AWG.

E. Stud Specifications: Stud terminals shall have a 10-32 thread with a recommended nut size of 3/8 x 3/8 inch.

F. Recommended Torque: 25 in-lbs for stud wiring connections.

6.3.3 The switch shall feature a 10-pole base to support multiple connection points, accommodating complex circuit configurations.

6.3.4 The base shall be constructed from a 3/4-inch non-tracking insulating material, highly resistant to moisture.

6.3.5 The switch shall include a clear, impact-resistant cover plate to allow visibility of switch blades and internal positions, enabling operators to verify status without removing the cover.

6.4 TEST SWITCH OPERABILITY

6.4.1 The switch shall accommodate wire sizes from #14 to #10 AWG, with a recommended torque of 25 in-lbs for secure connections.

6.4.2 The cover plate shall ensure visibility of all switch blades and include insulated, cadmium-plated steel cover studs for environmental resilience.

6.4.3 The layout shall support both direct and looped connections, enabling compatibility with standard testing tools.

6.4.4 The test switch shall feature color coded- handles to improve operational safety and clarity by visual distinguishing circuit functions:

A. Black Handles: Standard for current circuits.

B. Red Handles: Designated for potential trip circuits.

6.4.5 Black Handles (Current Circuit) shall incorporate a make-before-break (MBB) short-circuiting element to prevent open-circuit conditions in CT circuits.

6.4.6 A short-circuit jaw shall be included to ensure automatic CT secondary shorting when the switch is opened.

6.4.7 A test jack shall be provided for safe current measurements without disturbing the permanent wiring.

6.4.8 The test switch shall be equipped with a screw-on transparent cover to provide protection while allowing visual inspection of the switch position and status.

6.5 TEST SWITCH TESTING REQUIREMENTS

6.5.1 The test switch shall undergo dielectric testing to verify insulation strength and ensure safe operation at its rated voltage.

6.5.2 The switch shall meet contact resistance standards to prevent overheating and ensure efficient current flow.

6.5.3 The test switch shall demonstrate durability through repeated operational cycles, maintaining performance without functional loss.

6.5.4 The switch shall pass temperature and humidity tests, confirming that materials, including the cover plate and insulation base, retain integrity under environmental conditions.

6.5.5 The switch shall withstand high-voltage impulse tests simulating surge events, showing no damage to components or insulation.

7.0 MANUFACTURING

7.1 MARKING AND IDENTIFICATION

7.1.1 Each current transformer (CT) shall be equipped with a durable, legible nameplate affixed securely to the unit in a readily visible location.

7.1.2 The nameplate shall include essential identification information, including but not limited to:

A. Manufacturer's name or logo

B. Month and year of manufacture

C. Voltage and current ratings (including the primary and secondary current ratings)

D. Accuracy class and burden rating

E. Rating factor and applicable frequency (e.g., 60 Hz)

7.1.3 The nameplate shall be constructed from corrosion-resistant material suitable for both indoor and outdoor applications, ensuring that information remains legible and intact over the lifespan of the CT.

7.1.4 The test switch base shall be constructed from a non-tracking, moisture-resistant insulating material to prevent deterioration in high-humidity environments.

7.1.5 Switch handles shall be color-coded (e.g., black for current circuits, red for potential trip circuits) to enhance operational safety and clarity.

7.1.6 Metallic components, such as terminals and mounting hardware, must be treated with a corrosion-resistant coating (e.g., zinc or cadmium plating) for long-term durability.

7.1.7 The switch assembly must include a clear, impact-resistant cover to protect the internal components while allowing visibility of the switch positions.

8.0 QUALITY CONTROL

8.1 QUALITY CONTROL PROGRAM

Manufacturers of current transformers (CTs) and test switches must maintain a documented quality control program to ensure compliance with GPA specifications. This program should

include regular audits, statistical monitoring, and personnel training to uphold production standards.

8.2 QUALITY CONTROL DOCUMENTATION

Comprehensive records of testing procedures for CTs and test switches must be maintained. These include dielectric testing, accuracy validation, temperature rise assessments, short-circuit testing, and environmental durability evaluations. Final inspection reports verifying compliance with standards must also be documented.

GPA reserves the right to review quality control records for CTs and test switches to confirm compliance. Manufacturers must make these records available upon request.

9.0 PACKAGING AND SHIPPING

9.1 Current transformers and test switches must be securely packaged to prevent damage during transit and protect against environmental factors such as moisture and temperature fluctuations. Packaging materials should ensure the stability and safety of the equipment.

9.2 Containers must have clear labels identifying the product, including part numbers, handling instructions, and barcodes for inventory management. Proper labeling ensures accurate identification and handling during transport.

9.3 Weather-resistant cartons and compliant pallets must be used for shipping CTs and test switches. Preservation measures, such as desiccants, should be included to maintain product integrity during storage.

9.4 Each shipment must include a detailed packing list and required compliance documents, such as certificates of testing and inspection reports, specific to CTs and test switches.

Appendix A

600V Current Transformer

NOTE: Please complete product information and provide the required documents. Failure to complete information and documentation shall result of a disqualification.

Product Information				
No.	Item Description	Specification Details		
1.	Current Transformer Type (CT), Burden Class, Burden Rating, and Rating Factor	600:5 ; B-0.5(0.5Ω) ; 12.5 VA ; 2.0 at 30°C ; 1.5 at 55°C	Yes	No
		1000:5 ; B-0.5(0.5Ω) ; 12.5 VA ; 2.0 at 30°C ; 1.5 at 55°C	Yes	No
		2000:5 ; B-0.09(0.9Ω) ; 22.5 VA ; 2.5 at 30°C ; 1.75 at 55°C	Yes	No
2.	CT Voltage Rating	600V	Yes	No
3.	Basic Impulse Level (BIL)	10kV	Yes	No
4.	Frequency	60Hz	Yes	No
5.	Accuracy Class	0.15S	Yes	No
6.	CT Mounting Design	Flat Mounting Base	Yes	No
7.	Terminal Compatibility	#14 to #6 AWG	Yes	No
8.	Secondary Terminal Cover	Snap-On Transparent Cover	Yes	No

Name Plate Information			
1.	Corrosion Resistant for Indoor and Outdoor Use	Yes	No
2.	Manufacturer's Name with Production Date (Month and Year)	Yes	No
3.	Voltage Rating	Yes	No
4.	Primary and Secondary Ratings	Yes	No
5.	Rating Factor	Yes	No
6.	Frequency	Yes	No
7.	Basic Impulse Level (BIL)	Yes	No

Required Documents			
1.	Final Shop Drawings	Yes	No
2.	Certificates of Testing & Inspection	Yes	No
3.	Sample Nameplate Data's	Yes	No

Appendix B

Test Switch

NOTE: Please complete product information and provide the required documents. Failure to complete information and documentation shall result of a disqualification.

Product Information				
No.	Item Description	Specification Details		
1.	Test Switch Type	10-Pole Switch	Yes	No
2.	Terminal Compatibility	#14 to #6 AWG	Yes	No
3.	Secondary Terminal Cover	Screw-On Transparent Cover	Yes	No
4.	Test Switch Voltage Rating	600V	Yes	No
5.	Test Switch Current Rating	30A Continuous	Yes	No
6.	Test Switch Cover	Impact-Resistant, Transparent	Yes	No
7.	Test Switch Black Handle	Current Circuits	Yes	No
		Make-Before-Break Short-Circuit Feature w/ Test Jack	Yes	No
		Automatic CT secondary shorting when handle is opened	Yes	No
8.	Test Switch Red Handle	Potential Trip Circuits	Yes	No

Required Documents			
1.	Final Shop Drawings	Yes	No
2.	Certificates of Testing & Inspection	Yes	No

GUAM POWER AUTHORITY
P.O. BOX 2977
HAGATNA, GUAM 96910

TRANSMISSION & DISTRIBUTION SPECIFICATION

Specification No. E-029

FOR

13.8 KV SWITCHGEAR

13.8 KV SWITCHGEAR

TABLE OF CONTENTS

1.0 SCOPE

1.1. This specification describes the requirements for the design, manufacture, factory testing and delivery of 15kV indoor metal-clad switchgear, as well as associated control and accessory equipment. The switchgear shall be an ANSI C37.20.7 Type 2C arc-resistant, providing compartmental protection. The switchgear shall meet the indoor requirements of ANSI C37. This general specification along with the detailed specification establishes the minimum requirements for this equipment. If there is a discrepancy between the single line diagram(s) and the detailed specifications, the detailed specifications shall take precedence. The entire switchgear shall consist of the following equipment:

Main power circuit breaker equipment
Bus tie circuit breaker equipment
Sparing bus with removable links and a tap section for the mobile substation
Feeder power vacuum circuit breaker equipment
Primary bus system
Ground bus system
Protective relaying
Control devices
Connection provisions for primary, ground and control circuits
Auxiliary compartments and transformers
Accessories and material

1.2. The switchgear shall perform satisfactorily under a non-air conditioned environment and be suitably designed for satisfactory operation under the hot tropical climate conditions and shall be dust and vermin proof. All the parts and surface, which are subject to corrosion, shall either be made of such material or shall be provided with such protective finish, which provided suitable protection to them from any injurious effect of excessive humidity.

1.3. The equipment shall be suitable for satisfactory continuous operation under the following tropical conditions:

a. Maximum ambient temperature : 45 °C
b. Relative Humidity : 10 to 99 %(condensing)
c. Seismic level (Horizontal acceleration) : International Building Code Zone-4

1.4. Any special design or installation considerations to assure compliance with this requirement shall be thoroughly documented on the Supplier drawings.

2.0 CONFORMANCE TO STANDARDS AND SPECIFICATIONS

2.1. The metal-clad switchgear shall be designed, manufactured and tested in accordance with the latest editions of the applicable, National Electrical Code (NEC), National Electrical Safety Code (NESC), EEMAC, ANSI, IEEE and NEMA standards including:

2.1.1. American National Standards Institute, Inc. (ANSI)

C37.04	IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers
C37.06	IEEE Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities for Voltages Above 1000 V
C37.09	IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

C37.010	IEEE Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
C37.011	IEEE Guide for the Application of Transient Recovery Voltage for AC High-Voltage Circuit Breakers
C37.11	IEEE Standard Requirements for Electrical Control for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
C37.20.2	IEEE Standard for Metal-Clad Switchgear
C37.55	Conformance Testing Procedure of Metal-Clad Switchgear
C57.10	Requirements for Instrument Transformers
C57.13	Requirements for Instrument Transformers
47	Guide for Surge Withstand Capability Tests

2.1.2. National Electrical Manufacturer's Association (NEMA)

CC1	Electrical Power Connectors
SG2	High Voltage Fuses
SG4	AC High-Voltage Circuit Breakers
SG5	Power Switchgear Assemblies
SG6	Power Switching Equipment

2.1.3. National Electric Code (NEC) / National Fire Protection Association (NFPA)

70E	Standard for Electrical Safety in the Workplace

2.1.4. American National Standards Institute (ANSI) C2, 2012 National Electric Safety Code (NESC) Part 1 Rules for the Installation and Maintenance of Electric Supply Stations and Equipment

Section 18	Switchgear and Metal Enclosed Bus

2.1.5. International Building Code – 2009

2.1.6. International Electrotechnical Commission (IEC)

IEC 61850	Substation Automation

2.1.7. U.S. Department of Defense – Military Specifications

Mil-1-46058C	Insulating Compound, Electrical (For Coating Printed Circuit Assemblies)

2.1.8. IPC

IPC-CC-830	Qualification and Performance of Electrical Insulating Compound for Printed Wiring Assemblies

2.1.9. Underwriters Laboratories (UL)

UL 746E	Polymeric Materials - Industrial Laminates, Filament Wound Tubing, Vulcanized Fibre, and Materials Used In Printed-Wiring Boards

2.1.10. International Engineering Consortium (IEC)

IEC 60664-3 Insulation Coordination for Equipment within Low-Voltage Systems - Part 3: Use of Coating, Potting or Moulding for Protection Against Pollution

2.2. Deviations And Non-Conformance Requirements

2.2.1. Deviations from this specification or changes in materials or design after the Purchase Order has been placed must be approved by the GPA Engineering Department and acknowledged by a Purchase Order Amendment.

2.2.2. Units received with deviations or non-conformances which are not acknowledged as specified in Sub-Paragraph 2.2.1 are subject to rejection. The Supplier is responsible for any corrective action including but not limited to materials, labor and transportation necessary to dispose of, or make the units conform to the specification.

2.2.3. Notification of defects discovered before or after installation that are believed to be inherent to manufacturing problems or workmanship shall be made and forwarded to the Supplier. The description of the item, documentation of the problem and the described information, disposition and/or follow-up (as appropriate) that GPA expects from the Supplier will be specified. The Supplier's response shall be made within thirty (30) days unless an extension is acknowledged and approved in writing by the GPA Manager of Engineering.

2.2.4. GPA shall be allowed two (2) weeks to review and approve drawings without affecting the shipping date. Delays in delivery due to drawings which are not approved during this review period are the responsibility of the Supplier.

2.3. Warranty

2.3.1. The Supplier shall warrant the satisfactory and successful operation of the apparatus furnished under this specification at the rating, under the conditions, and for the service specified for a period of not less than one (1) year. The Supplier shall further warrant the apparatus against defects of design, material and workmanship.

3.0 SUBMITTALS

3.1. Equipment outline drawings shall be submitted for approval within 30 days after Notice to Proceed. The remaining Shop Drawings shall be submitted within 60 days after Notice to Proceed. GPA will provide the successful bidder samples for three-line and DC Schematics and preferred format for inter-connection diagrams as a guide.

3.2. Shop Drawings and data shall include the following:

a. General arrangement, floor plan, elevations and sections, anchor bolt details, overall dimensions and weights.

b. Interior structural drawings, elevations and sections of main bus, sparing bus, breakers and potential transformers.

c. A complete set of ac and dc schematic diagrams, one for each piece of equipment, including, but not necessarily limited to the following:
   (1) Protection and controls
   (2) Breaker controls
   (3) Auxiliary equipment controls

d. Current transformer data, including excitation and ratio correction factor curves and mechanical and thermal short-term ratings.

e. Nameplate data.

f. Wiring diagrams with terminal block and device connections for each panel and cubicle. Tabular format is not acceptable.

g. Interconnection diagrams.

h. Potential transformer data.

i. Notes and symbols.

j. Bill of material.

k. Three-line diagram.

l. One-line diagram.

m. Panel layout drawing.

n. Other drawings, diagrams, and instructions required for installation, operation and maintenance of the equipment.

3.3. Instructions for installation shall be submitted within 90 days after Notice to Proceed.

3.4. Operations and maintenance manuals with a section on troubleshooting shall be submitted 30 days prior to shipment.

3.5. Number of Copies

a. Submit five (5) copies of each shop drawing, pre-printed manufacturers' data, brochures and suppliers' information for review and approval.

b. After approval and manufacturing of equipment, submit one (1) reproducible transparency and five (5) prints of each shop drawing which has been specifically prepared for the Work. Indicate on the drawings that the drawings reflect the as-built condition of the equipment.

c. Submit two (2) paper copies and two (2) electronic copies of operations and maintenance manuals with a section on trouble shooting and instructions for installation. The electronic copies shall be in Portable Document Format (PDF) files in CD format.

d. Submit one (1) copy of the shop drawings in AUTOCAD 2005 format on a CD.

4.0 QUALIFICATIONS

4.1. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. An acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement with the bid submittal.

4.2. For all equipment specified herein, the manufacturer shall have a quality system that is ISO 9001 certified.

5.0 QUALITY ASSURANCE

5.1. The manufacturer shall have a formal Quality Assurance Program. The manufacturer's Quality Assurance Manual shall consist of systematic procedures that provide confidence that the work is in accordance with the manufacture's standard design, codes and standards referenced above, and these specifications for controlling activities affecting quality, such as welding, heat treating, and nondestructive examination. Formal training of individuals

performing the work shall be an element of the Quality Assurance Program. Inspections and audits shall be conducted to insure that the Quality Assurance Program is being followed.

5.1.1. The manufacturer's Quality Assurance Manual shall be available at GPA's request and shall include descriptive information and details of the program, including program organization, documentation requirements, and quality control procedures.

5.1.2. The Quality Assurance Program shall include testing procedures, acceptance criteria, repair methods and the quality control requirements of these specifications.

5.2. Factory Tests

5.2.1. General

Not less than 30 days prior to factory tests, a factory test plan shall be submitted to the Owner for approval. Each item of electrical equipment and similar equipment supplied as spare parts, shall be given the manufacturer's routine factory tests and also other tests as specified, to ensure successful operation of parts of the assemblies. The factory test equipment and the test methods used shall conform to the applicable requirements of ANSI, IEEE and NEMA standards. Five (5) certified copies of the reports of production tests, including complete test data shall be submitted to the Owner. Factory tests will be witnessed by two GPA representatives. Supplier shall cover the cost of airfare, rooms, meals and car rental for the GPA representatives to witness the FAT testing.

5.2.2. Assembly Tests

Units of the switchgear shall be assembled at the factory and checked for alignment and fit. Each circuit breaker to be supplied with the switchgear assembly shall be installed in the assigned unit after the switchgear has been fully assembled. Checks shall include correct operation of shutters, interlocks, auxiliary contacts, racking mechanisms and for ease of installation and withdrawal of circuit breakers. Wiring shall be given point-to-point circuit continuity tests and shall be subjected to dielectric tests in accordance with requirements of ANSI Standard C37.20. The control switches shall be checked for proper contact operation. Device marking, nameplate markings, conductor identification and the scale of meters and instruments shall be checked.

5.2.3. Functional Tests

Current and potential tests shall be made on relays, instruments, meters and transducers for proper operation, direction and calibration. Operational tests shall be performed to verify the functional controls.

5.3. Factory Test Reports

Four (4) copies of certified test results shall be provided to the Owner within 30 days after performance of factory tests.

6.0 RATING

6.1. Description

6.1.1. The switchgear shall be designed to be operated on a 15kV maximum rated voltage system and shall be suitable for operation on a solidly-grounded system rated 13.8 kV, 3-phase, 4-wire, 60Hz. The main bus shall be rated for 2,000 Amperes, continuous. Basic insulation level shall be 110 kV.

6.1.2. Equipment and materials shall be the products of manufacturers regularly engaged in the production of such equipment and materials.

6.1.3. The switchgear arrangement and dimensions shall be as specified in the design drawings.

6.2. Circuit Breakers

6.2.1. Unless otherwise specified or approved by GPA Engineering Department, all circuit breakers shall be GE PowerVac® circuit breakers.

6.2.2. The 15 kV circuit breakers shall have vacuum interrupters, and be 3-pole, single throw, trip free, draw-out type, rated on the symmetrical current basis. Each breaker shall have its characteristics based on a 15 second close-open duty cycle, and shall be capable of interrupting its rating in 5 cycles or less from the time the trip coil is energized until the arc is extinguished.

6.2.3. The circuit breaker closing shall be operated by a stored energy mechanism, which is normally charged by an electric motor, but which can also be charged by a manual handle for emergency manual closing or test. The power supply for the stored energy mechanism shall be 125 VDC.

6.2.4. The circuit breaker control voltage shall be 125 VDC. GPA will provide the 125 VDC station control power.

6.2.5. Each circuit breaker shall be designed specifically for installation in the breaker compartment, and breakers of like ratings shall be completely interchangeable. Circuit breakers of 1200A ratings shall not be interchangeable in a 2000A compartment. Each breaker shall be self-contained, equipped with self-coupling primary and secondary disconnect contacts, and with either fixed and swivel casters or fixed casters and a fifth wheel accessory, or a maintenance and handling device to permit easy mobility. Provisions shall be made and accessory materials and equipment furnished to permit complete disconnection of the breaker from the line and bus and testing of the breaker within the switchgear compartment. Breakers shall be mechanically interlocked to ensure that the breaker is tripped before being withdrawn from or inserted into the connected position.

6.2.6. The breakers shall have the following features:

a. Sturdy, self-aligning, silver-plated, primary disconnect contacts with high contact pressure. The circuit breaker element, primary disconnect shall be an integral part of the element.

b. Auxiliary switch contacts connected to the mechanism of each breaker shall be provided. A minimum of 10 "a" and 10 "b" contacts for the Owner's use shall be supplied and shall be wired to terminal blocks. Contacts shall be field changeable from "a" to "b" and vice versa.

c. An easy-to-read position indicator located on the front of the equipment which can be read without opening the compartment door.

d. A manual means for tripping.

e. Trip free and non-pumping operation.

f. An operations counter which can be read without opening the compartment door.

6.2.7. The circuit breakers shall meet their ratings as listed in ANSI C37.06. Principal breaker ratings shall be as follows:

a. Rated maximum voltage, kV	15
b. Withstand test voltages –	
Low frequency RMS, kV	36
Impulse crest, kV	95
c. Rated continuous current, Amperes:	
Feeder	1,200
Main	2,000
Bus Tie	2,000
d. Rated short-circuit current at rated maximum voltage, symmetrical Amperes, RMS	18,000
e. Maximum symmetrical interrupting capability, Amperes RMS	23,000
f. Rated Short Time Current: Three second Amperes	23,000

6.3. Enclosure

6.3.1. The switchgear assembly shall consist of metal-clad, free-standing, vertical, deadfront steel structures containing circuit breaker compartments and circuit breakers, primary bus system, ground bus system, auxiliary compartments and transformers, protection and control devices, control bus, and connection provisions for primary, ground and control circuits. Devices shall be arranged as shown on the contract drawings. The basic structure will be of modular construction and fabricated mainly of painted hot-dipped galvanized steel. The switchgear enclosure will be double wall construction with an air gap between sheets, so that in the event of a fault the second layer will be insulated by the air gap. The original vendor shall be the manufacturer of the enclosure and the final assembler.

6.3.2. The switchgear shall have a suitable framework of structural steel to provide self-supporting rigid and stable structures. Channel base members shall be provided as part of the frames for proper alignment. The panel and structure shall be sufficiently rigid to support the equipment without vibration and shall be sized as shown on the Contact Drawings. Each shipping group shall be provided with a welded base frame, so when assembled in the field it provides a completed structural metal-clad switchgear line-up assembly.

6.3.3. The panels and enclosure shall consist of selected sheets of smooth sheet steel. The panels shall be all the same size for front, rear and top alignment. Sheet steel shall not be less than No. 11 US Standard Gauge A-60 galvanneal steel, forming structural shapes or having bent angle or channel edges, with corner seams welded and ground smooth. Stiffeners shall be provided as required. The

exposed exterior surfaces shall not be drilled or welded for attaching wires or devices if holes or fastenings will be visible after installation. Vertical wiring trough shall be provided on both sides of panels. Doors to each enclosure shall be the same material and thickness as the housing sheets. Doors shall be braced or constructed so as to hang true and prevent warping. Doors shall have a 1 inch allowance from the floor. Hinges shall be the concealed, loose-pin type which will permit the panels or doors to swing out not less than 105°. Doors shall be provided with 3-point latches. Ventilated openings shall be grill or louver type and provided with corrosion-resistant screens to prevent entrance of insects and rodents. Lights shall be provided within each enclosure.

6.3.4. The switchgear will be constructed with two (2) circuit breaker compartments stacked in a single vertical section with an indoor frame size of 36 inches wide x 95 inches high x 85 inches deep.

6.3.5. The enclosure shall be provided with 304L stainless steel ground pads with 304L stainless steel ½" – 13 UNC, 7/16" deep threaded nuts welded to the ground pads. The ground pad shall be welded to the walls and shall be free of paint.

6.4. Buses

6.4.1. Main Bus

The main bus shall be copper, rated 2,000 Amperes, silver-plated at joints and tap points, installed in separate compartment from other wiring by a minimum 11 gauge steel barrier which fully encloses the bus, and insulated its entire length with a high dielectric strength, flame-retarding, self-extinguishing, moisture resistant epoxy coating applied using a fluidized bed process. Use of extruded sleeves or heat shrink insulation is not acceptable. Suitable insulation covers shall be provided for bus joints. The bus supports between units shall be cycloaliphanic epoxy resin or wet process porcelain insulators for 15kV class. Use of glass-filled polyester, dry process porcelain, ceramic or non-cycloaliphatic epoxy formulations for bus supports is not acceptable. All bus supports must have the same BIL rating as the switchgear. Bracing shall be provided as required for the bus to withstand short circuit current equal to the momentary rating of the breakers furnished with the switchgear. The main bus shall comply with ANSI/IEEE temperature rise requirement.

6.4.2. High Voltage Connections

High voltage connections between the main buses, and circuit breaker disconnecting devices, current transformers, and potheads shall be furnished with material installed. Connections shall be made of copper bar insulated between terminals with insulation comparable to that required for the main bus bars. The cross-section of bars and joints shall be uniform and smooth to permit a flow of current equal to the full load rating of the breaker without excessive temperature rise. Joints shall be silver-plated and bolted. Joints shall be relieved of voltage stress by metallic gauze, or other suitable conducting material, and insulated with tape and glyptal to provide insulation levels equal to or better than those of the main insulated buses. High voltage connections between the main bus or breaker load terminals and fixed studs of potential transformer assemblies shall be made with high voltage cable having insulation coordinated with basic impulse levels required for the switchgear. Supports,

bushings, terminal lugs and joint insulation shall be furnished as required, and the leads installed to form a complete installation.

6.4.3. Ground Bus

Copper ground bus shall be 1/4-inch by 2-inches solidly connected to each switchgear unit and extended into the power cable entrance compartment of each unit Ground bus shall be equipped with a clamp connector for #4/0 AWG – 500 kcmil copper cable. Provisions for external ground connections shall be provided at each end of the bus. Materials for interconnecting the ground bus on adjacent shipping groups shall be provided, as required. Bars of the various sections shall be bolted together to form an integral ground for the entire switchgear. At least three (3) studs shall be provided on the bar for connection of the external station ground.

6.4.4. Access

Removable panels shall be provided for access to the bus compartment.

6.5. Instrument Transformers

6.5.1. Voltage transformers shall be rated for 110 kV BIL with ANSI accuracy classification of 0.3 at burdens W, X, Y and Z. Potential transformers shall be dry-type draw-out or tilt-out mounted and equipped with high interrupting capacity current limiting fuses. The ratio shall be 70:1.

6.5.2. Current transformers shall be the toroidal type, suitable for metering or relaying as required. Metering current transformers shall have an accuracy rating equal to or better than 0.3B-0.1, 0.3B-0. 2, 0.3B-0.5, 0.3B-1 and 0.3B-2. Multi-ratio current transformer for relaying and metering shall be of C400 relaying accuracy.

6.6. Surge Arresters

6.6.1. Surge arresters shall be station class, metal-oxide-varistor (MOV), mounted in the switchgear enclosure and connected to each circuit conductor on the line side of the associated circuit breaker. The arresters shall have a nominal 12 kVrms rating and a MCOV 10.2kV rms rating.

6.6.2. The following characteristics are typical of these arresters:

40 kV maximum crest voltage for a 10 kA impulse, which results in a discharge voltage cresting in 0.5 microseconds. The maximum discharge voltage (crest kV) at indicated impulse currents of 8x20 microseconds:

30 kV at 1.5 kA
32 kV at 5.0 kA
35 kV at 10.0 kA
40 kV at 20.0 kA

6.7. Wiring and Accessories

6.7.1. The metal-clad switchgear shall be completely wired at the factory, ready for installation and connection by others. Inter-panel wiring required between shipping groups shall be brought to terminal blocks on adjacent panels necessitating only on-site reconnections of factory-supplied jumpers. Terminal blocks and jumper cables shall be properly identified for assembly. Unused terminals on relays and auxiliary contacts shall be brought to conveniently

located terminal blocks. Feeder and main transformer power cables and all control and meter connections will enter from the bottom. The incoming cables for the main breaker will consist of three (3) 750 kcmil cables per phase. The manufacturer shall ensure that sufficient vertical and horizontal clearances are provided for training and terminating these cables in the cable compartment without requiring excessive bending or the use of special adapter plates furnished by the cable installer. Rubber insulators shall be provided at the terminations of power cables. In addition, bracket supports for the cables shall be provided.

6.7.2. Unless otherwise specified, secondary and control wiring or connections shall be made with a minimum wire size of No. 12 AWG stranded, tinned copper switchboard wire, NEC type SIS, and rated for 600 Volts. Minimum wire size for CT wiring shall be No. 10 AWG. Insulation jacket shall be gray in color. Splices will not be permitted. Wires shall run in conduits, raceways or trays. Suitable, extra flexible wiring shall be provided over door hinges or other locations where leads may be subjected to flexing.

6.7.3. Ring-tongue terminals shall be used for secondary wiring. Spade, slotted spade, flanged spade, and hook terminals are not acceptable. The strength of the terminals shall be such that the terminals will not break during vibration of the equipment in which the terminals are installed. Ring-tongue terminals shall be Thomas & Betts Stakon.

6.7.4. Terminals shall have insulated ferrules. To assure positive electrical connections, and to avoid damage to the ferrule, it is mandatory that the crimping tool be used in accordance with manufacturer's instructions, and that the proper terminal and crimping tool be used for each wire size. Crimps shall be made with the crimp indentation opposite to the connector seam.

6.7.5. Miscellaneous accessories, such as resistors, fuses, fuse blocks, and capacitors not shown on the Contract Drawings but required for proper operation of the switchgear shall be furnished.

6.7.6. Terminal blocks for current transformer leads shall be 6-point and shall be provided with short-circuiting devices to permit removing or testing of wiring without opening the current transformer circuits. Leads from multi-ratio current transformers shall be brought out to the terminal blocks. Terminal blocks shall be Marathon Series 1600, or as approved by the Owner. Terminal blocks shall be provided for all wires leaving switchboard panels and shall have marking strips for Owner's 6-digit number identification system. Terminal blocks shall have washer head binding screw terminals, barriers between terminals, high flame retarding properties, mechanical toughness and high electrical strength. At least 20% spare terminals shall be provided on each panel. Each wire shall be identified at both ends with a permanently machine-embossed black identification on white plastic, heat-shrinkable, tubular slip-on marker.

6.7.7. Terminal blocks for grouping of SCADA wiring shall be thermo-plastic insulation type, rated 300 Volts, with test socket screws, knife switch contacts and shall be mounted on rails. The marking system shall be Dekafix consecutive vertical numbering system and Peso white blanks for Owner's marking. Terminal blocks shall be furnished complete with mounting rails, end brackets, end plates, partitions and test equipment. Wiring to the SCADA terminal blocks shall be made with No. 18 wire minimum.

6.7.8. Wiring for transducer output circuits shall be No. 18, twisted pair shielded conductor. Meter pulse circuit wiring shall be No. 18, 3-conductor shielded cable.

6.7.9. Wiring Format

6.7.10. All terminals shall be numbered, and the numbers shall correspond to the numbers on the wiring diagram.

6.7.11. All wires shall be identified at their termination points with the opposite end designation identification by labeled plastic sleeves or equal. Identification shall correspond to the lettered device, numbered terminal format of the wiring diagrams.

6.7.12. System Phase Rotation. The system phase rotation for the island-wide system is GPA C-B-A or NEMA 1-2-3 and all equipment purchased under this contract shall be wired and connected NEMA 1-2-3. All phase markings shall be NEMA 1-2-3. Instrument and relay arrangement shall be 1-2-3 left to right with neutral relays underneath phase grouping. GPA will make the external connections of the incoming and outgoing lines such that GPA C-B-A is connected to NEMA 1-2-3. Phase markings C-B-A shall be reserved for GPA's use.

6.8. Nameplates

Nameplates shall be furnished and installed for panels, switches, relays and devices, including those internally mounted, and shall be of laminated plastic or formica with white letters on black background and shall be sized for easy reading. Nameplates shall be securely fastened to the panel with stainless steel panhead screws to prevent detachment and loss. Nameplate data shall be submitted for Owner's approval. Designations shall be machine engraved in upper case letters and shall be centered on the nameplates. Each metal-clad switchgear unit shall be provided with a circuit identifying nameplate, letters approximately 3/4-inch high, and mounted at the top of the switchgear.

6.9. Instrument and Control Switches

6.9.1. Instrument and control switches shall be the rotary, cam-operated type with silver contacts and a positive means for maintaining contact position. Contact requirements shall be as shown on the Contract Drawings or as specified. Switch contacts shall be totally enclosed to prevent the accumulation of dust, grit, and foreign matter on the contact surface. The switches shall be GE type SB-1, Westinghouse type W-2, Electroswitch Series 24, or equal, and shall have operating handles as follows:

a. Large red pistol-grip handles for power circuit breaker control switches.

b. Black oval handles with arrow for transfer, and auxiliary switches.

6.9.2. Control switches for circuit breakers shall be momentary contact, spring-return type for both trip and close operation. Operation indicators showing the last operation shall be provided.

6.9.3. The switches shall have escutcheon plates marked as specified with standard circuit designation, except where otherwise specified, and shall be as follows:

a. Escutcheon plate for circuit breaker control switches, 52CS, shall

read "TRIP-CLOSE".

b. Escutcheon plate for supervisory selector switch, 43R/L shall be "REMOTE-LOCAL".

c. Escutcheon plate for recloser cutout switch, 79CO, shall be "CUTIN-CUTOUT".

6.10. Indicating Lamps

Schweitzer SEL-2652 Trip Coil Monitors with an external red LED shall be mounted on the switchgear, suitable for operation on 125 VDC or 120 VAC, as required for the specific circuit (SEL Part Number 2652A1XX-Red).

6.11. Meter

Each feeder position shall have a multi-function, poly-phase, switchboard type (draw-out case) meter with electronic registers, displays, and input and output pulse contacts. The meter shall be a Schweitzer SEL-735 power quality and revenue meter, 0.2% accuracy, Form 9, Current Class CL 10/20, load profiling, with 3 element Watt and Var inputs. The display shall include digital kV, kA, kWh, kVarh, kW-demand, kVar-demand, and power factor. The meter shall provide kWh and kVarh pulse outputs for interface to a SCADA system (SEL Part Number 0735VX10944CXXXXXX2610XX).

6.12. Protective Relays

6.12.1. General

Protective relays shall be semi-flush mounting-type with test facilities that automatically short current circuits and open potential and trip circuits when the relay is withdrawn from the case.

If the relay is not equipped with built-in test facilities, external test blocks shall be furnished. Output contacts shall be rated for tripping or closing of the circuit breaker. Output contacts shall be dry type. SCR outputs are not acceptable. Relays shall have targets to indicate which elements caused the operation.

Control voltage shall be 125 VDC.

Relays shall pass the ANSI surge withstand tests.

All printed circuit boards are to be covered with a Conformal Coating meeting the specification indicated in Section 2.1 and operate within a temperature range of -40°C to +75°C (-40°F to +160°F) and a relative humidity range between 0% and 100%.

Communication protocols shall include DNP3 and TCP/IP, fully compliant with IEC 61850.

6.12.2. 13.8 kV Feeder Relays – Device 50/51/79/50G/51G/50PAF/50NAF

a. Overcurrent relays shall be selectable curve type with a time overcurrent range of 0.5 to 15 Amperes and an instantaneous range of 0.5 to 100 Amperes.

b. Overcurrent ground relays shall be selectable curve type with a time overcurrent range of 0.5 to 15 Amperes and an instantaneous range of 10

to 0.5 to 100 Amperes.

c. Feeder reclosing relays shall be multi-shot, 4 adjustable reclosers with facilities for blocking of instantaneous overcurrent relays after the first trip.

d. Arc-flash detection shall be accomplished with fiber-optic, arc-flash light sensors strategically placed within the metal-clad switchgear, connected to the relay to send a fast trip signal to the circuit breaker.

e. All of the above functions shall be provided by the Schweitzer solid-state relay type SEL-751A (Part number 751A11AB0X74850000) with a SEL Fiber Optic cable (Part number C80430XXXXX). SEL C273A cable for connection to SEL-2032 integration relay shall also be provided. Spare relay contacts shall be wired to terminal blocks.

6.12.3. 13.8-kV Feeder Backup Relays – Device 50/51/50G/51G/50PAF/50NAF

a. Overcurrent relays shall be selectable curve type with a time overcurrent range of 0.5 to 15 Amperes and an instantaneous range of 10 to 80 Amperes.

b. Overcurrent ground relays shall be selectable curve type with a time overcurrent range of 0.5 to 15 Amperes and an instantaneous range of 0.5 to 100 Amperes.

c. Arc-flash detection shall be accomplished with fiber-optic, arc-flash light sensors strategically placed within the metal-clad switchgear, connected to the relay to send a fast trip signal to the circuit breaker.

d. All of the above functions shall be provided by the Schweitzer solid-state relay type SEL-751A (Part number 751A61ACA1A74850230) with a SEL c804 Fiber Optic Point Sensors (Part number C80430XXXXX). SEL C273A cable for connection to SEL-2032 integration relay shall also be provided. Spare relay contacts shall be wired to terminal blocks.

6.12.4. 13.8 kV Bus Relays – Device 51B, 51GB

a. Each bus section shall be protected by overcurrent relays with CT inputs connected to selectively trip the faulted bus section. The relays shall have selectable type characteristics with a time overcurrent range of 0.25 to 16 Amperes. The overcurrent relays shall be SEL 351-6.

b. Each bus section shall also be provided with a ground overcurrent relay having selectable type characteristics with a time current range of 0.25 to 16 Amperes. The ground overcurrent relays shall be SEL 351-6.

6.12.5. Synchronism Check Relays – Device 25

Each 13.8 kV feeder connected to a power plant shall be provided with a synchronism check relay with provisions for dead line and/or dead bus checks. The synchronism check relays shall be Basler or SEL.

6.12.6. Auxiliary Relays

a. Auxiliary relays shall be multi-contact type, with shunting or series

resistors if necessary, suitable for operation on 125 VDC, as indicated on the Contract Drawings or required for the circuits. Panel-mounted relays shall be semi-flush window type. Surface-mounted relays on back of panels or on side walls shall be front-connected type with molded or window-type covers. Auxiliary relays shall be GE type HGA and HFA.

b. Spare contacts shall be wired to terminal blocks

6.13. Display

Each SEL meter and relay shall have a built in LCD to display analog metered values and targets, Trip Circuit Monitor

The trip circuit monitor shall be SEL-2652. See section 6.10.

6.14. Test Switches and Devices

Current and potential test switches and test plugs shall be provided with the test switches semi-flush mounted on the switchboard. Test switches shall be connected to the appropriate circuits to permit checking and calibrating of meters or instruments against portable standards connected in series with the instruments undergoing tests, under service conditions, or by means of a phantom load. Switches and plugs shall permit "in-service testing" as well as calibration and checking of instruments, meters and relays from separate sources of power. Provisions shall also be included for connecting current measuring devices in series with the current circuits of the switches. Switch blades shall be separated by insulated barriers and each switch and handle shall be provided with a recessed section for inserting circuit identification cards. Switches shall automatically short circuit current transformer circuits so they cannot be opened inadvertently. Meter test switches shall be unit base, front-connected with current elements and potential elements and a solid cover. Current type switches shall be ABB type FT-1.

6.15. Painting

The switchgear enclosure shall be thoroughly cleaned of rust, welding scale and grease using a non-acidic and non-abrasive cleaner, and shall be treated to effect a bond between the metal and paint which will prevent the formation of rust under the paint. A zinc-oxide zinc-chromate anticorrosion priming coat shall be applied immediately after the bonding treatment. A final finish shall consist of not less than one coat for concealed surfaces and two coats for exterior surfaces. Final finish shall be light gray, ANSI Color No. 70. The interior shall be painted with 2 coats of white enamel. A computerized paint system shall be utilized to apply a uniform thickness and coverage of paint to all surfaces.

6.16. Control AC Power Supply

The 50 kVA single phase dry type transformer shall be provided in the switchgear. The switchgear shall have provisions for connecting these transformers to the bus. If required, a separate station service for the power plant will be provided by the power plant supplier.

7.0 CONSTRUCTION

7.1. Installation

Installation will be provided by others.

7.2. Accessories and Spare Parts

Accessories, special tools and spare parts required for proper maintenance and testing of the equipment, circuit breakers and devices shall be provided with the switchgear and shall include the following:

Breaker test cabinet, to facilitate operation of a circuit breaker out of its cubicle for test purposes.

One trip coil for every four power circuit breakers provided.

Twenty spare fuses for each rating of fuse provided in switchgear.

Test jumper for testing the breaker when removed from the cubicle.

Blank nameplates of each size used.

Gallons of touchup paint in one quart cans.

Closing lever for manual operation.

Levering device for breaker positioning.

Set test plugs for relays and meters.

Turning dolly for handling breaker, if required.

Transport truck for handling breaker outside the cubicle, if required.

Crank for manually charging the stored energy closing mechanism.

Spare fuses for potential transformers.

1,200-Ampere grounding and test device with provisions for independently locking each access door with a padlock without remote control, if applicable.

Special tools required for proper maintenance, testing and inspection of the equipment.

Spare vacuum bottle, if applicable.

8.0 PACKING AND SHIPPING REQUIREMENTS

8.1. Because of severe transportation conditions, the Supplier shall pay particular attention to the proper packaging and bracing of the apparatus to assure its safe arrival.

8.2. The Supplier shall prepare all materials and equipment for shipment in such a manner as to protect from damage in transit. All small parts and unit components shall be separately boxed or bundled to prevent galling due to rubbing of one part against another. Each item, box or bundle shall be plainly and individually identifiable for content according to item number, GPA P.O. Number, and Supplier's Identifying Number.

8.3. Complete itemized Bill of Lading, which clearly identifies and inventories each assembly, sub-assembly, carton, package, envelope, etc., shall be furnished and enclosed with each item or items at the time of shipment.

8.4. The switchgear shall be shipped in crates containing not more than two units each.

GUAM POWER AUTHORITY

Post Office Box 2977
Hagåtña, Guam 96932

TRANSMISSION AND DISTRIBUTION SPECIFICATION

Specification No. E-030

FOR

34.5 kV SWITCHGEAR

EFFECTIVE DATE: 05-17-2024	ISSUED:	APPROVED:

34.5 kV SWITCHGEAR

Table of Contents

1.0. SCOPE

1.1. This specification describes the requirements for the design, manufacture, factory testing and delivery of 38kV indoor metal-clad switchgear, as well as associated control and accessory equipment. The switchgear shall be an ANSI C37.20.7 Type 2C arc-resistant, providing compartmental protection. The switchgear shall meet the indoor requirements of ANSI C37. This general specification along with the detailed specification establishes the minimum requirements for this equipment. If there is a discrepancy between the single line diagram(s) and the detailed specifications, the detailed specifications shall take precedence. The entire switchgear shall consist of the following equipment:

a. Line circuit breaker equipment
b. Bus tie circuit breaker equipment
c. Sparing bus with removable links and a tap section for the mobile substation
d. Provisions for connection of a future line breaker to the main bus
e. Transformer circuit breaker equipment
f. Primary bus system
g. Ground bus system
h. Protective relaying and revenue grade metering equipment and devices
i. Control and status devices
j. Connection provisions for primary, ground and control circuits
k. Auxiliary compartments and transformers
l. Accessories and material

1.2. The switchgear shall perform satisfactorily under a non-air conditioned environment and be suitably designed for satisfactory operation under the hot tropical climate conditions and shall be dust and vermin proof. All the parts and surface, which are subject to corrosion, shall either be made of such material or shall be provided with such protective finish, which provided suitable protection to them from any injurious effect of excessive humidity.

1.3. The equipment shall be suitable for satisfactory continuous operation under the following tropical conditions:

a. Maximum ambient temperature: 45 °C
b. Relative Humidity: 10 to 99% (condensing)
c. **Seismic level (Horizontal acceleration): International Building Code Zone 4**

1.4. Any special design or installation considerations to assure compliance with this requirement shall be thoroughly documented on the Supplier drawings.

2.0. CONFORMANCE TO STANDARDS AND SPECIFICATION

The metal-clad switchgear shall be designed, manufactured and tested in accordance with the latest editions of the applicable, National Electrical Code (NEC), National Electrical Safety Code (NESC), EEMAC, ANSI, IEEE and NEMA standards.

2.1. Applicable Standards

2.1.1. American National Standards Institute, Inc. (ANSI)

C37.04	IEEE Standard For Ratings And Requirements For AC High-Voltage Circuit Breakers With Rated Maximum Voltage Above 1000 V
C37.06	IEEE Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities for Voltages Above 1000 V
C37.09	IEEE Standard Test Procedures For AC High-Voltage Circuit Breakers With Rated Maximum Voltage Above 1000
C37.010	IEEE Guide for AC High-Voltage Circuit Breakers > 1000 Vac Rated on Symmetrical Current Basis
C37.011	IEEE Guide for the Application of Transient Recovery Voltage for AC High-Voltage Circuit Breakers with Rated Maximum Voltage above 1000 V
C37.11	IEEE Standard Requirements for Electrical Control for AC High-Voltage (>1000 V) Circuit Breakers
C37.20.2	IEEE Standard for Metal-Clad Switchgear
C37.55	Medium-Voltage Metal-Clad Switchgear Assemblies – Conformance Test Procedures
C37.90.1	IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
C57.13	IEEE Standard Requirements for Instrument Transformers

2.1.2. National Electrical Manufacturers Association (NEMA)

CC1	Electric Power Connection for Substations
SG2	High Voltage Fuses
SG4	AC High-Voltage Circuit Breakers
SG5	Power Switchgear Assemblies
SG6	Power Switching Equipment

2.1.3. National Fire Protection Association (NFPA)

70	National Electrical Code (NEC)
70E	Standard for Electrical Safety in the Workplace

2.1.4. American National Standards Institute (ANSI) C2, National Electric Safety Code (NESC)

Part 1	Rules for the Installation and Maintenance of Electric Supply Stations and Equipment

2.1.5. International Building Code (IBC)

2.1.6. International Electrotechnical Commission (IEC)

IEC 61850	Substation Automation – Fundamentals

2.1.7. U.S. Department of Defense – Military Specifications

Mil-1-46058C	Insulating Compound, Electrical (For Coating Printed Circuit Assemblies)

2.1.8. IPC

IPC-CC-830	Qualification and Performance of Electrical Insulating Compound for Printed Wiring Assemblies

2.1.9. Underwriters Laboratories (UL)

UL 746 E	Polymeric Materials – Industrial Laminates, Filament Wound Tubing, Vulcanized Fibre, and Materials Used in Printed-Wiring Boards

2.1.10. International Engineering Consortium (IEC)

IEC 60664-3	Insulation Coordination for Equipment within Low-Voltage Systems – Part 3: Use of Coating, Potting or Moulding for Protection Against Pollution

2.2. Deviations and Non-Conformance Requirements

2.2.1. Deviations from this specification or changes in the material or design after the purchase order has been placed must be approved by the GPA Engineering Department and acknowledged by a Purchase Order Amendment.

2.2.2. Units received with deviations or non–conformances that are not acknowledged as specified in Section 2.2.1, are subject to rejection. The Supplier is responsible for any corrective action including but not limited to materials, labor and transportation necessary to dispose of, or make the units conform to the specification.

2.2.3. Notification of defects discovered before or after installation that are believed to be inherent to manufacturing problems or workmanship shall be made and forwarded to the Supplier. The description of the item, documentation of the problem and the described information, disposition and/or follow-up (as appropriate) that GPA expects from the Supplier will be specified. The Supplier's response shall be made within thirty (30) days unless an extension is acknowledged and approved in writing by the GPA Manager of Engineering.

2.2.4. GPA shall be allowed two (2) weeks to review and approve drawings without affecting the shipping date. Delays in delivery due to drawings which are not approved during this review period are the responsibility of the Supplier.

3.0. SUBMITTALS

3.1. Equipment outline drawings shall be submitted for approval within 30 days after Notice to Proceed. The remaining Shop Drawings shall be submitted within 60 days after Notice to Proceed. GPA will provide the successful bidder samples of three-line and DC Schematics and preferred format for inter-connection diagrams as a guide.

3.2. Shop Drawings and data shall include the following:

a. General arrangement, floor plan, elevations and sections, anchor bolt details, overall dimensions and weights.

b. Interior structural drawings, elevations and sections of main bus, sparing bus, breakers and potential transformers.

c. A complete set of ac and dc schematic diagrams, one for each piece of equipment, including, but not necessarily limited to the following:
   1. Protection and controls
   2. Breaker controls
   3. Auxiliary equipment controls
   4. Communications and SCADA

d. Current transformer data, including excitation and ratio correction factor curves and mechanical and thermal short-term ratings.

e. Nameplate data.

f. Wiring diagrams with terminal block and device connections for each panel and cubicle. Tabular format is not acceptable.

g. Interconnection diagrams for panels and for external devices and field equipment.

h. Potential transformer data.

i. Notes and symbols.

j. Bill of materials and manufacturers catalog sheets clearly marked.

k. Three-line diagram.

l. One-line diagram.

m. Panel layout drawing.

n. Other drawings, diagrams, and instructions required for installation, operation and maintenance of the equipment.

3.3. Installation manuals shall be submitted within 90 days after Notice to Proceed.

Operations and maintenance manuals with a section on troubleshooting shall be submitted 30 days prior to shipment.

3.4. Number of Copies

a. Submit two (2) hardcopies and one (1) electronic soft file in Portable Document Format (PDF) of each shop drawing, pre-printed manufacturers' data, brochures and suppliers' information for review and approval.

b. After approval and manufacturing of equipment, submit two (2) sets of full size hardcopies and two (1) set of electronic soft file copy of each shop drawing which has been specifically prepared for the Work. Indicate on the drawings that the drawings reflect the Approved Manufacturer As-Built condition of the equipment. Electronic soft file copy shall include a Portable Document Format (PDF) stored on USB Flash Drive/Storage Devices.

c. Submit two (2) hardcopies and two (2) electronic soft file copies of installation, operations and maintenance manuals with a section on trouble shooting. The electronic soft file copies shall be in Portable Document Format (PDF) on USB Flash Drive/Storage Devices.

d. Upon completion of installation and commissioning of switchgear equipment, submit two (2) sets of full size hardcopies and two (2) sets of electronic soft file copies of each shop drawing which has been specifically revised and updated based on the Commissioned As-Built condition. Indicate on the drawings that the drawings reflect the Commissioned As-Built condition of the equipment. Electronic soft file copies shall include a Portable Document Format (PDF) and an AUTOCAD 2013 format, stored on USB Flash Drive/Storage Devices.

4.0. QUALIFICATIONS

4.1. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. An acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement with the bid submittal.

4.2. For all equipment specified herein, the manufacturer shall have a quality system that is ISO 9001 certified.

5.0. QUALITY ASSURANCE

5.1. The manufacturer shall have a formal Quality Assurance Program. The manufacturer's Quality Assurance Manual shall consist of systematic procedures that provide confidence

that the work is in accordance with the manufacture's standard design, codes and standards referenced above, and these specifications for controlling activities affecting quality, such as welding, heat treating, and nondestructive examination. Formal training of individuals performing the work shall be an element of the Quality Assurance Program. Inspections and audits shall be conducted to insure that the Quality Assurance Program is being followed.

5.1.1. The manufacturer's Quality Assurance Manual shall be available at GPA's request and shall include descriptive information and details of the program, including program organization, documentation requirements, and quality control procedures.

5.1.2. The Quality Assurance Program shall include testing procedures, acceptance criteria, repair methods and the quality control requirements of these specifications.

5.2. Factory Tests

5.2.1. General

Not less than 30 days prior to factory tests, a factory test plan shall be submitted to the Owner for approval. Each item of electrical equipment and similar equipment supplied as spare parts, shall be given the manufacturer's routine factory tests and also other tests as specified, to ensure successful operation of parts of the assemblies. The factory test equipment and the test methods used shall conform to the applicable requirements of ANSI, IEEE, NETA, and NEMA standards. Three (3) certified copies of the reports of production tests, including complete test data shall be submitted to the Owner. Factory tests will be witnessed by three (3) GPA representatives for a minimum of three (3) days, with additional days as required, to perform a comprehensive Factory Acceptance Testing. Supplier shall cover the cost of airfare, rooms, meals and car rental for the GPA representatives to witness the FAT testing.

5.2.2. Assembly Tests

Units of the switchgear shall be assembled at the factory and checked for alignment and fit. Each circuit breaker to be supplied with the switchgear assembly shall be installed in the assigned unit after the switchgear has been fully assembled. Checks shall include correct operation of shutters, interlocks, auxiliary contacts, racking mechanisms and for ease of installation and withdrawal of circuit breakers.

Wiring shall be given point-to-point circuit continuity tests and shall be subjected to dielectric tests in accordance with requirements of ANSI Standard C37.20. The control switches shall be checked for proper contact operation. Device marking, nameplate markings, conductor identification and the scale of meters and instruments shall be checked.

5.2.3. Functional Tests

Current and potential injection tests shall be made on relays, instruments, meters and transducers for proper operation, direction, phasing, and calibration. Operational tests shall be performed to verify the functional controls of all devices and equipment.

5.3. Factory Test Reports

Three (3) hardcopies and One (1) soft file in pdf format of certified test results shall be provided to the Owner within 30 days after performance of factory tests.

6.0. RATING

6.1. Description

6.1.1. The switchgear shall be designed to be operated on a 38 kV maximum rated voltage system and shall be suitable for operation on a solidly-grounded system rated 34.5 kV, 3-phase, 4-wire, 60Hz. The main bus shall be rated for 2,500 amperes-continuous for bulk power transfer substations and 2,000 amperes-continuous for regular/normal substations. Basic insulation level shall be 150 kV.

6.1.2. Equipment and materials shall be the products of manufacturers regularly engaged in the production of such equipment and materials.

6.1.3. The switchgear arrangement and dimensions shall be as specified in the design drawings.

6.1.4. Switchgear manufacturer shall provide lifting mechanism for breakers and VT drawout.

6.1.5. The preferred manufacturer is **"Myers Power Products Inc."**.

6.2. Circuit Breakers

6.2.1. Unless otherwise specified or approved by GPA Engineering Department, all circuit breakers shall be **"CP HVF" or "Siemens"** circuit breakers.

6.2.2. The 34.5 kV circuit breakers shall have **vacuum interrupters, oil-less type, and be 3-pole, single throw, trip free, draw-out type**, rated on the symmetrical current basis. Each breaker shall have its characteristics based on a 15 second close-open duty cycle, and shall be capable of interrupting its rating in **5 cycles or less** from the time the trip coil is energized until the arc is extinguished.

6.2.3. The circuit breaker closing shall be operated by a stored energy mechanism, which is normally charged by an electric motor, but which can also be charged by a manual handle for emergency manual closing or testing. The power supply for the stored energy mechanism shall be 125 VDC.

6.2.4. The circuit breaker control voltage shall be **125 VDC** supplied by the substation control power.

6.2.5. Each circuit breaker shall be designed specifically for installation in the breaker compartment, and breakers of like ratings shall be completely interchangeable. Circuit breakers of 1200A rating shall not be interchangeable in a 2000A compartment as well as a 2000A rating breaker shall not be interchangeable with a 2500A compartment. Each breaker shall be self-contained, equipped with self-coupling primary and secondary disconnect contacts, and with either fixed and swivel casters or fixed casters and a fifth wheel accessory, or a maintenance and handling device to permit easy mobility. Provisions shall be made and accessory materials and equipment furnished to permit complete disconnection of the breaker from the line and bus and testing of the breaker within the switchgear compartment. Breakers shall be mechanically interlocked to ensure that the breaker is tripped before being withdrawn from or inserted into the connected position.

6.2.6. The breakers shall have the following features:

a. Sturdy, self-aligning, silver-plated, primary disconnect contacts with high contact pressure. The circuit breaker element, primary disconnect shall be an integral part of the element.

b. Auxiliary switch contacts connected to the mechanism of each breaker shall be provided. A minimum of 10 "a" and 10 "b" contacts for the Owner's use shall be supplied and shall be wired to terminal blocks. Contacts shall be field changeable from "a" to "b" and vice versa.

c. An easy-to-read position indicator located on the front of the equipment which can be read without opening the compartment door.

d. A manual means for tripping.

e. Trip free and non-pumping operation.

f. An operations counter which can be read without opening the compartment door.

6.2.7. The circuit breakers shall meet their ratings as listed in ANSI C37.06. Principal breaker ratings shall be as follows:

a.	**Rated maximum voltage, kV**	**38**
b.	**Withstand test voltages**	
	Low frequency RMS, kV	**80**
	Impulse crest BIL, kV	**150**
c.	**Rate continuous current, A**	
	Bulk Power Transfer Station	
	Line	**2000**
	Transformer	**2000**
	Bus Tie	**2500**
	Regular/Normal Substation	
	Line	**2000**
	Transformer	**1200**
	Bus Tie	**2500**
d.	**Rated interrupting current at rated maximum voltage, kA RMS**	**40**
e.	**Rated close and latch, kA**	**104**
f.	**Rated short time current: Three second kA**	**40**
g.	**Minimum number of trip coils per breaker**	**2 each**

6.3. Enclosure

6.3.1. The switchgear assembly shall consist of **metal-clad, free-standing, vertical, deadfront** steel structures containing circuit breaker compartments and circuit breakers, primary bus system, ground bus system, auxiliary compartments and transformers, protection and control devices, control bus, and connection provisions for primary, ground and control circuits. Devices shall be arranged as shown on the contract drawings. The basic structure will be of modular construction and fabricated mainly of painted hot-dipped galvanized steel. The switchgear enclosure will be double wall construction with an air gap between sheets, so that in the event of a fault the second layer will be insulated by the air gap. The original vendor shall be the manufacturer of the enclosure and the final assembler.

6.3.2. The switchgear shall have a suitable framework of structural steel to provide self-supporting rigid and stable structures. Channel base members shall be provided as part of the frames for proper alignment. The panel and structure shall be sufficiently rigid to support the equipment without vibration and shall be sized as shown on the Contract Drawings. Each shipping group shall be provided with a welded base frame, so when assembled in the field it provides a completed structural metal-clad switchgear line-up assembly.

6.3.3. The panels and enclosure shall consist of selected sheets of smooth sheet steel. The panels shall be all the same size for front, rear and top alignment. Sheet steel shall not be less than No. 11 US Standard Gauge A-60 galvanneal steel, forming structural shapes or having bent angle or channel edges, with corner seams welded and ground smooth. Stiffeners shall be provided as required. The exposed exterior surfaces shall not be drilled or welded for attaching wires or devices if holes or fastenings will be visible after installation. Vertical wiring trough shall be provided on both sides of panels. Doors to each enclosure shall be the same material and thickness as the housing sheets. Doors shall be braced or constructed so as to hang true and prevent warping. Doors shall have a 1-inch allowance from the floor. Hinges shall be the concealed, loose-pin type which will permit the panels or doors to swing out not less than 105°. Doors shall be provided with 3-point latches. Ventilated openings shall be grill or louver type and provided with corrosion-resistant screens to prevent entrance of insects and rodents. Lights shall be provided within each enclosure.

6.3.4. The switchgear will be constructed with an indoor frame size of 36 inches wide x 95 inches high x 85 inches deep.

6.3.5. The enclosure shall be provided with 304L stainless steel ground pads with 304L stainless steel ½" – 13 UNC, 7/16" deep threaded nuts welded to the ground pads. The ground pad shall be welded to the walls and shall be free of paint.

6.4. Buses

6.4.1. Main Bus

The main bus shall be copper, rated 2,500 amperes for bulk power transfer substations and 2,000 amperes for regular/normal substations. The bus shall be silver-plated at joints and tap points, installed in separate compartment from other wiring by a minimum 11-gauge steel barrier which fully encloses the bus, and insulated its entire length with a high dielectric strength, flame-retarding, self-extinguishing, moisture resistant epoxy coating applied using a fluidized bed process. Use of extruded sleeves or heat shrink insulation is not acceptable. Suitable insulation covers shall be provided for bus joints. The bus supports between units shall be cycloaliphatic epoxy resin or wet process porcelain insulators for 38 kV class. Use of glass-filled polyester, dry process porcelain, ceramic or non-cycloaliphatic epoxy formulations for bus supports is not acceptable. All bus supports must have the same BIL rating as the switchgear. Bracing shall be provided as required for the bus to withstand short circuit current equal to the momentary rating of the breakers furnished with the switchgear. The main bus shall comply with ANSI/IEEE temperature rise requirement.

6.4.2. High Voltage Connections

High voltage connections between the main buses, and circuit breaker disconnecting devices, current transformers, and potheads shall be furnished with material installed. Connections shall be made of copper bar insulated between terminals with insulation comparable to that required for the main bus bars. The cross-section of bars and joints shall be uniform and smooth to permit a flow of current equal to the full load rating of the breaker without excessive temperature rise. Joints shall be silver-plated and bolted. Joints shall be relieved of voltage stress by metallic gauze, or other suitable conducting material, and insulated with tape and glyptal to provide insulation levels equal to or better than those of the main insulated buses. High voltage connections between the main bus or breaker load terminals and fixed studs of potential transformer assemblies shall be made with high voltage cable having insulation coordinated with basic impulse levels required for the switchgear. Supports, bushings, terminal lugs and joint insulation shall be furnished as required, and the leads installed to form a complete installation.

6.4.3. Ground Bus

Copper ground bus shall be 1/4-inch by 2-inches solidly connected to each switchgear unit and extended into the power cable entrance compartment of each unit Ground bus shall be rated at a minimum equivalent of #4/0 AWG copper wire and equipped with a clamp connector for #4/0 AWG - 500 kcmil copper cable.

6.4.4. Sparing Bus

The sparing bus shall be same as the main bus.

6.4.5. Access

Removable panels shall be provided for access to the bus compartment.

6.5. Instrument Transformers

6.5.1. Voltage transformers shall be rated for **200 kV BIL** with ANSI accuracy classification of **0.3 at burdens W, X, Y and Z**. Potential transformers shall be dry-type draw-out or tilt-out mounted epoxy construction and equipped with high interrupting capacity current limiting fuses. The voltage transformers shall be **dual-ratio rated at 20,125 primary voltage (L-G), 67.08/115 secondary voltage and 300/175:1 ratio**. One set of **3-phase** voltage transformers shall be provided for **each bus section** of the switchgear. If design drawings require synching voltage transformers, one (1) each VT shall be provided on line side of incoming lines and connected on Ø1 GPA C.

6.5.2. Current transformers shall be the **toroidal type,** suitable for metering or relaying as required. Metering current transformers shall have an accuracy rating equal to or better than **0.3B-0.1, 0.3B-0.2, 0.3B-0.5, 0.3B-1 and 0.3B-2. Multi-ratio** current transformer for relaying and metering shall be of **C800** relaying accuracy or as determined by CT saturation calculations. **Four (4)** current transformers shall be provided for **each breaker** and placed **2 on each side** of the breaker. Current transformer **polarity shall be away** from breaker contacts and **secondary currents** shall be **5 amperes.**

6.6. Surge Arresters

6.6.1. Surge arresters shall be **station class**, metal-oxide-varistor (MOV), mounted in the switchgear enclosure and connected to each circuit conductor on the line side of the associated circuit breaker. The arresters shall have a nominal **30 kV rms** rating, **MCOV of 24.4 kV rms**, and meet or exceed **33 inches of leakage distance.**

6.6.2. The following characteristics are typical of these arresters:

90 kV maximum Front-Of-Wave (FOV) Protection Level voltage for a 10 kA impulse, which results in a discharge voltage cresting in 0.5 microseconds.

The maximum discharge voltage (crest kV) at indicated impulse currents of 8x20 microseconds:

a. 68 kV at 1.5 kA
b. 74 kV at 5.0 kA
c. 80 kV at 10.0 kA
d. 90 kV at 20.0 kA

6.7. Wiring and Accessories

6.7.1. The metal-clad switchgear shall be completely wired at the factory, ready for installation and connection by others. Inter-panel wiring required between shipping groups shall be brought to terminal blocks on adjacent panels necessitating only on-site reconnections of factory-supplied jumpers. Terminal blocks and jumper cables shall be properly identified for assembly. Unused terminals on relays and auxiliary contacts shall be brought to conveniently located terminal blocks. Feeder and main transformer power cables and all control and meter connections will enter from the bottom. The incoming cables for the line breaker will consist of two (2) 1000 kcmil cables per phase. The manufacturer shall ensure that sufficient vertical and horizontal clearances are provided for training and terminating these cables in the cable compartment without requiring excessive bending or the use of special adapter plates furnished by the cable installer. Rubber insulators shall be provided at the terminations of power cables. In addition, bracket supports for the cables shall be provided.

6.7.2. Unless otherwise specified, all **secondary and control wiring** or connections shall be made with a minimum wire size of **No. 12 AWG, CT wiring** shall be **No. 10 AWG**, and **SCADA wiring** shall be **No. 18 AWG.** Switchboard wire shall be stranded, tinned copper, NEC type SIS, and rated for 600 Volts. Insulation jacket shall be gray in color. Splices will not be permitted. Wires shall run in conduits, raceways or trays. Suitable, extra flexible wiring shall be provided over door hinges or other locations where leads may be subjected to flexing.

6.7.3. **Ring-tongue terminals** shall be used for secondary wiring. Spade, slotted spade, flanged spade, and hook terminals are not acceptable. The strength of the terminals shall be such that the terminals will not break during vibration of the equipment in which the terminals are installed. Ring-tongue terminals shall be Thomas & Betts Stakon.

6.7.4. Terminals shall have insulated ferrules. To assure positive electrical connections, and to avoid damage to the ferrule, it is mandatory that the crimping tool be used in accordance with manufacturer's instructions, and that the proper terminal and crimping tool be used for each wire size. Crimps shall be made with the crimp indentation opposite to the connector seam.

6.7.5 Miscellaneous accessories, such as resistors, fuses, fuse blocks, and capacitors not shown on the Contract Drawings but required for proper operation of the switchgear shall be furnished.

6.7.6 Terminal blocks for **current transformer** leads shall be **6-point** and shall be provided with **short-circuiting** devices to permit removing or testing of wiring without opening the current transformer circuits. Leads from multi-ratio current transformers shall be brought out to the terminal blocks. Terminal blocks shall be Marathon Series 1600, or as approved by the Owner. Terminal blocks shall be provided for all wires leaving switchboard panels and shall have marking strips for Owner's 6-digit number identification system. Terminal blocks shall have washer head binding screw terminals, barriers between terminals, high flame retarding properties, mechanical toughness and high electrical strength. At least **20% spare terminals** shall be provided on each panel. Each wire shall be identified at both ends with a permanently **machine-embossed black identification** on white plastic, heat-shrinkable, tubular slip-on marker.

6.7.7 Terminal blocks for grouping of SCADA wiring shall be thermo-plastic insulation type, rated 300 Volts, with test socket screws, knife switch contacts and shall be mounted on rails. The marking system shall be Dekafix consecutive vertical numbering system and Peso white blanks for Owner's marking. Terminal blocks shall be furnished complete with mounting rails, end brackets, end plates, partitions and test equipment. Wiring to the **SCADA** terminal blocks shall be made with **No. 18 wire** minimum.

6.7.8 Wiring for **transducer output** circuits shall be **No. 18, twisted pair** shielded conductor. **Meter pulse** circuit wiring shall be **No. 18, 3-conductor shielded** cable.

6.7.9 Wiring Format

a. All terminals shall be numbered, and the numbers shall correspond to the numbers on the wiring diagram.

b. All wires shall be identified at their termination points with the opposite end designation identification by labeled plastic sleeves or equal. Identification shall correspond to the lettered device, numbered terminal format of the wiring diagrams.

c. System Phase Rotation. The system phase rotation for the island-wide system is GPA C-B-A or NEMA 1-2-3 and all equipment purchased under this contract shall be wired and connected NEMA 1-2-3. All phase markings shall be NEMA 1-2-3. Instrument and relay arrangement shall be 1-2-3 left to right with neutral relays underneath phase grouping. GPA will make the external connections of the incoming and outgoing lines such that GPA C-B-A is connected to NEMA 1-2-3. Phase markings C-B-A shall be reserved for GPA's use.

6.8. Nameplates

Nameplates shall be furnished and installed for panels, switches, relays and devices, including those internally mounted, and shall be of **laminated plastic or formica** with **white letters on black background** and shall be sized for easy reading. Nameplates shall be securely fastened to the panel with stainless steel panhead screws to prevent detachment and loss. Nameplate data shall be submitted for Owner's approval. Designations shall be **machine engraved** in upper case letters and shall be centered on the nameplates. Each metal-clad switchgear unit shall be provided with a circuit identifying nameplate, letters approximately 3/4-inch high, and mounted at the top of the switchgear.

6.9. Mimic Bus and Devices

Mimic bus shall be 3/8-inch in width and shall be anodized aluminum, approximately 1/16-inch thick, fastened to the panels with adhesive backing or blind metal fasteners. Mimic devices shall be made of the same materials as the bus, and shall indicate the required symbol. The Contractor shall obtain the colors for the mimic bus from the Owner.

a. Yellow 13.8 kV
b. Red 34.5 kV
c. Cyan 115 kV

6.10. Instrument and Control Switches

6.10.1. Instrument and control switches shall be the rotary, cam-operated type with silver contacts and a positive means for maintaining contact position. Contact requirements shall be as shown on the Contract Drawings or as specified. Switch contacts shall be totally enclosed to prevent the accumulation of dust, grit, and foreign matter on the contact surface. The switches shall be GE type SB-1, Westinghouse type W-2, Electroswitch Series 24, or equal, and shall have operating handles as follows:

1. Large red pistol-grip handles for power circuit breaker control switches.
2. Black oval handles with arrow for transfer and auxiliary switches.

6.10.2. Control switches for circuit breakers shall be momentary contact, spring-return type for both trip and close operation. Operation indicators showing the last operation shall be provided.

6.10.3. The switches shall have escutcheon plates marked as specified with standard circuit designation, except where otherwise specified, and shall be as follows:

1. Escutcheon plate for circuit breaker control switches, 52CS, shall read "TRIP-CLOSE".

2. Escutcheon plate for supervisory selector switch, 43R/L shall be "REMOTE-LOCAL".

6.11 Indicating Lamps

Indicating lights shall be the manufacturer's standard transformer type units **125-volt DC** input utilizing low-voltage **LEDs with red color indicating breaker closed and LED off when breaker open.** Provide indicating lights that are capable of being re-lamped from the switchgear front. Indicating lights utilizing resistors in series with the lamps are not permitted, except in direct-current control circuits. For all breaker control switches and hand reset lockout relays, use Trip Coil Monitors in lieu of standard indicating lights.

6.12 Substation Metering

Power delivery measurement of each power transformer and 13.8 kV feeders shall be made via Schweitzer Engineering Laboratories' SEL-735 or latest device. The **SEL-735 power quality and revenue meter** shall have intermediate PQ and recording, 256 MB memory, Form 9, vertical panel mount, ANSI optical port, 125/250 VDC/VAC power supply, 125 VDC/VAC control input voltage, 2 inputs, 3 contact outputs, 2 EIA 232 ports, one 10/100 Base T Ethernet port, IRIG, current Class CL 10/20, 60 Hz frequency, DNP 3, LAN/WAN, MV90 Translation, Synchrophasor, ANSI labeling, Accelerator Quickset compatible, and conformal coating. **Provide meter part number for review and approval.**

6.13 Test Switches and Devices

Current and potential test switches and test plugs shall be provided with the test switches semi-flush mounted on the switchboard. Test switches shall be connected to the appropriate circuits to permit the checking and calibrating of meters, instruments or relays individually against portable standards connected in series with the instruments or relay undergoing tests, under service conditions or by means of a phantom load. The switches and plugs shall permit "in service" testing as well as calibration and checking of instruments, meters, and relays from separate sources of power. Provisions shall also be included for connecting current measuring devices in series with the current circuits of the switches. Switch blades shall be separated by insulated barriers and each switch handle shall be provided with a recessed section for inserting circuit identification cards. **Switches shall automatically short circuit current transformer circuits** so they cannot be opened inadvertently. Current test switches shall be **ABB type FT-1.**

6.14 Trip Coil Monitor

The Trip Coil Monitor shall be Schweitzer Engineering Laboratories SEL-2652 with an external red LED mounted on the switchgear. It shall be suitable for operation on 120

VDC or 120 VAC, as required for the specific circuit. The SEL-2652 shall have breaker status indicator function, **red LED color, 200 ms time delay**, and conformal coating. **Trip Coil Monitors shall be installed to monitor loss of DC for each circuit breaker and lock-out relay. Trip Coil Monitor alarm contacts will be wired to GPA SCADA RTU for TCM status.**

6.15 Protective Relays

6.15.1 General

a. Protective relays shall be semi-flush mounting-type with test facilities that automatically short current circuits and open potential and trip circuits when the relay is withdrawn from the case.
b. If the relay is not equipped with built-in test facilities, external test blocks shall be furnished.
c. Output contacts shall be rated for tripping or closing of the circuit breaker.
d. Output contacts shall be dry type.
e. SCR outputs are not acceptable.
f. Relays shall have targets to indicate which elements caused the operation.
g. Control voltage shall be 125 VDC.
h. Relays shall pass the ANSI surge withstand tests.
i. All printed circuit boards are to be covered with a Conformal Coating meeting the specification indicated in Section 2.1 and operate within a temperature range of -40°C to +75°C (-40°F to +160°F) and a relative humidity range between 0% and 100%.
j. Communication protocols shall include DNP3 and TCP/IP, fully compliant with IEC 61850.

6.15.2 Power Transformer Relays

a. Transformer Differential Relays – 87T

Primary transformer differential relays shall be a percentage differential type and shall have harmonic restraint. They shall be Schweitzer type SEL-787 Primary Relay or latest device. The SEL-787 transformer protection relay shall have two winding current differential or more based on drawing design. The relay shall have vertical chassis, front panel LCD display, 125 VDC/VAC power supply, 60 Hz, 125 VDC/VAC digital input, fast high-current interrupting digital output, EIA-232 port, 10/100 Base-T Ethernet, IRIG B, DNP3, IEC 61850, C37.118 Synchrophasor, Accelerator Quickset, 5-amp current winding inputs, and conformal coating. Provide relay part number for review and approval.

b. Transformer Time Overcurrent and Breaker Failure Relay – 51/51N/50BF

Backup transformer relay shall be Schweitzer type SEL-751 protection relay for overcurrent and breaker failure or latest device. The **SEL-751 Backup Relay** shall have standard overcurrent firmware, 125 VDC/VAC power supply, 60 Hz, 125 VDC/VAC digital input, fast high-current interrupting digital output, 4 pushbutton controls, EIA-232 port, 10/100 Base-T Ethernet, IRIG B, DNP3, IEC 61850, Accelerator Quickset, 3-phase AC voltage input, 3-phase AC current 5 amps input, neutral AC current 5 amp input, and conformal coating. **Provide relay part number for review and approval.**

6.15.3. Transmission Line Relays

a. Transmission Line Differential, Line Distance, Residual Time Overcurrent, Direction Ground, and Breaker Failure – 87L/21/50/51/67/50BF

Primary transmission line relays shall be advanced line differential and distance protection. They shall be Schweitzer type **SEL-411L Primary Relay** or latest device. The SEL-411L relay shall have line differential, distance elements, traveling wave fault location, horizontal mount, 125 VDC/ VAC power supply, 60 Hz, 125 VDC/VAC digital input, high speed high current interrupting digital output, connectorized type, 300 V secondary voltage inputs, 5 amp current inputs, 1300 nm IEEE C37.94 Fiber communications for Channel 1 and Channel 2, EIA-232 port, 10/100 Base-T Ethernet, IRIG B, DNP3, IEC 61850, C37.118 Synchrophasor, Accelerator Quickset, and conformal coating. **Include 100' fiber optic cables for connections to Channels 1 and 2. Provide relay part number for review and approval.**

b. Transmission Line Differential, Line Distance, Residual Time Overcurrent, Direction Ground, and Breaker Failure – 87L/21/50/51/67/50BF

Backup transmission line relays shall be line differential and distance protection. They shall be Schweitzer type **SEL-311L Backup Relay** or latest device. The SEL-311L relay shall have line differential, distance elements, horizontal mount, 125 VDC/VAC power supply, 60 Hz, 125 VDC/VAC digital input, standard output, 150 VAC maximum wye connected voltage inputs, 5 amp current inputs, 1300 nm IEEE C37.94 Fiber communications for Channel X and Channel Y, EIA-232 port, 10/100 Base-T Ethernet, IRIG B, DNP3, IEC 61850, Accelerator Quickset, and conformal coating. **Include 100' fiber optic cables for connections to Channels X and Y. Provide relay part number for review and approval.**

6.15.4. Bus Relays

a. Bus Differential Relays and Breaker Failure– 87B/50BF

Primary and backup bus differential relays shall be a percentage differential type and shall have harmonic restraint. They shall be Schweitzer type **SEL-787 Primary and Backup Relays** or latest device. The SEL-787 transformer protection relay shall have four winding current differential. The relay shall have vertical chassis, front panel LCD display, 125 VDC/VAC power supply, 60 Hz, 125 VDC/VAC digital input, fast high-current interrupting digital output, EIA-232 port, 10/100 Base-T Ethernet, IRIG B, DNP3, IEC 61850, C37.118 Synchrophasor, Accelerator Quickset, 5 amp current winding inputs, and conformal coating. **Provide relay part number for review and approval.**

6.15.5. Bus Tie Relays

a. Bus Tie Time Overcurrent and Breaker Failure Relay – 51/51N/50BF

Primary and backup bus tie relays shall be Schweitzer type SEL-751 protection relay for overcurrent and breaker failure or latest device. The **SEL-751 Primary and Backup Relays** shall have standard overcurrent firmware, 125 VDC/VAC power supply, 60 Hz, 125 VDC/VAC digital input, fast high-current interrupting digital output, 4 pushbutton controls, EIA-232 port, 10/100 Base-T Ethernet, IRIG B, DNP3, IEC 61850, Accelerator Quickset, 3-phase AC voltage input, 3-phase AC current 5 amps input, neutral AC current 5 amp input, and conformal coating. **Provide relay part number for review and approval.**

6.15.6. Zigzag Grounding Transformer Relays

a. Zigzag Grounding Transformer Overcurrent and Breaker Failure Relay – 51/51N/50BF

Primary and backup zigzag grounding transformer relays shall be Schweitzer type SEL-751 protection relay for overcurrent and breaker failure or latest device. The **SEL-751 Primary and Backup Relays** shall have standard overcurrent firmware, 125 VDC/VAC power supply, 60 Hz, 125 VDC/VAC digital input, fast high-current interrupting digital output, 4 pushbutton controls, EIA-232 port, 10/100 Base-T Ethernet, IRIG B, DNP3, IEC 61850, Accelerator Quickset, 3-phase AC voltage input, 3-phase AC current 5 amps input, neutral AC current 5 amp input, and conformal coating. **Provide relay part number for review and approval.**

6.15.7. Lockout Relays

a. Lockout Relays – 86

Lockout relays shall be electrical trip, hand-reset, 125 VDC auxiliary lockout relay type. Relays shall be multi-contact and shall be **Electroswitch Series 24. Spare contacts of 25%** shall be provided for all lockout relays.

6.16. Display

Each meter and relay shall have a built in LCD to display analog metered values and targets.

6.17. Communication Processor

The communication processor shall be Schweitzer type SEL-3530 capable of communicating with different microprocessor based devices. The **SEL-3530** shall be horizontal mount, 125 VDC/VAC power supply, 60 Hz, 125 VDC/VAC digital inputs, standard outputs, 16 EIA-232 ports, 10/100 Base-T Ethernet, IRIG B, DNP3, IEC 61850, C37.118 Synchrophasor, Accelerator RTAC, and conformal coating. **Provide part number for review and approval.**

6.18. GPS Satellite Clock

To synchronize relays and other devices, a GPS satellite clock shall be provided. The GPS satellite clock shall be Schweitzer SEL-2407 and have 125 VDC/VAC power supply, modulated/demodulated IRIG B BNC outputs, ±100 ns average time accuracy, LED time display, and conformal coating. Include GPS antenna, 50 ohm resistor, and 75 feet of antenna cable. **Provide part number for review and approval.**

6.19. Painting

The switchgear enclosure shall be thoroughly cleaned of rust, welding scale and grease using a non-acidic and non-abrasive cleaner, and shall be treated to effect a bond between the metal and paint which will prevent the formation of rust under the paint. A zinc-oxide zinc-chromate anticorrosion priming coat shall be applied immediately after the bonding treatment. A final finish shall consist of not less than one coat for concealed surfaces and two coats for exterior surfaces. Final finish shall be light gray, ANSI Color No. 70. The interior shall be painted with 2 coats of white enamel. A computerized paint system shall be utilized to apply a uniform thickness and coverage of paint to all surfaces.

6.20. Power Supply

The switchgear power supply shall be **120/240 VAC or 120/208 VAC,** based on available station power, and **125 VDC** control power supply.

6.21. Space Heaters

6.21.1. **Equip each section of the switchgear assembly with externally energized space heaters** to provide approximately 4 watts per square foot of outer surface area and designed for operation at 120/240 VAC or 120/208 VAC. Locate heaters at the lowest portion of each space to be heated. Cover terminals. **Use thermostats to regulate the temperature.**

6.22. Infrared Camera Windows

FLIR IRW – 4C 4 inch Infrared Windows shall be installed on switchgear rear panels at each compartment where power transformer, transmission line and station power cable-connection to switchgear bus sections are terminated. Window installation shall be so that all three phase connections are visible from infrared test equipment or as specified by the manufacturer. Infrared camera windows shall have the following specifications:

a. Body Material: Anodized Aluminum
b. Gasket: Silicone
c. NEMA Environment Type: Type 4/12 (outdoor/indoor)
d. Overall Height: 136.5 mm (5.37 in)
e. Overall Width: 127.44 mm (5.01 in)
f. Overall Thickness: 29.25 mm (1.15 in)
g. Required Hole Diameter (Nominal): 114.3 mm (4.5 in)
h. Greenlee Punch: 742BB
i. Window Thickness: 2 mm (0.07 in)
j. Crystal Insert Diameter: 95 mm (3.74 in)
k. Viewing Aperture Area: 6221 mm^2 (9.64 in^2)
l. Viewing Aperture Diameter: 89 mm (3.50 in)
m. Optic Maximum Temperature: 1355.6 °C (2474 °F)
n. Arc flash test standard: 5 kV, 63 kA for 30 cycles at 60 Hz
o. Maximum Pullout Strength: 1678 kg (3700 lbs)
p. Impact Resistant Cover

q. 15-day extreme humidity withstand
r. 102 m/s^2 vibration withstand
s. IP Rating: IP69
t. Maximum Operating Temperature: 260 °C /500 °F

7.0. CONSTRUCTION

7.1. Installation

Installation will be based on construction scope requirements.

7.2. Accessories and Spare Parts

Accessories, special tools and spare parts required for operation, proper maintenance and testing of the equipment, circuit breakers and devices shall be provided with the switchgear and shall be **turned over to GPA upon completion of the project.** Accessories, special tools and spare parts shall include the following:

7.2.1. Accessories and Special Tools

a. Indicating lamp pullers.
b. Breaker test cabinet, to facilitate operation of a circuit breaker out of its cubicle for test purposes.
c. One (1) test jumper,1-12 pins for testing the breaker when removed from the cubicle.
d. Closing lever for manual operation.
e. One (1) Levering-in crank (Racking handle) for 38 HVF 38 kV breaker accessory.
f. Lifting truck for inserting and removing breaker and voltage transformer from the switchgear compartment.
g. Set of Test Plugs for each relays and meters.
h. Turning dolly for handling breaker, if required.
i. Transport truck for handling breaker outside the cubicle, if required.
j. Crank for manually charging the stored energy closing mechanism.
k. 1,200-Ampere grounding and test device with provisions for independently locking each access door with a padlock without remote control.
l. Insulated Boots for each terminal plugs and exposed joints.
m. Special tools required for proper maintenance, testing, and inspection of the equipment.

7.2.2. Spare Parts

a. Ten (10) switchboard indicating lamps or LEDs.
b. One (1) color cap for indicating lamps for each ten or less of each color and type used.
c. Resistors and lamp sockets for indicating lamps.
d. One (1) trip coil for every four power circuit breakers provided.
e. Twenty (20) control spare fuses for each rating of fuse provided in switchgear.
f. Five (5) blank nameplates of each size used.
g. Gallons of touch up paint in one quart cans, ANSI 70 Gray.
h. Spare fuses for potential transformers.
i. One (1) Manual charging handle of HVF 38 kV breaker accessory.
j. One (1) Racking handle.
k. One (1) Set – (3) each Insulated Boots for each rating.
l. One (1) 38 kV breaker, 2000A, 40KA, 5 Cycle, 150 kV BIL, 50/60 Hz. See Section 6.2 for characteristics.
m. One (1) Set – three (3) each Indoor Voltage Transformer, 34.5kV. See Section 6.5 for characteristics.
n. One set, three (3) each Circuit Breaker Vacuum Bottles, if applicable.

7.3. Disconnect Switches (If Required)

7.3.1. Disconnect switches (if required) shall be provided as an integral part of the switchgear lineup as shown on the drawings.

7.3.2. Disconnect switches shall be rated for 38 kV, 2000A, 3-pole, no-load break, non-fused, manual operation, and shall include a handle interlocked with operating mechanism, viewing window, and auxiliary contacts for future remote indication.

8.0. PACKING AND SHIPPING REQUIREMENTS

8.1. Because of severe transportation conditions, the Supplier shall pay particular attention to the proper packaging and bracing of the apparatus to assure its safe arrival.

8.2. The Supplier shall prepare all materials and equipment for shipment in such a manner as to protect from damage in transit. All small parts and unit components shall be separately boxed or bundled to prevent galling due to rubbing of one part against another. Each item, box or bundle shall be plainly and individually identifiable for content according to item number, GPA P.O. Number, and Supplier's Identifying Number.

8.3. Complete itemized Bill of Lading, which clearly identifies and inventories each assembly, sub-assembly, carton, package, envelope, etc., shall be furnished and enclosed with each item or items at the time of shipment.

8.4. The switchgear shall be shipped in crates containing not more than two units each.

9.0. STATEMENT OF COMPLIANCE

The Supplier shall provide a signed statement verifying that the products being supplied fully comply with the specification stated herewith. Items not in full compliance with this specification will be identified with a description of the deficiency and any proposed substitutions must be approved by the Guam Power Authority Engineering Department, as described in Section 2.2.1.

10.0. WARRANTY

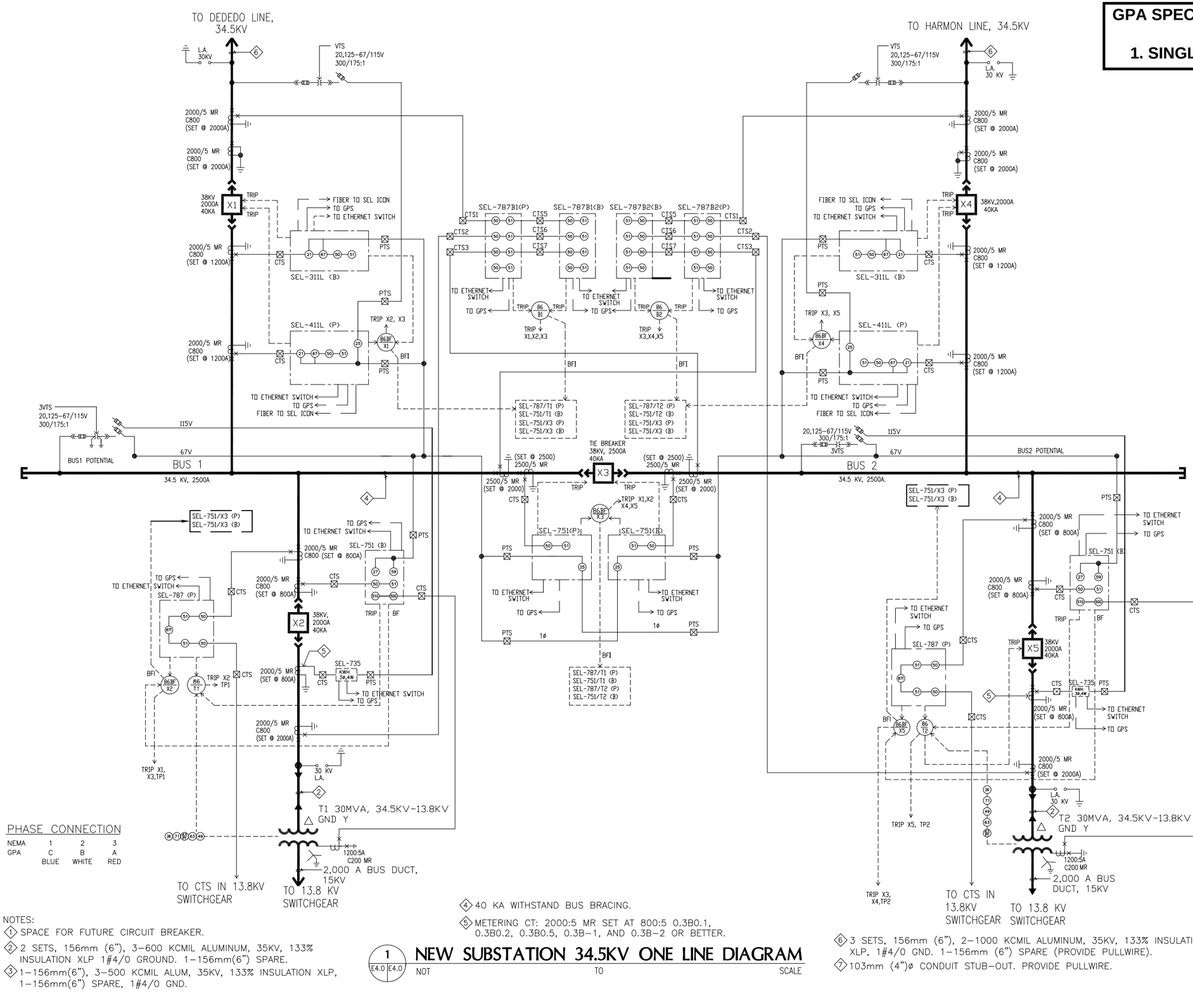
The Supplier shall warrant the satisfactory and successful operation of the equipment furnished under this specification at the rating, under the conditions, and for the service specified. The Supplier shall further warrant this equipment against defects of design, material and workmanship. All workmanship and parts shall have a warranty of at least (1) year from the date of equipment's commissioning.

11.0. ATTACHMENTS

11.1. Sample Drawings.

1. Single One Line Diagram
2. Three Line Diagram
3. DC Trip Coil Circuit Primary
4. DC Trip Coil Circuit Backup

GPA SPECIFICATION NO E-030 RV5
ATTACHMENT
1. SINGLE ONE LINE DIAGRAM



NOTES:
1. SPACE FOR FUTURE CIRCUIT BREAKER.
2. 2 SETS, 156mm (6"), 3–600 KCMIL ALUMINUM, 35KV, 133% INSULATION XLP 1#4/0 GROUND. 1–156mm(6") SPARE.
3. 1–156mm(6"), 3–500 KCMIL ALUM, 35KV, 133% INSULATION XLP, 1–156mm(6") SPARE, 1#4/0 GND.
4. 40 KA WITHSTAND BUS BRACING.
5. METERING CT: 2000:5 MR SET AT 800:5 0.3B0.1, 0.3B0.2, 0.3B0.5, 0.3B–1, AND 0.3B–2 OR BETTER.
6. 3 SETS, 156mm (6"), 2–1000 KCMIL ALUMINUM, 35KV, 133% INSULATION XLP, 1#4/0 GND. 1–156mm (6") SPARE (PROVIDE PULLWIRE).
7. 103mm (4")ø CONDUIT STUB–OUT. PROVIDE PULLWIRE.

1 E4.0 E4.0 **NEW SUBSTATION 34.5KV ONE LINE DIAGRAM**
NOT TO SCALE

GPA SPECIFICATION NO E-030 RV5
ATTACHMENT
2. THREE LINE DIAGRAM

TO SHEET

2V11
2V21
2V31
2V0
(1)ØC
(2)ØB
(3)ØA

BUS 1, 34.5KV, 2500A, 3Ø, 3W, 60HZ, 40KA, 200KV BIL

BUS 1 POTENTIAL, 67 VAC

7A (ACB) 41IL(CP)/X1

7B (ACB) 31IL(CP)/X1

6B (ACB) 787-1P

6B (ACB) 787-1B

8A (ACB) 787-T1

8B (ACB) 735-T1

8B (ABC) 735-T1

7CT1 7CT2 7CT3 7CT4 7CT5 7CT6 7CT7 7CT8 7CT9 7CT10 7CT11 7CT12

8CT1 8CT2 8CT3 8CT4 8CT5 8CT6 8CT7 8CT8 8CT9 8CT10 8CT11 8CT12

2000/5A MRCT C800 SET @ 1200/5A

2000/5A MRCT C800 SET @ 2000/5A

2000/5A MRCT C800 SET @ 800/5A

38 KV 40KA 2000A MAIN BKR

38 KV 40KA 2000A XFMR BKR

SPARE

13.8KV SWGR CURRENT INPUT

TO 115V BUS 1 PT'S

7PT
X1 LINE PT'S
20125-67/115V
R = 175/300:1

FU-7PT-P 1.0E

FU-7PT-S 10A

681-202MR

RATIO	AT
300:5	X3-X4
400:5	X1-X2
500:5	X4-X5
800:5	X2-X3
1100:5	X2-X4
1200:5	X1-X3
1500:5	X1-X4
1600:5	X2-X5
2000:5	X1-X5

SA 30 KV

TO DEDEDO LINE, 34.5KV (2) 1000 KCMIL/ Ø

T1, 30 MVA, 34.5KV-13.8KV GND Y

1200/5 MR C200 XFMR T16 NEUTRAL

TO 13.8 KV SWITCHGEAR

GPA SPECIFICATION NO E-030 RV5
ATTACHMENT
3. DC TRIP COIL CIRCUIT PRIMARY

125VDC F.B.O. 34.5 DC PANEL 'DC1' CIRCUIT#1

(+) 30A 1PB-1 TPP-X1 'FU1' 20A 1TB18-5 CPP-X1

(B) 311L-X1 OUT105 CLOSE A09 A10

(P) 411L-X1 OUT105 CLOSE A09 A10

INSTALL JUMPER IF TOC NOT USED

52 TOC (X1) 7 8

52CS CLOSE 26 27

86BF/X2 RESET 86BF/X3 RESET 86B1 RESET

6F-X1 6G-X1 6E-X1 6-X1 4-X1 11-X1 6H-X1

43LR R 43LR L

74R/X1 RAW TO SCADA RTU

52CS TRIP 43LR L 43LR R TPPA-X1 TPPB-X1

411L(P)-X1 IN102 TCM OUT101 TRIP A19 A20 A01 A02

411L(P)-X1 OUT104 TRIP 311L(B)-X1 OUT104 TRIP A07 A08

1TB5-1 1TB5-2 2TB11-3 2TB11-4 3TB11-3 3TB11-4 5TB22-3 5TB22-4

86BF/X2 TRIP 86BF/X3 TRIP 86B1 TRIP

(P) 411L-X1 ALARM A15 A16 4A-X1 2TB20-9 2TB20-10 TO SCADA RTU

411L(P) STATUS THIS SHT 411L(B) STATUS SHT A5-2 787B-1(P) STATUS SHT A5-11 SPRING CHARGE IND. SPARE SPARES

PP1A 101 EC-1 EC-6 EC-11 EC-4 EC-9 ED-1 ED-5 ED23 ED-3 ED-7 ED-11

52-X1 1 6 11 4 9 13 17 23 15 19 23

S3 S1 S21 S22 K1 M1 K1 Y9 1ST TRIP COIL Y1 S1 52a

2 7 12 5 10 14 18 24 16 20 24

EC-2 EC-7 EC-12 EC-5 EC-10 ED-2 ED-6 ED24 ED-4 ED-8 ED-12

CPN-X1 'FU1' 20A 4 1TB18-6

(-) 1TBP-2 TPN-X1

787B-1(B) STATUS SHT. A5-11

1TB23-1 PP4A MOC MOC3 MOC5 MOC7 MOC9 MOC11 MOC13 MOC15 MOC17 MOC19 PP4B MOC4 MOC6 MOC8 MOC10 MOC12 MOC14 MOC16 MOC18 MOC20 1TB23-2 1TB23-4 1TB23-6 1TB23-8 1TB23-10 1TB23-12 1TB24-2 1TB24-4 1TB24-6 1TB24-8

MOC CONTACT ASSIGNMENTS
OPERATES IN TEST AND CONNECTED POSITIONS
(CONTACTS SHOWN WITH BKR OPEN)

1TB30-1 1TB30-3 1TB30-5 1TB30-7 1TB30-9 1TB30-11 TOC1 TOC3 TOC5 TOC7 TOC9 TOC11 TOC TOC2 TOC4 TOC6 TOC8 TOC10 TOC12 1TB30-2 1TB30-4 1TB30-6 1TB30-8 1TB30-10 1TB30-12

TOC CONTACT ASSIGNMENTS
(CONTACTS SHOWN WITH BKR IN DISCONNECTED/TEST POSITION)

411L(P) 43LR THIS SHT. 311L(B) 43LR SHT. A5-2 43LR/X1 LOCAL TB 21 22 25 26

1TB16-1 1TB16-2 1TB16-3 PP1C-X1 PP1A-X1 6R-X1 74R/X1 LOCAL TO SCADA RTU

1TB16-4 1TB16-5 1TB16-6 PP1D-X1 PP1A-X1 6R86-X1 74R/86BF-X1 LOCAL TO SCADA RTU

BREAKER AUXILIARY SWITCH

SHEET A5-11 X32B 13 14 PN4A SHEET A5-11 52a

GREEN INDICATING LIGHT EC11 21 22 EC12 GREEN INDICATING LIGHT 52b

THIS SHEET PP1A 23 24 101 THIS SHEET 52a

SPARE ED3 31 32 ED4 SPARE 52b

SHEET A5-2 PP2A 33 34 IN17 SHEET A5-2 52a

SPARE ED7 41 42 ED8 SPARE 52b

SHEET A5-11 X32P 43 44 PN3A SHEET A5-11 52a

SPARE ED9 51 52 ED10 SPARE 52b

'FU2' 5A 2 1TB18-7 PP1A-X1 EC-9 S1 52a (X1) EC-10 10-X1 43LR L PP1B-X1

411L(P) Z25 PWR Z26 411L(P) 52a (X1) IN101 A17 A18 411L(P) 43LR (X1) IN104 A23 A24

411L(P)-X1 OUT 103 TRIP 311L(B)-X1 OUT 103 TRIP A06 A06 BF1R-X1

74R/86BF-X1 TO SCADA RTU

86BF/X1 COIL 86-BF G F E 3R-X1 32 86BF X1 38

'FU2' 5A 3 4 1TB18-8 PN1A-X1

43LR/X1 43 SELECTOR SWITCH

LOCAL-REMOTE SW	DECK	CONTACTS	POS. LOCAL	POS. REMOTE	FUNCTION	REF. DWG.
LOCAL	1	11–12	X		LOCAL TRIP X1	THIS SHT.
REMOTE		13–12		X	REMOTE TRIP X1	THIS SHT.
		15–16	X		LOCAL CLOSE X1	THIS SHT.
		17–16		X	REMOTE CLOSE X1	THIS SHT.
	2	21–22	X		X1 L/R STATUS	THIS SHT.
		23–22		X		
		25–26	X		X1 L/R STATUS	SHT. A5-2
		27–26		X		

52CS/X1

DECK	CONTACTS	POSITION TRIP	NAT	NAC	CLOSE	FUNCTION	REF. DWG.
1	11–18	X				BKR TRIP X1	THIS SHEET
	1TB17-1 – 1TB17-2 14–15	X				WIRED SPARE	
2	1TB17-3 – 1TB17-4 21–22		X	X		WIRED SPARE	
	26–27				X	BKR CLOSE X1	THIS SHEET
3	1TB17-5 – 1TB17-6 32–33			X	X	WIRED SPARE	
	1TB17-7 – 1TB17-8 36–37			X	X	WIRED SPARE	
4	1TB17-9 – 1TB17-10 42–43			X	X	WIRED SPARE	
	1TB17-11 – 1TB17-12 46–47			X	X	WIRED SPARE	

52CS BREAKER CONTROL SWITCH

LEGEND:

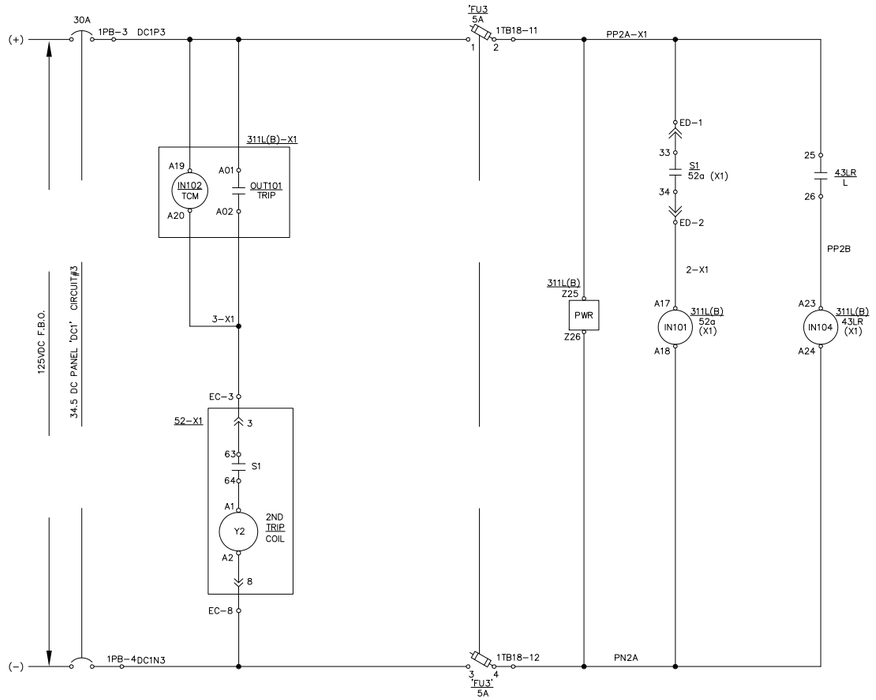
K1 = ANTI PUMPING RELAY
M1 = MOTOR
R1 = RESISTOR
S1 = AUXILIARY SWITCH
S3 = LIMIT SWITCH
S41 = POSITION SWITCH
S21, S22 = LIMIT SWITCH
XO = PLUG CONNECTOR (SECONDARY CONNECTION)
Y1 = TRIPPING SOLENOID (TRIP COIL)
Y2 = TRIPPING SOLENOID (2NDTRIP COIL)
Y9 = CLOSING SOLENOID
MOC = MECHANISM OPERATED CELL
TOC = TRUCK OPERATED CELL

X TB X – X = INTERCONNECTION TERMINAL POINT & SPARES
TERMINAL NUMBER
TERMINAL BLOCK NUMBER
TERMINAL BLOCK
UNIT #

86BF-X1

DECKS	CONTACTS	POS. TRIP	POS. RESET	FUNCTION	REF. DWG.
1	1TB11-1 – 1TB11-2 11–13		X	BREAKER X2 BLOCK CLOSE	SHT. A5-3
	1TB11-3 – 1TB11-4 12–18	X		BREAKER X2 TRIP	SHT. A5-3
	1TB11-5 – 1TB11-6 15–17		X	BREAKER X3 BLOCK CLOSE	SHT. A5-5
	1TB11-7 – 1TB11-8 16–14	X		BREAKER X3 TRIP	SHT. A5-5
2	1TB11-9 – 1TB11-10 21–23		X	WIRED SPARE	
	1TB11-11 – 1TB11-12 22–28		X	WIRED SPARE	
	1TB12-1 – 1TB12-2 25–27		X	WIRED SPARE	
	1TB12-3 – 1TB12-4 26–24		X	WIRED SPARE	
3	1TB12-5 – 1TB12-6 31–53		X	WIRED SPARE	
	1TB12-7 – 1TB12-8 32–38		X	74R/86BF-X1	THIS SHT.
	1TB12-9 – 1TB12-10 35–37		X	WIRED SPARE	
	1TB12-11 – 1TB12-12 36–34		X	WIRED SPARE	
4	1TB13-1 – 1TB13-2 41–43		X	WIRED SPARE	
	1TB13-3 – 1TB13-4 42–48		X	WIRED SPARE	
	1TB13-5 – 1TB13-6 45–47		X	WIRED SPARE	
	1TB13-7 – 1TB13-8 46–44		X	BFI SEL-787/T5	SHT. A5-3
5	1TB13-9 – 1TB13-10 51–53		X	WIRED SPARE	
	1TB13-11 – 1TB13-12 52–58		X	BFI SEL-751/T1	SHT. A5-4
	1TB14-1 – 1TB14-2 55–57		X	WIRED SPARE	
	1TB14-3 – 1TB14-4 56–54		X	BFI SEL-751(P)/X3	SHT. A5-10
6	1TB14-5 – 1TB14-6 61–63		X	WIRED SPARE	
	1TB14-7 – 1TB14-8 62–64		X	BFI SEL-751(B)/X3	SHT. A5-10
	1TB14-9 – 1TB14-10 65–67		X	WIRED SPARE	
	1TB14-11 – 1TB14-12 66–64		X	WIRED SPARE	

GPA SPECIFICATION NO E-030 RV5
ATTACHMENT
4. DC TRIP COIL CIRCUIT BACKUP



411L(P)/X1	FUNCTIONS	REF. DWG.
OUT101 1TB1–1 A01 — 1TB1–2 A02	BREAKER X1 TRIP COIL 1	SHEET A5–1
OUT102 1TB1–3 A03 — 1TB1–4 A04	WIRED SPARE	
OUT103 1TB1–5 A05 — 1TB1–6 A06	86BF/X1 TRIP	SHEET A5–1
OUT104 1TB1–7 A07 — 1TB1–8 A08	BREAKER X1 SCADA TRIP	SHEET A5–1
OUT105 1TB1–9 A09 — 1TB1–10 A10	BREAKER X1 SCADA CLOSE	SHEET A5–1
OUT106 1TB1–11 A11 — 1TB1–12 A12	WIRED SPARE	
OUT107 1TB2–1 A13 — 1TB2–2 A14	WIRED SPARE	
ALARM 1TB2–3 A15 — 1TB2–4 A16	SCADA RTU X1 ALARM	SHEET A5–1
1TB2–5 (IN101) A17 — 1TB2–6 A18	BREAKER X1 S1/52a	SHEET A5–1
1TB2–7 (IN102) A19 — 1TB2–8 A20	BREAKER X1 TCM 1	SHEET A5–1
1TB2–9 (IN103) A21 — 1TB2–10 A22	WIRED SPARE	
1TB2–11 (IN104) A23 — 1TB2–12 A24	43LR STATUS SCADA	SHEET A5–1
1TB3–1 (IN105) A25 — 1TB3–2 A26	WIRED SPARE	
1TB3–3 (IN106) A27 — 1TB3–4 A28	WIRED SPARE	
OUT201 1TB3–5 B01 — 1TB3–6 B02	WIRED SPARE	
OUT202 1TB3–8 B04 — 1TB3–9 B05	WIRED SPARE	
OUT203 1TB3–11 B07 — 1TB3–12 B08	WIRED SPARE	
OUT204 1TB4–1 B09 — 1TB4–2 B10	WIRED SPARE	
OUT205 1TB4–4 B12 — 1TB4–5 B13	WIRED SPARE	
OUT206 1TB4–7 B15 — 1TB4–8 B16	WIRED SPARE	

311L(B)/X1	FUNCTIONS	REF. DWG.
OUT101 1TB6–1 A01 — 1TB6–2 A02	BREAKER X1 TRIP COIL 2	THIS SHEET
OUT102 1TB6–3 A03 — 1TB6–4 A04	WIRED SPARE	
OUT103 1TB6–5 A05 — 1TB6–6 A06	86BF/X1 TRIP	SHEET A5–1
OUT104 1TB6–7 A07 — 1TB6–8 A08	BREAKER X1 SCADA TRIP	SHEET A5–1
OUT105 1TB6–9 A09 — 1TB6–10 A10	BREAKER X1 SCADA CLOSE	SHEET A5–1
OUT106 1TB6–11 A11 — 1TB6–12 A12	WIRED SPARE	
OUT107 1TB7–1 A13 — 1TB7–2 A14	WIRED SPARE	
ALARM 1TB7–3 A15 — 1TB7–4 A16	WIRED SPARE	
1TB7–5 (IN101) A17 — 1TB7–6 A18	BREAKER X1 S1/52a	THIS SHEET
1TB7–7 (IN102) A19 — 1TB7–8 A20	BREAKER X1 TCM 2	THIS SHEET
1TB7–9 (IN103) A21 — 1TB7–10 A22	WIRED SPARE	
1TB7–11 (IN104) A23 — 1TB7–12 A24	43LR STATUS SCADA	THIS SHEET
1TB8–1 (IN105) A25 — 1TB8–2 A26	WIRED SPARE	
1TB8–3 (IN106) A27 — 1TB8–4 A28	WIRED SPARE	
OUT201 1TB8–5 B01 — 1TB8–6 B02	WIRED SPARE	
OUT202 1TB8–8 B04 — 1TB8–9 B05	WIRED SPARE	
OUT203 1TB8–11 B07 — 1TB8–12 B08	WIRED SPARE	
OUT204 1TB9–1 B09 — 1TB9–2 B10	WIRED SPARE	
OUT205 1TB9–4 B12 — 1TB9–5 B13	WIRED SPARE	
OUT206 1TB9–7 B15 — 1TB9–8 B16	WIRED SPARE	

GUAM POWER AUTHORITY
P.O. BOX 2977
HAGATNA, GUAM 96910

TRANSMISSION & DISTRIBUTION SPECIFICATION

Specification No. E-001

FOR

15 KV UNDERGROUND POWER CABLE, SINGLE CONDUCTOR WITH CONCENTRIC NEUTRAL, TYPE MV-90, EXTRUDED TR-XLPE INSULATION

EFFECTIVE DATE: 6/19/2013	ISSUED:	APPROVED:

TABLE OF CONTENTS

1.0 SCOPE

1.1. This specification covers GPA requirements for 15 kV single conductor,133% insulation level, Type MV-90, 220 mils nominal insulation thickness, Tree-Retardant Cross-Linked Polyethylene (TR-XLPE) insulated power cable, with a concentrically wound copper neutral, and a High Density Polyethylene (HDPE) jacket.

1.2. The phase conductors shall be Class B stranded copper or aluminum as specified.

1.3. The concentric neutral conductors shall consist of annealed, round uncoated copper wires, providing a full neutral or one-third neutral as specified.

1.4. The cable is intended for use in wet or dry locations in a 15kV solidly grounded neutral underground system, suitable for either direct burial or installation in ducts, with conductor temperature of 90 degrees C for normal operation.

1.5. The cables may be used in single-phase and multi-phase circuits.

2.0 CONFORMANCE TO STANDARDS AND SPECIFICATIONS

2.1. Except where provisions therein conflict with the requirements of this specification, the cable shall meet all applicable provisions of American National Standards Institute/Insulated Cable Engineers Association, Inc. (ANSI/ICEA) S-94-649.

2.2. The cable shall meet the requirements of the following standards, including the latest revisions with respect to material, design and tests.

2.2.1. ANSI/ICEA S-94-649, "Standard for Concentric Neutral Cables Rated 5,000–46,000 Volts"

2.2.2. ANSI/IEEE C2, "National Electrical Safety Code"

2.2.3. ICEA S-97-682, "Utility Shielded Power Cables Rated 5 Through 46 kV"

2.2.4. ICEA T-31-610, "Guide for Conducting a Longitudinal Water Penetration Resistance Test for Sealed Conductor"

2.2.5. ICEA T-32-645, "Guide for Establishing Compatibility of Sealed Conductor Filler Compounds with Conductor Stress Control Materials"

2.2.6. ASTM B 3, "Specification for Soft or Annealed Copper Wire"

2.2.7. ASTM B 8, "Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft"

2.2.8. ASTM B 230, "Specification for Aluminum 1350-H19 Wire for Electrical Purposes"

2.2.9. ASTM B 231, "Specification for Concentric-Lay-Stranded Aluminum 1350 Conductors"

2.2.10. ASTM B 609, "Specification for Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes"

2.2.11. ASTM B 901, "Specifications for Compressed Round Stranded Aluminum Conductors Using Single Input Wire Construction"

2.2.12. ASTM B 902, "Specifications for Compressed Round Stranded Copper Conductors Using Single Input Wire Construction"

2.2.13. ASTM D 746, "Test Method for Brittleness Temperature of Plastics and Elastomers by Impact"

2.2.14. ASTM D 1248, "Specification for Polyethylene Plastics Molding and Extrusion Materials"

2.2.15. ASTM D 1693, "Test Method for Environmental Stress-Cracking of Ethylene Plastics"

2.2.16. ASTM D 2275, "Test Method for Voltage Endurance of Solid Electrical Insulating Materials Subjected to Partial Discharges (Corona) on the Surface"

2.2.17. ASTM D 2765, "Test Methods for Determination of Gel Content and Swell Ratio of Cross-Linked Ethylene Plastics"

2.2.18. ASTM D 3349, "Test Method for Absorption Coefficient of Ethylene Polymer Material Pigmented with Carbon Black"

2.2.19. ASTM D 4496, "Test Method for DC Resistance or Conductance of Moderately Conductive Materials"

2.2.20. ASTM E 96, "Test Methods for Water Vapor Transmission of Materials"

2.3. Deviations And Non-Conformance Requirements

2.3.1. Deviations from this specification or changes in materials or design after the Purchase Order has been placed must be approved by the GPA Engineering Department and acknowledged by a Purchase Order Amendment.

2.3.2. Units received with deviations or non-conformances which are not acknowledged as specified in Sub-Paragraph 2.3.1 are subject to rejection. The Supplier is responsible for any corrective action including but not limited to materials, labor and transportation necessary to dispose of, or make the units conform to the specification.

2.3.3. Notification of defects discovered before or after installation that are believed to be inherent to manufacturing problems or workmanship shall be made and forwarded to the Supplier. The description of the item, documentation of the problem and the described information, disposition and/or follow-up (as appropriate) that GPA expects from the Supplier will be specified. The Supplier's response shall be made within thirty (30) days unless an extension is acknowledged and approved in writing by the GPA Manager of Engineering.

2.3.4. GPA shall be allowed two (2) weeks to review and approve drawings without affecting the shipping date. Delays in delivery due to drawings which are not approved during this review period are the responsibility of the Supplier.

2.4. Warranty – the Supplier shall warrant the cable to be free from defects in material and workmanship under normal use and service conditions. The term of the Warranty shall be the lesser of twelve (12) months from the date of initial installation or eighteen (18) months from date of manufacture.

2.5. Statement of Compliance - The Supplier shall provide a signed statement verifying that the products being supplied fully comply with the specifications and drawings. Items not in

full compliance with the specification and drawings will be identified with a description of the deficiency and any proposed substitutions. Items not in full compliance with the specifications and drawings must be approved by the GPA Engineering Department, as described in Section 2.3.1.

3.0 SUBMITTALS

3.1. The bidder shall provide with their bid the following data:

3.1.1. Cable manufacturing specifications.

3.1.2. Shop drawings indicating details of construction.

3.1.3. The positive and zero impedance in ohms per mile, and the susceptance (B) of the cable shall be submitted to GPA Engineering for review and approval.

3.2. Drawings returned to the Supplier as approved shall be considered authorization to proceed with the work. The approval of GPA shall in no way abrogate the requirements of this specification.

3.3. The Supplier shall furnish one copy of certified test reports of all the tests covered by this Specification to the GPA Manager of Engineering prior to each shipment.

4.0 QUALIFICATIONS

4.1. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of fifteen years.

4.2. For all equipment specified herein, the manufacturer shall have a quality system that is ISO 9001 certified.

5.0 QUALITY ASSURANCE

5.1. The manufacturer shall have a formal Quality Assurance Program. The manufacturer's Quality Assurance Manual shall consist of systematic procedures that provide confidence that the work is in accordance with the manufacture's standard design, codes and standards referenced above, and these specifications for controlling activities affecting quality. Formal training of individuals performing the work shall be an element of the Quality Assurance Program. Inspections and audits shall be conducted to insure that the Quality Assurance Program is being followed.

5.1.1. The manufacturer's Quality Assurance Manual shall be available at GPA's request and shall include descriptive information and details of the program, including program organization, documentation requirements, and quality control procedures.

5.1.2. The Quality Assurance Program shall include testing procedures, acceptance criteria, repair methods and the quality control requirements of these specifications.

6.0 TESTS AND TEST REPORTS

6.1. Cable shall be tested in accordance with American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI) and Insulated Cable Engineers Association, Inc. (ICEA). Electrical Tests shall be performed after jacketing. The

following production sampling tests shall be run and the results shall be reported in certified test reports.

6.2. Qualification Tests. The manufacturer shall submit certified test data results that detail full compliance with ANSI/ICEA S-94-649 for each cable design.

6.2.1. Test results shall confirm compliance with each of the material tests, production sampling tests, tests on completed cable, and qualification tests included in ANSI/ICEA S-94-649.

6.2.2. The testing procedure and frequency of each test shall be in accordance with ANSI/ICEA S-94-649.

6.2.3. Certified test data results shall be submitted to GPA for any test, which is designated by ANSI/ICEA S-94-649 as being "For Engineering Information Only," or any similar designation.

6.3. Partial Discharge Tests. Manufacturers shall demonstrate that their cable complies with Section 6.3.1 or 6.3.2 of this specification.

6.3.1. Each shipping length of completed cable shall be tested and have certified test data results available indicating compliance with the partial discharge test requirements in ANSI/ICEA S-94-649.

6.3.2. Manufacturers shall test production samples and have available certified test data results indicating compliance with ASTM D 2275 for discharge resistance as specified in the ANSI/ICEA S-94-649. Samples of insulated cable shall be prepared by either removing the overlying extruded insulation shield material, or using insulated cable before the extruded insulation shield material is applied. The sample shall be mounted as described in ASTM D 2275 and shall be subjected to a voltage stress of 250 volts per mil of nominal insulation thickness. The sample shall support this voltage stress, and not show evidence of degradation on the surface of the insulation for a minimum test duration of 100 hours. The test shall be performed at least once on each 50,000 feet (15,240 m) of cable produced, or major fraction thereof, or at least once per insulation extruder run.

6.4. Accelerated water/electrochemical treeing test shall be performed on all completed cables.

6.5. Jacket Tests. Tests described in this section shall be performed on cable jackets from the same production sample as in Section 6.3 of this specification.

6.5.1. A Cold Bend Test shall be performed in accordance with the applicable provisions of the ANSI/ICEA S-94-649. The test temperature shall be -35°C (-31°F). The sample shall show no cracks visible to the normal, unaided eye at the conclusion of the test. The test shall be performed at least once on each 50,000 feet (15,240 m) of cable produced, or major fraction thereof, or at least once per jacket extruder run.

6.6. A Spark Test shall be performed on non-conducting jacketed cable in accordance with ANSI/ICEA S-94-649 on 100 percent of the completed cable prior to its being wound on shipping reels. The test voltage shall be 4.5 kV ac for cable diameters <1.5 inches and 7.0 kV for cable diameters >1.5 inches and shall be applied between an electrode at the outer surface of the non-conducting jacket and the concentric neutral for not less than 0.15 second.

6.7. Frequency of sample tests shall be in accordance with ANSI/ICEA S-94-649.

6.8. All test results shall be furnished to GPA manager of Engineering within two weeks of cable delivery. If test results indicate the cable is not in compliance with acceptable standards, delivery may not be made.

7.0 CONSTRUCTION

7.1. The cable shall be manufactured to the specifications listed in the table below:

TABLE A

CONDUCTOR SIZE (AWG / kcmil)	CONDUCTOR NUMBER OF STRANDS	CONCENTRIC NEUTRAL Number - Size	CONDUCTOR SHIELD THICKNESS (minimum mils)	INSULATION SHIELD THICKNESS (minimum / maximum mils)	JACKET THICKNESS (nominal mils)
ALUMINUM CONDUCTORS – full neutral					
#2 AWG	7	10 - #14 AWG	15	30 / 60	80
#2/0 AWG	19	13 - #12AWG	15	30 / 60	80
#4/0 AWG	19	13 - #10 AWG	15	40 / 75	80
COPPER CONDUCTORS –1/3 neutral					
500 kcmil	37	17 - #10AWG	25	40 / 75	80
750 kcmil	61	24 - #10AWG	30	40 / 75	110
1000 kcmil	61	33 - #10AWG	30	55 / 90	110

CONDUCTOR SIZE (AWG / kcmil)	CONDUCTOR OVERALL DIAMETER (mils)	NOMINAL DIAMETER OVER INSULATION (mils)	NOMINAL DIAMETER OVER INSULATION SHIELD (mil)	NOMINAL DIAMETER OVER JACKET (mils)
#2 AWG	292	770	840	1080
#2/0 AWG	418	900	970	1240
#4/0 AWG	528	1010	1080	1390
500 kcmil	813	1290	1390	1730
750 kcmil	998	1480	1580	1960
1000 kcmil	1152	1640	1770	2150

7.2. Conductors – the conductors specified shall conform to ANSI/ICEA S-94-649:

7.2.1. Copper wire shall be uncoated, Class B stranded soft annealed copper in accordance with ASTM B 3. The conductors shall conform to ASTM B 8 for Class B compressed stranding. The copper conductors shall be annealed after stranding.

7.2.2. Aluminum wire shall be Class B stranded aluminum alloy #1350 H26 semi-annealed after strain hardening, three quarter hard drawn in accordance with ASTM B 609. The conductors shall conform to ASTM B-231 for Class B compressed stranding.

7.2.3. The interstices between the strands of stranded conductors shall be filled with a material designed to prevent the longitudinal migration of water that might enter the conductor. This material shall be compatible with the conductor and conductor shield materials. The outer surfaces of the strands that form the outer layer of the stranded conductor shall be free of the strand fill material. Compatibility of the strand fill material with the conductor shield shall be tested and shall be in compliance with ICEA T-32-645. Water penetration shall be tested and shall be in compliance with ICEA T-31-610.

7.2.4. The center strand of stranded conductors shall be indented with the manufacturer's name and year of manufacture at regular intervals with no more than 12 inches (0.3 m) between repetitions.

7.3. Conductor Shielding – conductors shall be covered with a super-smooth layer of extruded semi-conducting cross-linked polyethylene strand shield (stress control layer) with a uniform cylindrical surface. The extruded layer shall be firmly bonded to the cable insulation and shall meet the resistivity requirements of ANSI/ICEA S-94-649.

7.3.1. The conductor shield minimum thickness at any point shall be in accordance with ANSI/ICEA S-94-649, except minimum thickness requirements as shown on Table A shall also be met.

7.3.2. The conductor shield shall have a temperature rating equal to, or higher than, that of the insulation.

7.3.3. The void and protrusion limits on the conductor shield shall be in compliance with the ANSI/ICEA S-94-649.

7.4. Insulation – the insulation shall be chemically cross-linked thermosetting tree retardant polyethylene (TR-XLPE) meeting the applicable requirements of ANSI/ICEA S-94-649. The insulation nominal thickness shall be 220 mil. The minimum thickness shall be not less than 210 mils and the maximum thickness shall not be greater than 250 mils.

7.4.1. The pellets used in the manufacture of the insulation shall be the Dow Chemical Company HFDB-4202 EC compound "extra-clean" high-molecular-weight polyethylene.

7.4.2. Insulation shall be applied in one continuous extension and shall be homogeneous, solid, free of any contaminants, gels, or discolorations larger than 7 mils in any dimension, and free of porosities and voids larger than 3 mils.

7.5. Insulation Shield – the insulation shield and protective covering shall consist of an extruded layer of semi-conducting cross-linked polyethylene over the insulation in accordance with ANSI/ICEA S-94-649.

7.5.1. The shielding shall be in intimate contact with the outer surface of the insulation and shall be free stripping, leaving no conducting particles or other residue on the surface of

the insulation. The shield shall be applied such that all conducting material can be easily removed without the need for externally applied heat. Stripping removal tension values shall be a minimum of six (6) pounds and a maximum of eighteen (18) pounds.

7.5.2. The insulation shield thickness shall be not less than as specified on Table A. The maximum concentric neutral indent for cable sizes #2 AWG to 750 kcmil shall be 15 mils and 20 mils for 1000 kcmil.

7.5.3. The void and protrusion limits on the insulation shield shall be in compliance with the ANSI/ICEA S-94-649.

7.6. Concentric neutral – a concentric neutral conductor shall consist of annealed round, uncoated copper wires in accordance with ASTM B 3 and shall be spirally wound over the insulation shield with uniform and equal spacing between wires. The concentric neutral wires shall remain in continuous intimate contact with the extruded insulation shield.

7.6.1. A full neutral is required for #2 and #2/0 AWG conductors.

7.6.2. A one-third neutral is required for 500, 750 and 1000 kcmil conductors.

7.6.3. The number of wires and wire size for the concentric neutral are listed in Table A.

7.7. Jacket – an electrically non-conducting outer jacket shall be applied directly over the concentric neutral conductors. Jackets shall consist of black polyethylene compound meeting the requirements of ANSI/ICEA S-94-649. Jacket material may be Cross-linked Polyethylene (XLPE), High Density Polyethylene (HDPE) or Linear Low Density Polyethylene (LLDPE). Polyvinyl chloride (PVC) or chlorinated polyethylene (CPE) jackets are not acceptable.

7.7.1. The jacket material shall be an extruded to fill jacket that fills the area between the concentric neutral wires and covers the wires to the proper thickness. The jacket shall be free stripping from underlying insulation shield and wires. The jacket shall have three red stripes longitudinally extruded into the jacket surface 120° apart as per ANSI/ICEA S-94-649.

7.7.2. The jacket shall be of smooth and uniform composition free of hole, cracks, blisters, and other imperfections.

7.7.3. The jacket is for corrosion and insulation protection, moisture entry prevention, and mechanical protection for conduit installation.

7.7.4. The jacket shall be such that it will not deteriorate or alter its physical or electrical properties from exposure to sunlight or the elements.

7.8. Extrusion and Curing Process – the extrusion and curing processes shall be performed in a closed system Class 1000 clean room to insure maximum cleanliness.

7.8.1. The conductor shield, insulation, and insulation shield shall be extruded over the conductor using the 3-in-1 triple method, using a true triple-head unit.

7.8.2. The cable shall be cured using the dry curing method.

7.9. Identification Markings:

7.9.1. All cable jackets shall have a durable (lifetime) surface identification showing manufacturer's name, conductor size and type, insulation type, and thickness, voltage and ampere rating, sequential footage, and year of manufacture. The jacket shall be marked with the symbol required by Rule 350G of the National Electrical Safety Code and shall have three red stripes longitudinally extruded into the jacket surface 120° apart as per ANSI/ICEA S-94-649.

7.9.2. Identification shall be repeated along the cables at regular surface intervals with unmarked surfaces not exceeding twelve inches. There shall be no more than six inches of unmarked spacing between text label sequences.

7.9.3. Identification shall be sized as to be easily readable by workers holding the cable.

7.10. Moisture – there shall be no water in the strands and between the jacket and insulation of the cable when shipped. Each end of each conductor shall be made watertight with an end seal or a thick wall heat shrinkable cap. Free water present anywhere in the cable is grounds for rejection of the cable.

8.0 PACKAGING AND SHIPPING REQUIREMENTS

8.1. The cable shall be furnished in lengths specified by Guam Power Authority.

8.1.1. One single conductor cables shall be supplied on reels with length of cable per reel as shown in the table below, unless otherwise specified.

#2 AWG	2,000 feet
#2/0 AWG	2,000 feet
500 kcmil	1,000 feet
750 kcmil	1,000 feet
1000 kcmil	1,000 feet

8.2. Reels:

8.2.1. Reels shall be designed to support the weight of the cable and withstand handling in accordance with industry practices.

8.2.2. The inner drum end of the cable, when allowed to project through the flange of the reel, shall be protected to avoid injury to the cable or cable seal.

8.2.3. Wooden reels shall have steel collars with an outer flange of at least one half inch to withstand handling by GPA. Reels with at least 72 inch flanges shall be four ply and at least three ply above 60 inches. Mandrel hole shall have at least two inches of uncut wood all around the hole.

8.2.4. Mandrel hole size shall be 3 ½ inches, minimum.

8.2.5. A durable, non-fading label shall be securely attached to a flange of the reel plainly stating GPA's Purchase Order Number, shipping length in feet of cable on reel, beginning and ending sequential footage number, number, type and size of conductors, thickness and type of insulation, voltage and ampere rating, and tare weight.

8.2.6. Each reel shall be marked with an arrow and suitable stenciled working on the flange of the reel indicating the direction the reel should be rolled.

8.3. Each end of each length of cable shall be durably sealed, conforming to paragraph 7.10 of this specification and pressurized with dry nitrogen to 10 P.S.I. before shipment to prevent entrance of moisture. Evidence of water in the cable as received shall be cause for rejection.

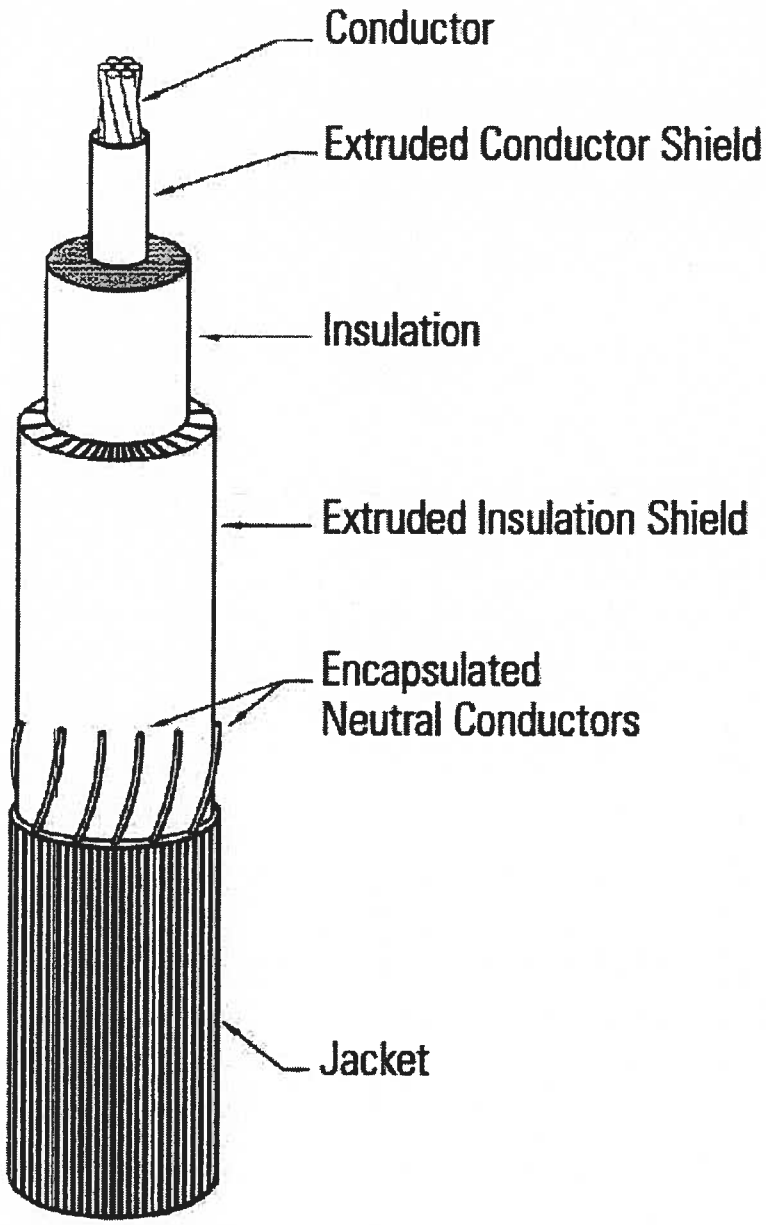
8.4. The cable shall be placed on the reels in such a manner that it will be protected from injury during shipment. Care shall be taken to prevent the reeled cable from becoming loose. Each end of the cable shall be firmly and properly secured to the reel.

8.5. The reels shall be lagged or covered with suitable material to provide physical protection for the cable during transit and during ordinary handling operations and storage, and the materials and system used shall be approved by the GPA Engineering Department.

8.6. Reels shall be transported upright and securely blocked in position so that they will not shift during transit.

8.7. Reels must be stored upright (NOT FLAT) in a secured and suitably paved area with adequate drainage. Reels should not be stored in a continuous damp environment; ideally, a covered area is preferred.

9.0 DIAGRAM



GUAM POWER AUTHORITY
P.O. Box 2977
Agana, Guam 96932

TRANSMISSION & DISTRIBUTION SPECIFICATION

Specification No. E-045

For

35 KV XLPE UNDERGROUND CABLE
SINGLE CONDUCTOR, SHIELDED,
1000 KCMIL ALUMINUM

35 KV XLPE UNDERGROUND CABLE, SINGLE CONDUCTOR, SHIELDED, 1000 KCMIL ALUMINUM

	Table of Contents	Page

35 KV XLPE UNDERGROUND CABLE, SINGLE CONDUCTOR, SHIELDED, 1000 KCMIL ALUMINUM

1.0 SCOPE

1.1 This specification describes 35 kV single conductor, tree retardant-cross linked polyethylene insulated, copper taped, water blocked, HDPE jacketed power cable.

1.2 The cable is intended for use in wet or dry locations in an underground system suitable for either direct burial or installation in ducts, with conductor temperatures of 90 degree C for normal operation. The cable shall be rated not less than 35 KV, 133% insulation.

1.3 The cable shall be manufactured to ICEA S-93-639 except where otherwise indicated herein.

1.4 The cable manufacturer must have developed and implemented a Quality Management System, using the ISO 9001 standard as the model for quality assurance and criteria for third party accreditation. Proof of compliance with this requirement must be supplied at tender stage with a Registered Supplier Certificate.

2.0 CONFORMANCE TO SPECIFICATION REQUIREMENTS

2.1 APPLICABLE STANDARDS

2.1.1 ICEA Publication No. S-93-369, "5-46 kV Shielded Power Cable for use in the Transmission and Distribution of Electrical Energy".

2.1.2 NEMA Standards Publication No. WC 26, "Wire and Cable Packaging".

2.1.3 ISO 868 "Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness)"

2.1.4 Except as specified herein, equipment covered by this specification shall conform to all applicable industry standards (i.e. ANSI, ASTM, etc.).

2.2 DEVIATIONS AND NON-CONFORMANCE REQUIREMENTS

2.2.1 Deviations from this specification or changes in the material or design after the purchase order has been placed must be approved by the Guam Power Authority's Engineering Department and acknowledged by a Purchase Order Amendment.

2.2.2 Units received with deviations or non-conformance, which are not acknowledged as specified in sub-paragraph 2.2.1, are subject to rejection. The supplier of units rejected in this paragraph is responsible for any corrective action including but not limited to materials, labor, and transportation necessary to dispose of, or make the units conform to the specification.

2.2.3 Notification of defective units discovered before or after installation that are believed to be inherent to manufacturing problems or workmanship shall be forwarded to the supplier. The description of the item, documentation of the problem and the desired information, disposition and/or follow-up (as appropriate) that GPA expects from the supplier will be specified. The supplier's response shall be made within thirty (30) days unless otherwise noted or an extension is acknowledged and approved in writing by the Guam Power Authority's Engineering Department.

3.0 CONDUCTORS

3.1 Aluminum wire shall be Class B, stranded aluminum alloy 1350, semi-annealed, three quarter hard drawn.

3.2 The numbers of strands are specified in Table A for each conductor size.

4.0 CONDUCTOR SHIELDING

The conductor shall be covered with a layer of extruded semi-conducting cross linked polyethylene strand shield with a minimum average thickness as specified in Table A.

5.0 INSULATION

5.1 Insulation shall be the Dow Chemical Company's HFDB 4202 EC compound.

5.2 The conductor shield, insulation, and insulation shield shall be applied via a triple extrusion head and dry cured in one continuous operation. The insulation shall be homogeneous, solid, free of any contaminants, gels, or discolorations larger than 7 mils in any dimension, and free of porosities and voids larger than 3 mils.

5.3 The nominal insulation thickness shall be as specified in Table A. Tolerances on thickness shall be as specified in ICEA S-93-639.

6.0 INSULATION SHIELDING AND PROTECTIVE COVERING

6.1 The protective covering and insulation shield shall consist of an extruded layer of semi-conducting cross linked polyethylene over the insulation.

6.2 The shielding shall be in intimate contact with the outer surface of the insulation and shall be free stripping, leaving no conducting particles or other residue on the surface of the insulation.

6.3 The insulation shield thickness shall be not less than as specified in Table A.

6.4 A coated or uncoated copper wire shield shall be utilized.

7.0 JACKET

7.1 The cable jacket shall be a black high intensity polyethylene (HDPE), with a minimum thickness as specified in Table A. In addition to the requirements of

ICEA S-93-639, the material must have a minimum instantaneous Shore D hardness of 62 when prepared and tested in accordance with ISO 868.

7.2 The jacket shall be of smooth and uniform composition free of holes, cracks, blisters, and other imperfections.

7.3 The jacket is for metallic shield corrosion protection, moisture entry prevention, protection from termite damage, and mechanical protection for conduit installation.

8.0 IDENTIFICATION

8.1 All cable jackets shall have a durable (lifetime) surface identification showing the manufacturer's name, conductor size and type, insulation type and nominal thickness, voltage, and year of manufacture.

8.2 Identification shall be repeated along the cable at regular surface intervals, with unmarked surfaces not exceeding twelve inches.

8.3 Identification shall be sized as to be easily readable by workmen holding the cable.

9.0 TESTS AND TEST REPORTS

9.1 Cable shall be tested in accordance with ICEA S-93-639.

9.2 Accelerated water/electrochemical treeing test results shall be furnished to the GPA Manager of Engineering at the point of tendering.

9.3 The Supplier shall furnish one copy of a certified report, de tailing the results obtained for tests indicated as having a frequency of 100% in Table 9.7 of ICEA S-93-639, to the GPA Manager of Engineering.

9.4 All test results shall be furnished to the GPA Manager within two weeks of cable delivery.

10.0 REELS

10.1 Reels shall be designed to meet NEMA WC 26, or an equivalent international standard, to support the weight of the cable and withstand handling in accordance with industry practices.

10.2 The inner drum end of the cable, when allowed to project through the flange of the reel, shall be protected to avoid injury to the cable or cable seal.

10.3 The mandrel hole size shall be 3-1/2 inches, minimum.

10.4 A durable, non-fading label shall be securely attached to a flange of the reel plainly stating GPA's Purchase Order Number, shipping length in feel of cable on the reel, beginning and ending sequential footage number, the number, type and size of conductors, nominal thickness and type of insulation, voltage, and tare weight.

10.5 Each reel shall be marked with an arrow suitably stenciled on the flange of the reel, indicating the direction the reel should be rolled.

11.0 PACKING, SEALING, SHIPPING AND STORAGE

11.1 Each end of each length of cable shall be durably sealed and pressurized with dry nitrogen to 10 psi, before shipment, to prevent entrance of moisture. Evidence of water in the cable as received shall be cause for rejection.

11.2 The cable shall be placed on the reels in such a manner that it will be protected from injury during shipment. Care shall be taken to prevent the reeled cable from becoming loose. Each end of the cable shall be firmly and properly secured to the reel.

11.3 The reels shall be lagged or covered with suitable material to provide physical protection for the cable during transit and during ordinary handling operations and

storage, and the materials and system used shall be approved by the GPA Engineering Department.

11.4 Reels shall be transported upright and securely blocked in position so that they will not shift during transit.

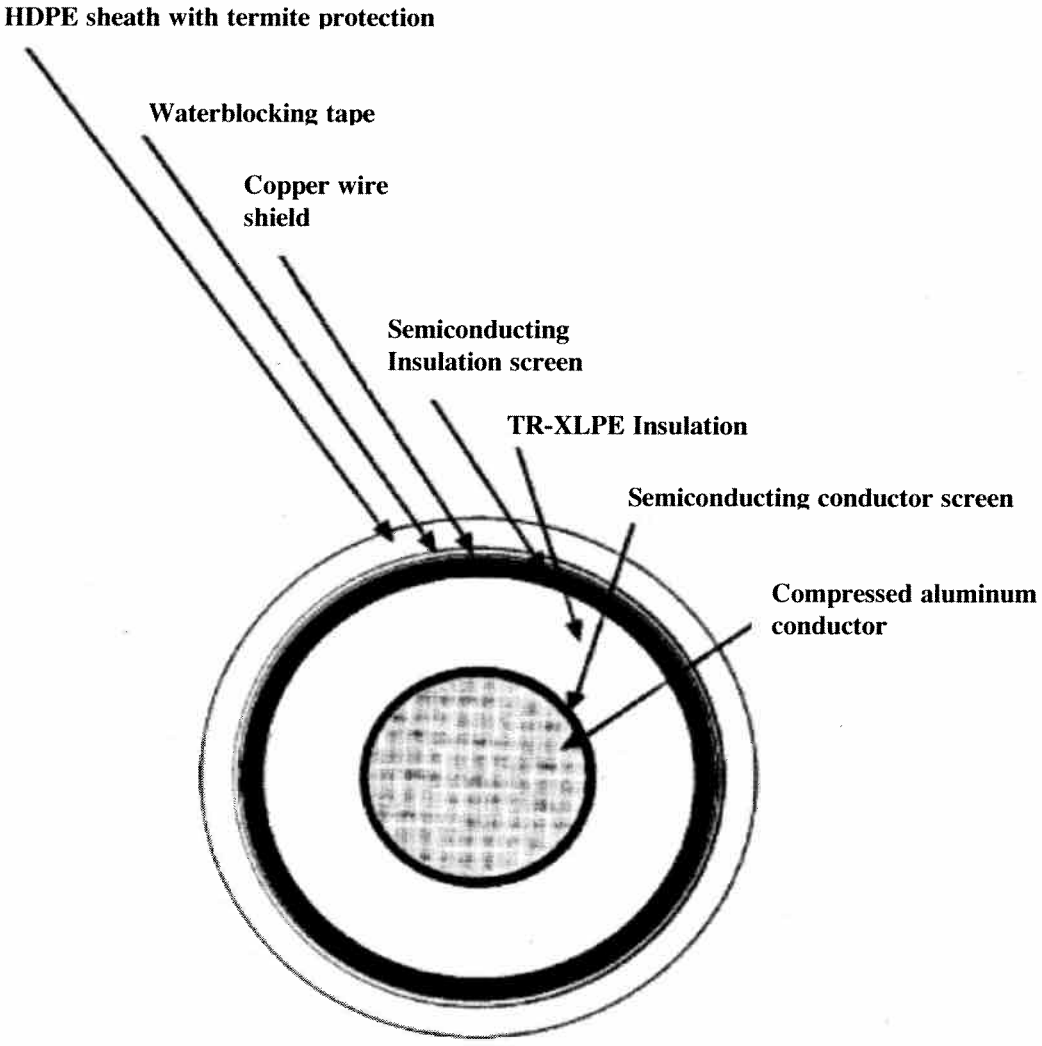
11.5 Reels must be stored upright (NOT FLAT) in a secured and suitably paved area with adequate drainage. Reels should not be stored in a continuous damp environment; ideally a covered area is preferred.

12.0 WARRANTY

The Supplier shall provide a warranty of at least one year that the cable is free from defects.

TABLE A

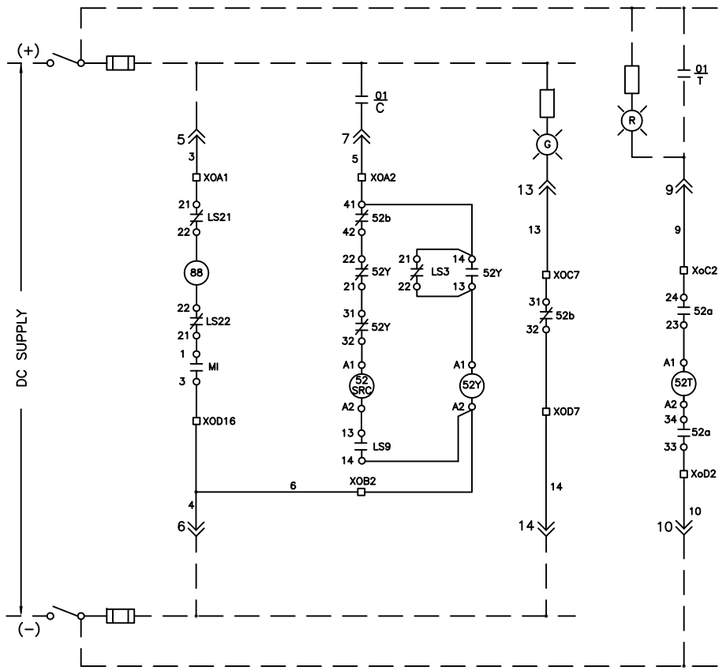
CONDUCTOR SIZE (AWG / kcmil)	CONDUCTOR NO. OF STRANDS	CONDUCTOR SHIELD THICKNESS (mils)	INSULATION THICKNESS (mils)	INSULATION SHIELD/PROTECTIVE COVERING THICKNESS (mils)	JACKET THICKNESS (mils)
ALUMINUM CONDUCTOR					
1000	61	25	420	50	110



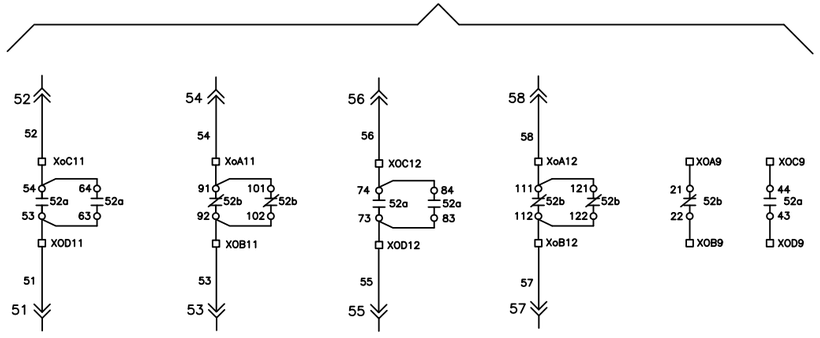
Aluminum 35 kV 133%, CuTp, WbTp
HDPE Jacket

Cable Cross Section

ATTACHMENT C.

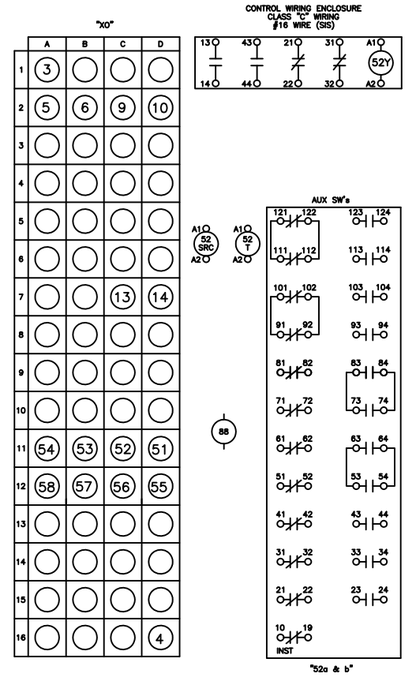


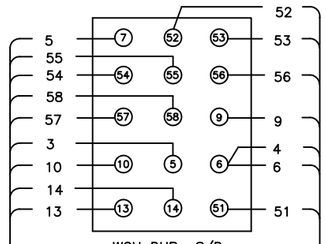
SPARE AUX. SWITCH CONTACTS



SYMBOL LIST

88 – SPRING CHARGING MOTOR
52SRC – SPRING RELEASE COIL (CLOSED)
52Y – CLOSING RELAY (ANTI–PUMP)
52T – SHUNT TRIP COIL
LS – SPRING CHARGED SWITCH
52a – AUX. SW. OPEN WHEN BRK IS OPEN
52b – AUX SW. CLOSED WHEN BRK IS OPEN
R – RED INDICATING LIGHT (CLOSED)
G – GREEN INDICATING LIGHT (TRIP)
OI/C – CONTROL SWITCH (CLOSED)
OI/T – CONTROL SWITCH (TRIP)
MI – MOTOR CUT–OFF SWITCH





Control Cable
18–753–575–504

WIRE CHART

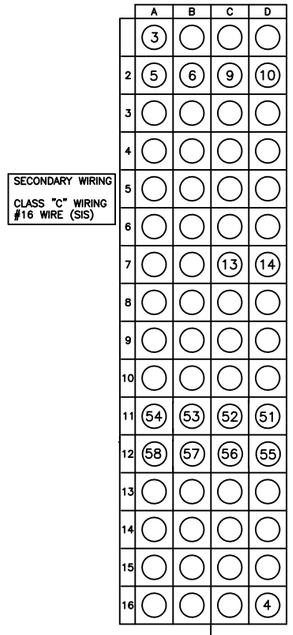
CONNECT	
CHARG CKT.	XoA1 – LS21/21 LS21/22 – 88 LS22/22 – 88 MI/1 – LS22/21 XoD16 – MI/3
CLOSE CKT.	XoA2 – 52a & b/41 52a & b/41 – 52Y/14 52Y/14 – LS3/21 52a & b/42 – 52Y/22 52Y/21 – 52Y/31 52Y/32 – 52SRC/A1 52SRC/A2 – LS9/13 LS9/14 – 52Y/A2 52Y/A2 – XOB2 52Y/A1 – 52Y/13 52Y/13 – LS3/22
GRN LT. CKT.	XoC7 – 52a & b/31 XoD7 – 52a & b/32
TRIP CKT.	XoC2 – 52a & b/24 52a & b/23 –52T/A1 52T/A2 – 52a & b/34
'a' AUX. SW.	52a & b/33 – XOD2 XOC11 – 52a & b/54 52a & b/54 – 52a & b/64 XOD11 – 52a & b/53 52a & b/53 – 52a & b/63
"b" AUX. SW.	XOA11 – 52a & b/91 52a & b/91 – 52a & b/101 XOB11 – 52a & b/92 52a b/92 – 52a & b/102
"b" AUX. SW.	XOC12 – 52a & b/74 52a & b74 – 52a & b/84 XOD12 – 52a & b/73 52a & b/73 – 52a & b/83
"b" AUX. SW.	XOA12 – 52a & b/111 52a & b/111 – 52a & b/121 XOB12 – 52a & b/112 52a & b/112 – 52a & b/122
"b" AUX. SW.	XOA9 – 52a & b/21 XOB9 – 52a & b/22
"a" AUX. SW.	XOC9 – 52a & b/44 XOD9 – 52a & b/43

MI

WIRE CHART

WIRE NO.	CONNECT
9	XOC2 – SD9
10	XOD2 – SD10
13	XOC7 – SD13
58	XOA12 – SD58
57	XOB12 – SD57
56	XOC12 – SD56
55	XOD12 – SD55
54	XOA11 – SD54
53	XOB11 – SD53
52	XOC11 – SD52
51	XOD11 – SD51
5	XOA2 – SD7
14	XOD7 – SD14
6	XOB2 – SD6
4	XOD16 – SD6
3	XOA1 – SD5

"XO"



SECONDARY WIRING
CLASS "C" WIRING
#16 WIRE (SIS)

STANDARD DRAWING

DO NOT DESTROY, CHANGE OR ADD MARK NO'S W/O APPROVAL OF DESIGN ENGINEERING.

USED ON: 2R: * CAD GENERATED, DO NOT CHANGE MANUALLY.

NO.	DATE	DESCRIPTION
03	09/15/00	was SD3 was SD13 and SD13 was 6, SD10 was wire at sec– 56
02	09/11/00	power supply/SEH
01	07/20/00	added (+)&(–)cct

Confidential–Property of
Siemens Power Transmission & Distribution
Raleigh, NC

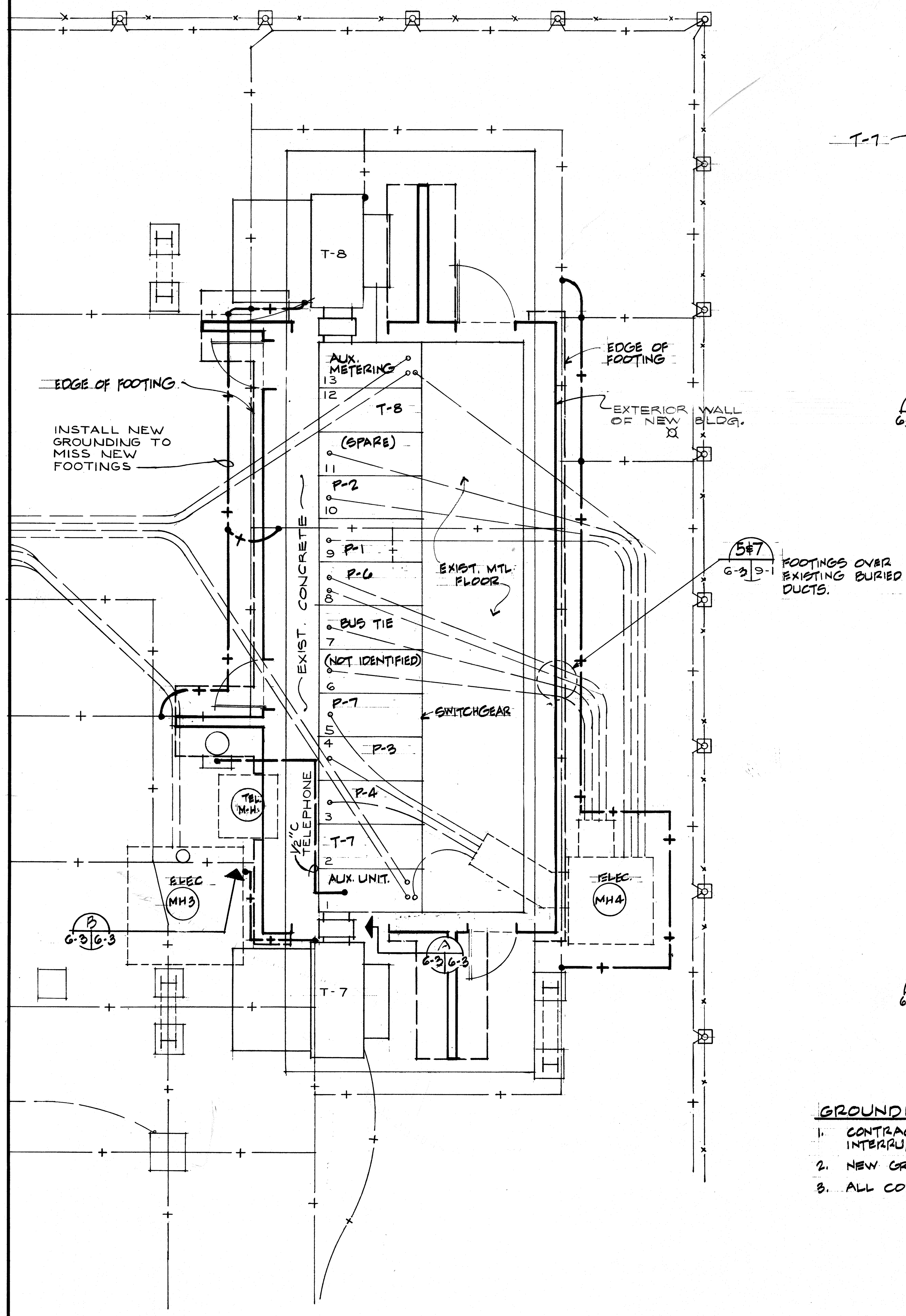
1–PLACE DECIMAL ±	ANGULAR		SIMILAR TO 18818967428
2–PLACE DECIMAL ±		MACHINED SURFACE TEXTURE	DR SEH
3–PLACE DECIMAL ±			CH
DATA BASE 18831180404			APP
			BULLETIN 09/00

MATERIAL	N–C 2	CURRENT DATE 3–8	PART NUMBER 9–19	ISS 20–21
	C	09/15/00	18–831–180–404	03

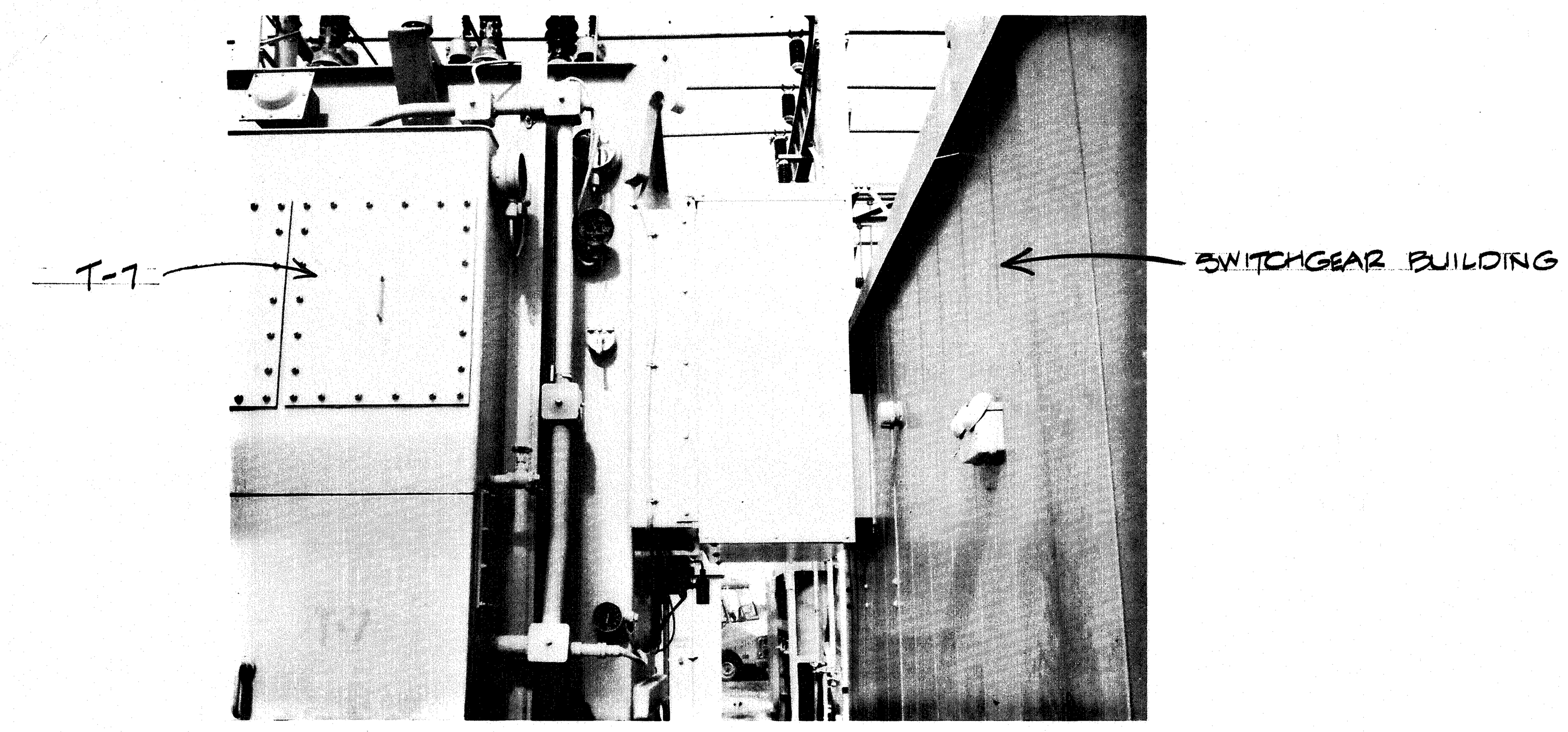
TYPE 22	REP 23	PART NAME 24–43	N.M. 44–48	49–53	SCALE	CHARACTERISTICS	SHEET NO.
P	M	BREAKER SCHEMATIC			1X		1F

ATTACHMENT D.

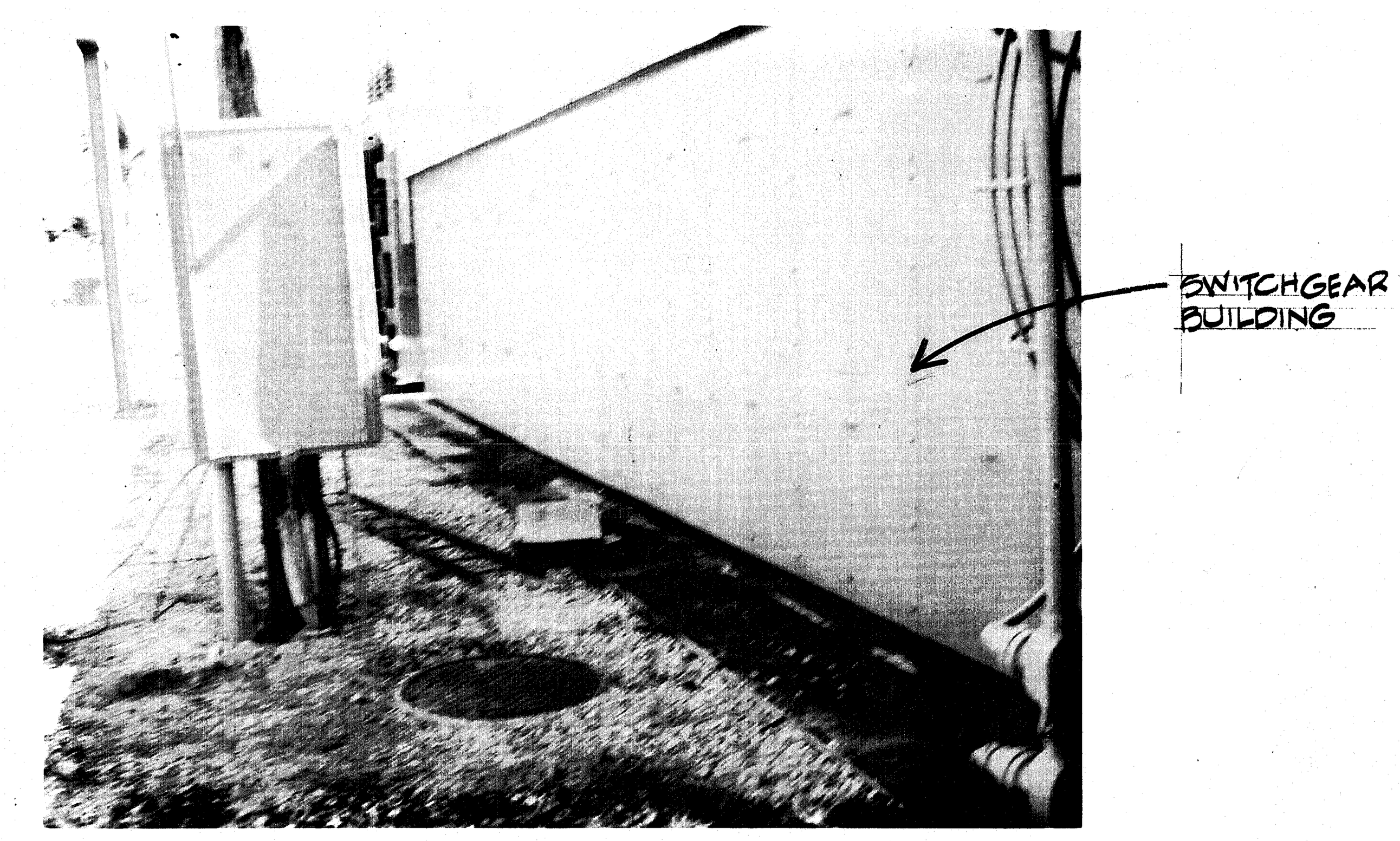
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
	AS BUILT	11/18/82	[illegible]



SITE PLAN · NEW WORK
SCALE 1/4" = 1'-0"



A 6-3 6-3 THROAT DETAIL - EXISTING



B 6-3 6-3 TELEPHONE MANHOLE - EXIST.

GROUNDING NOTES:

1. CONTRACTOR TO MAINTAIN GROUND CONTINUITY WHERE INTERRUPTED BY CONSTRUCTION WORK.
2. NEW GROUNDING CABLE TO BE #4/0 B.C.
3. ALL CONNECTIONS TO BE CADWELD.

THE CONTRACTOR WILL BE RESPONSIBLE FOR COORDINATING THE WORK AMONG THE VARIOUS TRADES AS NECESSARY TO AVOID CONFLICTS AND TO INSURE THE INSTALLATION OF ALL WORK WITHIN THE AVAILABLE SPACE.

RECORD DRAWING
DATE 1 NOV 1982

IF SHEET IS LESS THAN 28" X 40" IT IS A REDUCED PRINT — SCALE REDUCED ACCORDINGLY

4' 2' 0' 4' 8'
GRAPHIC SCALE 1/4" = 1'-0"

KELLER & GANNON
ENGINEERS-ARCHITECTS-CONSULTANTS
AE CONTR. NO. N62742-76-C-0092

DES GR | DR DP | CHK GR
SUPV JFK | CH ENG RSC
SUBMITTED BY B. Schiller DATE
FIRM MEMBER (TITLE) EXEC. V.P. 6/15/77
PACDIV NFEC: RVD [illegible] BR MGR [illegible]
DFPE ____ PDE [illegible] INBM [illegible]
DIR D. Johnson, P.E. 17 JUN 77
APPROVED [illegible] DATE 9/8/77
FOR COMMANDER, NAVFAC

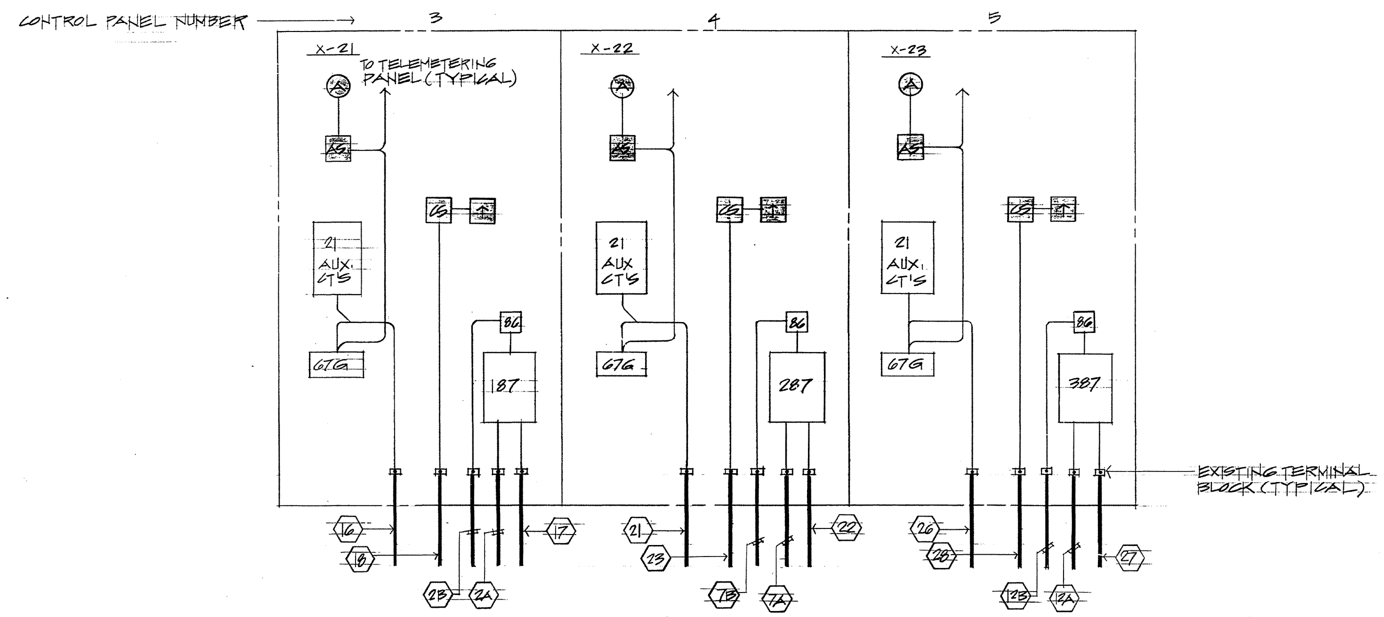
DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
PACIFIC DIVISION
MAKALAPA, HAWAII

GUAM — MARIANA ISLANDS
RESTORATION & HARDENING OF ELECTRIC POWER & TELEPHONE
POWER SYSTEM
PITI SUBSTATION PROTECTION
GENERAL PLAN

SIZE	CODE IDENT. NO.	NAVFAC. DRAWING NO.
F	80091	7,016,999
		CONST. CONTR. NO. N62766-77-C-0207

SCALE AS SHOWN | SPEC. 41-77-0207 | SHEET 180 OF 443

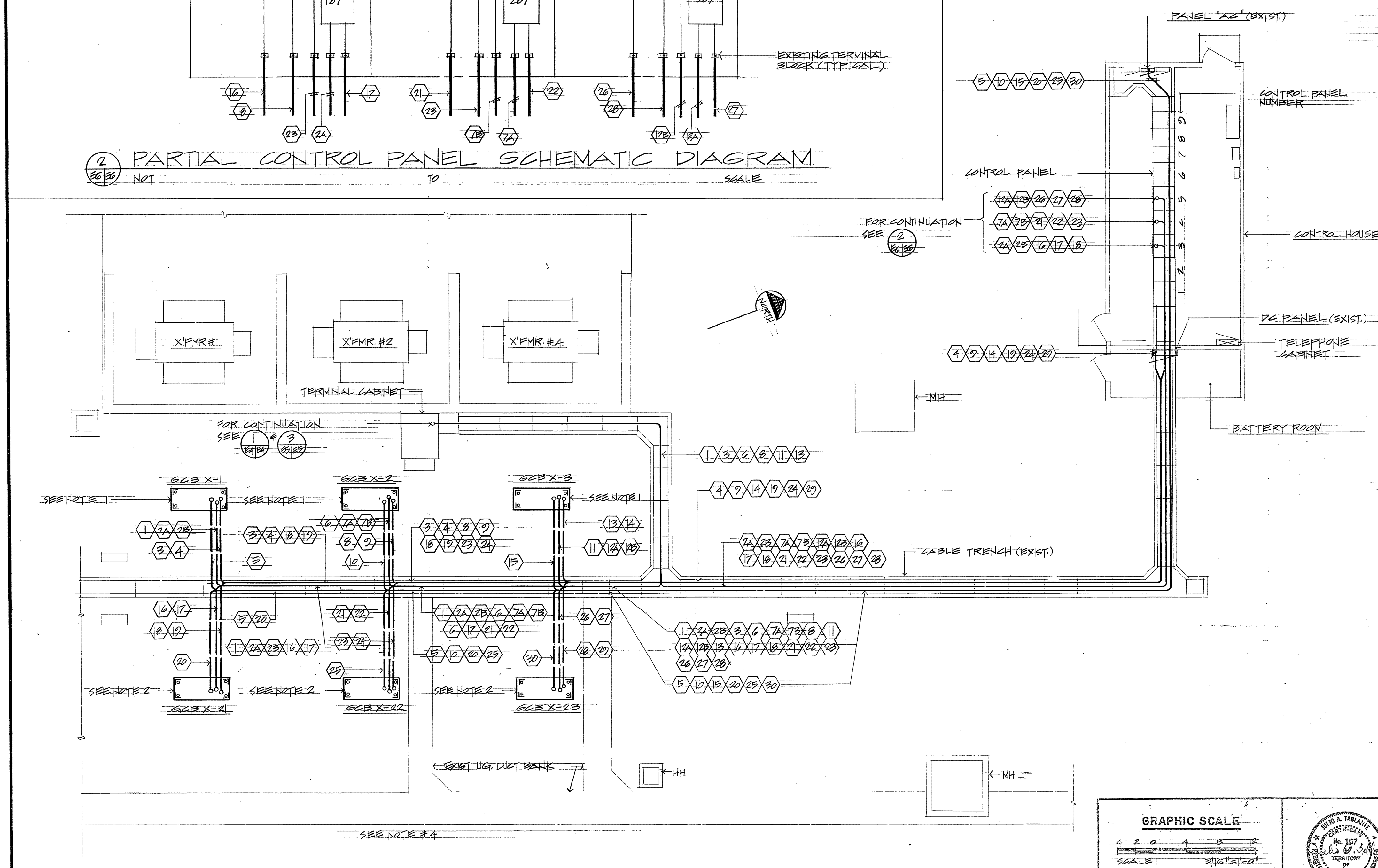
6-3 | SATISFACTORY TO ____ DATE ____ | TITLE



2 E6|E6 PARTIAL CONTROL PANEL SCHEMATIC DIAGRAM
NOT TO SCALE

NOTES:

1. FOR CONTINUATION OF CIRCUITS TO NEW GCB'S X-1, X-2 & X-3, SEE 1 E6|E4 & 3 E6|E5
2. FOR CONTINUATION OF CIRCUITS TO NEW GCB'S X-21, X-22 & X-23, SEE 1 E6|E4 & 2 E6|E4
3. CONTRACTOR SHALL LABEL EACH NEW CABLE AT BOTH ENDS & AT 20'-0" O.C INTERVAL IN CABLE TRENCH. IDENTIFICATION SHALL BE BY CIRCUIT NUMBER SIMILAR TO NUMBERING SYSTEM SHOWN ABOVE. VERIFY EXISTING CABLE NUMBERING SYSTEM AND ASCERTAIN THAT NUMBERING ASSIGNMENT ARE NOT DUPLICATED. INDICATE NUMBERING ASSIGNMENT ON AS BUILT DRAWINGS. LABEL SHALL BE WEATHERPROOF.
4. OTHER CABLES WHICH WILL NOT BE REPLACED ARE INSTALLED IN THE SAME CONDUIT OR TRENCH WITH CABLES THAT WILL BE REPLACED. CONTRACTOR SHALL PROTECT THESE CABLES FROM BEING DAMAGED DURING CONSTRUCTION. ANY CABLE DAMAGED BY THE CONTRACTOR SHALL BE REPLACED AT NO ADDITIONAL COST TO THE GOVERNMENT.



1 E6|E6 NEW CONTROL CT'S, DC AND AC CABLES ROUTING PLAN
SCALE: 3/16" = 1'-0"

GRAPHIC SCALE
4 2 0 4 8 12
SCALE: 3/16" = 1'-0"

JULIO A. TABLANTE CERTIFICATE No. 107 TERRITORY OF GUAM REGISTERED PROFESSIONAL ENGINEER
4-31-84

E-6

SATISFACTORY TO ... 5-7-84 DATE

SYMBOL	DESCRIPTION	DATE	APPD
A1	CHANGED CONTRACT & SPECS # FROM OICC #0202 TO PWC 2007 DATED 3/19/85	12/3/85	

REVISION

EMC2 HARMON PLAZA, SUITE B-103 P.O. BOX 8888 TAMUNING, GUAM 96911 TELEPHONE 646-5363/1558

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
OFFICER IN CHARGE OF CONSTRUCTION
NAVAL FACILITIES ENGINEERING COMMAND CONTRACTS, MARIANAS, GUAM, M.I.

DES JAT DRN RS CHK JAT
SUPV JAT CH ENGR JAT
SUBMITTED BY ... 5/3/84
PRESIDENT DATE
... 5/7/84
ENG-IN-CHRG OICC DATE
REVIEWED BY ... 5-7-84
DIR OICC DESIGN DIV. DATE
APPROVED ... 8 MAY 1984
OICC FOR COMMANDER NAVFAC DATE

PROJECTS R2-83 & R16-83 REPLACE OIL CIRCUIT BREAKERS AT PITI AND AGANA SUBSTATIONS

PITI SUBSTATION - NEW CONTROL CT'S, DC & AC CABLES ROUTING PLAN, PARTIAL CONTROL PANEL SCHEMATIC DIAGRAM & NOTES

SIZE F | CODE IDENT NO. 80091 | NAVFAC DRAWING NO. 732285
CONSTR. CONTR. NO. N62766-84-C-2007
SCALE AS SHOWN | SPECS NO. 41-84-2007 SHT 9 OF 17

ATTACHMENT E.

SECTION 16051

OWNER-FURNISHED EQUIPMENT AND MATERIALS

1.0 GENERAL

The electrical equipment and materials described in this section will be furnished by the Owner under separate specifications for installation by the Contractor.

Except as indicated otherwise herein, all work, materials, and additional equipment required for complete erection of the equipment, including receiving from carriers, unloading, and storage prior to erection, shall be provided by the Contractor.

Information describing equipment included in this section will give only an approximate scope of the erection work and is not intended to be a detailed itemization of all work to be done as a part of these specifications. Equipment purchase specifications for Owner-furnished equipment may be examined at the offices of the Owner. If necessary, supplemental information may be obtained from the manufacturer concerning the extent of field erection work. The weights and dimensions given are approximate.

Two copies of all manufacturer's shop drawings will be furnished to the successful bidder.

All spare parts and maintenance tools provided with equipment shall be delivered to the Owner as directed.

2.0 DESCRIPTION

The following equipment and materials will be furnished for the substation as indicated in this Section. (Please refer to section 16355)

3.0 DELIVERY

The owner-furnished equipment and materials have been shipped Delivered Duty Paid (DDP) site. The Contractor shall be responsible to transport owner-furnished equipment and materials from the Owner’s designated storage site to the job site.

4.0 INSTALLATION

The Contractor shall install the equipment and materials complete as indicated on the drawings as specified and in accordance with the manufacturer’s drawings and recommendations. The Contractor shall be responsible for bringing in Manufacturer technical

representative to oversee the assembly of equipment, namely the power transformer, testing and energizing the owner-furnished equipment and materials.

END OF SECTION 16051

SECTION 16355

POWER TRANSFORMER 34.5/13.8 KV 30 MVA

1.0 GENERAL

The section covers furnishing of the 34.5/13.8 kV power transformer complete with surge arresters, insulating oil, and accessories as indicated in GPA Specification No. E-034. Equipment furnished shall be complete with all accessories ready for mounting, assembly, connection, and immediate service. The Contractor shall furnished ASTM A-307 anchor bolts with heads embedded 12 inches in concrete with an ultimate compressive strength of 3000 pounds per square inch.

END OF SECTION 16355

GUAM POWER AUTHORITY

Post Office Box 2977
Hagåtña, Guam 96932

TRANSMISSION AND DISTRIBUTION SPECIFICATION

Specification No. E-034

FOR

34.5 KV/13.8 KV 18/24/30 MVA POWER TRANSFORMER OUTDOOR TYPE

34.5 KV/13.8 KV 18/24/30 MVA POWER TRANSFORMER OUTDOOR TYPE

Table of Contents

1.0 SCOPE:

This specification covers Guam Power Authority's requirement for three-phase power transformer and accessories.

2.0 SERVICE CONDITIONS AND OPERATION:

2.1 The three-phase power transformer and its accessories are intended for use in an average ambient temperature of 21-32 deg. C (70-90 deg. F) with corrosive, salt air environment, sustained wind strengths of 170 MPH, and subject to IBC seismic zone 4 conditions.

2.2 Transformer will be used for distribution step-down operation.

3.0 CONFORMANCE TO SPECIFICATION REQUIREMENTS:

Transformer shall meet the requirements of the following standards and specifications, including latest revisions with respect to material, design and tests.

3.1 Applicable Standards

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

C57.12.00	IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
C57.12.80	IEEE Standard Terminology for Power and Distribution Transformers
C57.12.90	IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
C57.12.70	IEEE Standard for Terminal Markings and Connections for Distribution and Power Transformers
C57.19.00	IEEE Standard General Requirements and Test Procedure for Power Apparatus Bushings
C57.19.01	IEEE Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

TR 1	Transformers, Step Voltage Regulators and Reactors

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D92-78	Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
D877-84	Standard Test Method for Dielectric Breakdown voltage of Insulating Liquids Using Disk Electrodes

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

70	National Electrical Code
70B	Standard for Electrical Equipment Maintenance

UNDERWRITER'S LABORATORIES, INC. (UL)

UL 467	UL Standard for Safety Grounding and Bonding Equipment

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (IETA)

ANSI/NETA ATS -2021	Standard for Acceptance Testing Specification for Electrical Power Equipment and Systems

3.2 Deviations and Non - Conformance Requirements

3.2.1 Deviations from this specification or changes in the material or design after the purchase order has been placed must be approved by the GPA Engineering Department and acknowledged by a Purchase Order Amendment issued by Guam Power Authority.

3.2.2 Units received with deviations or non – conformances that are not acknowledged as specified in Section 3.2.1, are subject to rejection. The Supplier of rejected units is responsible for any corrective action including but not limited to materials, labor and transportation necessary to dispose of, or make the units conform to this specification.

3.2.3 Notification of defects discovered before or after installation that are believed to be inherent to manufacturing problems or workmanship shall be made and forwarded to the Supplier. The description of the item, documentation of the problem and the described information, disposition and/or follow-up (as appropriate) that Guam Power Authority expects from the Supplier will be specified. The Supplier's response shall be made within thirty (30) days unless an extension is acknowledged and approved in writing by the GPA Manager of Engineering.

4.0 DATA TO BE PROVIDED:

4.1 The Bidder shall provide **with his bid** the following data:

1. Transformer
   a. Manufacturer _____
   b. Type, Core _____
   c. Windings, Two-winding _____
   d. Service Area, Outdoor _____
   e. Factory Technician Representative on Site _____
   f. Warranty, 1-Year _____
   g. Quantity _____

2. Delivery Date
   a. 8 months ARO or the earliest date _____

3. Rating
   a. Rated Output Capacity, 18/24/30 MVA _____
   b. Number of Phase, 3 _____
   c. Rated Frequency, 60 Hz _____
   d. HV rating and connections, 34.5 kV/Delta _____
   e. LV rating and connections, 13.8 kV/Grounded Wye _____
   f. Vector Group, Dyn1 _____
   g. HV Tap Steps, 5 _____
      HV Tap Voltage, 34.5 kV +/- 2 x 2.5% _____
   h. LV Tap Steps, 32 _____
      LV Tap Voltage, 13.8 kV +/- 16 x 0.625% _____
   i. Cooling Class _____

4. High Voltage (HV) Bushings
   a. Manufacturer/ Country _____
   b. Model/ Part No. _____

c. Voltage Class, 35 kV
d. Minimum BIL, 200 kV
e. Minimum Voltage Creepage, 35 Inches

5. Low Voltage (LV) Bushings
   a. Manufacturer/ Country
   b. Model/ Part No.
   c. Voltage Class, 15 kV
   d. Minimum BIL, 110 kV
   e. Minimum Voltage Creepage, 15 Inches

6. Low Voltage Neutral (LVN) Bushing
   a. Manufacturer/ Country
   b. Model/ Part No.
   c. Voltage Class, 15 kV
   d. Minimum BIL, 110 kV
   e. Minimum Voltage Creepage, 15 Inches

7. High Voltage (HV) Bushing Current Transformers
   a. Manufacturer/ Country
   b. Model/ Part No.
   c. MRCT, 1200/5
   d. Class, C800
   e. Burden, 100 VA

8. Low Voltage (LV) Bushing Current Transformers
   a. Manufacturer/ Country
   b. Model/ Part No.
   c. MRCT, 2000/5
   d. Class, C800
   e. Burden, 100 VA

9. Low Voltage (LVN) Bushing Current Transformer
   a. Manufacturer/ Country
   b. Model/ Part No.
   c. MRCT, 600/5
   d. Class, C800
   e. Burden, 100 VA

10. Spare Bushings
    a. HV Bushings, 2 each
    b. LV Bushings, 2 each
    c. LVN Bushing, 1 each

11. Guaranteed Efficiency at 100% Power Factor
    a. At 1-1/4 load (125%) _____
    b. At full load (100%) _____
    c. At 3/4 load (75%) _____
    d. At 1 /2 load (50%) _____
    e. At 1/4 load (25%) _____

12. Guaranteed Regulation at 100% Load _____
    a. At 100% power factor _____
    b. At 80% power factor _____

13. Guaranteed Loss
    a. Total loss at 100% voltage, kW _____
    b. Load loss (P_k) at rated voltage, kW _____
    c. No-load loss (P_o) at rated voltage, kW _____
    d. No-load loss at 110 % voltage, kW _____
    e. Maximum auxiliary power loss, kW _____

14. Guaranteed Exciting Current
    a. At 100% voltage, Amps _____
    b. At 110 % voltage, Amps _____

15. Guaranteed percent impedance, 7.5% _____

16. Calculated zero-sequence percent impedance, % _____

17. Guaranteed maximum average audible sound level for each stage of cooling
    a. Self-Cooled, dB _____
    b. 1st Stage, dB _____
    c. 2nd Stage, dB _____

18. Forced Cooling
    a. Cooling power requirements, kW _____
    b. Auxiliary power, Volts _____

19. Total Auxiliary Load with cooling, LTC, and cabinet space heaters
    a. Power Requirements (P_{co}) at No-Load Operation, kW _____
    b. Power Requirements (P_{cs}) at Rated Power Operation, kW _____
    c. Auxiliary power, volts _____

20. Type of Oil Preservation System _____

21. Method of mounting radiators
    a. Removable or Integral with the tank _____

22. Shipping data
    a. Shipping weight, Lbs. _____
    b. Shipping dimension (LxWxH), Inches _____
    c. Oil or gas filled _____

23. Transformer Overall Dimension (LxWxH), Inches _____

24. Type of transformer winding material used for all windings
    a. HV windings, COPPER _____
    b. LV windings, COPPER _____

25. No Voltage Tap Changer
    a. Manufacturer/ Country _____
    b. Model/ Part No. _____
    c. Current rating, Amps _____

26. Load Tap Changer
    a. Manufacturer/ Country, ABB _____
    b. Model/ Part No. _____
    c. Current rating, Amps _____

27. Automatic Voltage Regulator (AVR)
    a. Manufacturer/ Country, Beckwith Electric/ USA _____
    b. Model/ Part No., M-2001D _____

28. Dissolve Gas Analysis (DGA) or Fault Gas and Moisture Monitor
    a. Manufacturer/ Country, GE USA _____
    b. Model/ Part No., Hydran M2 _____

29. Spare Hydran M2 Sensor 0-2000 ppm
    a. Part No.16270, 2 each _____

30. LTC Filtration System
    a. Manufacturer/ Country, Oil Filtration Systems/ USA _____
    b. Model/ Part No., LTCFS-6-S514D/2-120-N4-B _____

31. HV Surge Arresters
    a. Manufacturer/ Country _____
    b. Voltage rating (duty cycle), rms kV _____

c. Max. continuous operating voltage, rms kV _____
d. One second TOV capability, rms kV _____
e. Creepage distance, inches _____
f. Total weight of each unit, lbs. _____

32. LV Surge Arresters
a. Manufacturer/ Country _____
b. Voltage rating (duty cycle), rms kV
c. Max. continuous operating voltage, rms kV _____
d. One second TOV capability, rms kV _____
e. Creepage distance, inche _____
f. Total weight of each unit, lbs. _____

33. Oil
a. Manufacturer/ Country _____
b. Product, INHIBITED _____
c. Type, ASTM D3487 Type II _____
d. Amount required, Main tank, gals _____
Conservator tank, gal. _____
e. Total weight, Main tank, lbs. _____
Conservator tank, lbs. _____
f. Method of delivery _____

34. Target Type Fault Indicator
a. Manufacturer/ Country, Fuji Electric/ Japan _____
b. Model/Part No., TK Series/ TKL 200-DC12-B _____

35. Anchor Bolts, 1" dia. x 16" L _____

36. Space Heaters at HV and LV Terminal Cabinets _____

37. Attach list of recommended spare parts with quantities.

38. Attach list of special tools.

39. Bidder shall include in his bid proposal the cost for three (3) Guam Power Authority's representatives to witness factory testing.

40. In the event that the factory witness testing is cancelled or does not occur, the bid costs for the testing shall be deducted from the overall cost. The manufacturer shall provide factory test results, videos, and pictures of the testing.

4.2 An outline drawing shall be provided **with each bid quotation**. This drawing shall include the following information:

a. Projected floor space of the transformer, including radiators and expansion tanks.
b. Height of transformer from floor level to top of high-voltage bushing.
c. Height of transformer from floor level to top of low-voltage bushing.
d. Height of transformer from floor level to top of tank, and to the highest non-removable part.
e. Weight of core and windings.
f. Weight of tank and radiators.
g. Number of gallons of oil and total weight of the oil.
h. Total weight of the assembled transformer including oil.
i. Power requirements for all control and auxiliary equipment.

4.3 Within ten (10) weeks after award of contract, the successful bidder shall provide the following drawings for Guam Power Authority approval.

4.3.1 Nameplate drawing including all current transformer ratios.

4.3.2 Outline drawing including the following:

a. Accessories and location
b. Weights with and without oil
c. Shipping center of gravity-shown on two views.
d. Installed center of gravity-shown on two views.
e. Anchoring requirements.

4.3.3 Base drawing including anchor bolt locations, completely detailed and dimension from equipment center lines:

a. Bushing outlines including size of stud, thread size and thread length.
b. Surge arrester outlines.
c. Location of radiators.
d. Location of conservator.
e. Control elementary and wiring diagrams.
f. LTC control elementary and wiring diagrams.
g. Current transformer elementary and wiring diagrams.
h. Current transformer ratio correction factor and secondary excitation curves.

The Supplier shall supply three (3) sets of prints of the above requirements. In addition, a list indicating the drawing number and title of each drawing shall be provided.

4.4 Drawings Approval

4.4.1 Guam Power Authority shall be allowed three (3) weeks to review and approve drawings provided in Section 4.3 without affecting the shipping date.

4.4.2 Drawings returned to the Supplier as approved shall be considered authorization to proceed with the work. The approval of Guam Power Authority shall in no way abrogate with the requirements of this specification.

4.5 Certified Reproducible

4.5.1 At least three (3) weeks prior to shipment of the equipment the Supplier shall furnish Guam Power Authority an AutoCAD file (AutoCAD version to be determined by GPA), a certified reproducible hard copy and soft file in pdf format for each transformer. Under no circumstances will **"Typical Drawings"** be accepted. This includes both schematic and wiring diagrams.

4.5.2 The Supplier shall provide three (3) Final certified reproducible hardcopies (11" x 17" Ledger Paper, ANSI B. A3) and one (1) soft file in pdf format. The following information shall be shown on each drawing submitted:

a. Guam Power Authority Purchase Order
b. Supplier's Name
c. Description of Drawing

4.6 Installation, Operation and Maintenance Manuals

4.6.1 The Supplier shall provide Guam Power Authority with three (3) sets of hardcopies and one (1) soft file in pdf format of full Installation, Operating and Maintenance Manuals for each unit, at least three (3) weeks prior to delivery.

4.6.2 One (1) additional Installation, Operation and Maintenance Manual shall be placed with each unit within the transformer control or marshalling cabinet.

4.6.3 Each set of manuals shall include the following:

a. Both schematic and wiring drawings. No typical drawings are acceptable.
b. List of parts that were shipped loose from the transformer and to be installed in the field.
c. A replacement parts list that includes part number identification.
d. A list of recommended spare parts and complete packing lists of accessory items.
e. Instruction manuals covering step-by-step installation and assembly with illustrative drawings. Each separate part shall be marked with or

identification system to aid in erection.

f. Manual recommending proper storage procedures.

g. Operating and "troubleshooting" manual for the transformer.

h. List of all special tools needed for installation and maintenance.

5.0 RATINGS:

5.1 Description

Transformer shall be a three-phase, oil-immersed, outdoor type unit for use on a 60 hertz effectively grounded system. Transformer windings (primary and secondary) shall be made of COPPER.

5.2 Operations and Environment

The transformer is to be used for step-down operation, in a salt air environment near sea level with ambient temperatures ranging between 21-32 deg. C (70-90 deg. F).

5.3 KVA Rating/Temperature Rise

The transformer shall have the following ratings:

Self-Cooled OA	18 MVA
1st Stage Fans FA	24 MVA
2nd Stage Fans FA	30 MVA

The average winding temperature use will not exceed 65-degree C (measured by resistance method) when operated at the OA/FA/FA rating.

5.4 Voltage Ratings and Phase Displacement

5.4.1 The primary winding (high voltage) shall be rated 34,500 volts, delta connected.

5.4.2 The secondary winding (low voltage) shall be rated 13,800 Y/ 7970 volts, grounded wye connected.

5.4.3 The phase displacement between the 34,500 volt and the 13,800 volt winding shall be 30 electrical degrees with the low voltage lagging the high voltage in a counter-clockwise phase rotation. The vector group of the transformer shall be Dyn1.

5.5 Basic Insulation Levels (BIL)

The BIL ratings shall be as tabulated:

High Voltage Winding	200 KV
Low Voltage Winding	110 KV
Low Voltage Neutral Winding	110 KV

5.6 Impedance

The percent impedance voltage for the high to low voltage windings (H-X) shall be 7.5 percent on the unit's OA rating; impedance shall have tolerances as specified in ANSI Standard C5.12.00.

5.7 Sound Level

5.7.1 The average sound level of transformer shall be of a standard sound level or reduced sound level. Standard sound levels shall not exceed 71/72/73 db based on the transformer rating in accordance with NEMA TR-1 Standards. Reduced sound level transformers shall be 12dB below the standard and shall not exceed the levels for 59/60/61dB for OA/FA/FA, OA/FA/FOA or OA/FOA/FOA ratings.

5.7.2 The transformer sound level shall be reduced by reducing the flux density of the core.

5.7.3 The Supplier shall state in his quotation the price difference between a standard sound level and a reduced sound level transformer.

5.8 Surge Arresters

5.8.1 Station class metal oxide surge arresters shall be provided.

5.8.2 The Maximum Continuous Operating Voltage rated 27 kV rms shall be 22 kV MCOV for the transformer HV terminals. High voltage arresters shall be cover mounted, ABB type or equal.

5.8.3 The Maximum Continuous Operating Voltage rated 10 kV rms shall be 8.4 kV MCOV for the transformer LV terminals. Low voltage arresters shall be cover mounted, ABB type or equal.

6.0 CONSTRUCTION:

6.1 Bushings

6.1.1. High voltage bushings shall be of the paper and oil "capacitor" TYPE, ANSI Standard Inter-changeable, with visible oil level gauge at the top of each bushing. Each bushing shall be provided with a power factor test tap. Bushing color shall be ANSI 70 light gray. Threaded stud for connection of bushing to cable or straps shall be silver-plated.

6.1.2. Low voltage phase and all neutral bushings shall be of the dry-type, one- piece porcelain body, or acceptable condenser type. Threaded stud for connection of bushing to cable or straps shall be silver-plated. The bushing color shall be ANSI 70 light gray.

6.1.3. All bushings minimum creepage distance is 1 inch/ kV. Bushings provided with the transformer shall be in accordance with the following:

BUSHING	VOLTAGE CLASS KV	MINIMUM BIL KV	MINIMUM VOLTAGE CREEPAGE IN	LOCATION
HV Phase	35	200	35	Cover Mtd.
LV Phase	15	110	15	Cover Mtd.
LV Neutral	15	110	15	Cover Mtd.

6.1.4. Two each spare bushing shall be provided for both high and low voltage bushings. And one each spare bushing shall be provided for low voltage neutral bushing.

6.1.5. HV and LV terminal cabinets used for termination of underground power cables to the bushings shall be provided with space heater and cable support. Bushing terminals shall be at least 60 inches from the cable entry at the bottom of the cabinet to avoid stressing the cables when terminated.

6.2 Bushing Current Transformers

6.2.1. Standard multi-ratio current transformers for Authority's use are required as follows:

Each HV Phase Bushing	Two (2) 1200/5 MRCT accuracy C800.
Each LV Phase Bushing	Two (2) 2000/5 MRCT accuracy C800.
LV Neutral Bushing	One (1) 600/5 MRCT accuracy C800.

6.2.2. All secondary tap leads (total of five for each CT) shall be brought out of the top or side wall of the transformer through a gas and oil tight compartment and wired to identified circuit shorting terminal blocks in the transformer control cabinet. All connections between CT's and GPA connection points shall be bolted or crimped. No soldered, split or disconnecting lugs shall be used.

6.2.3. All CT circuits shall be terminated into an eight-pole test switch.

6.2.4. The manufacturer shall provide accuracy curves for the current transformers furnished.

6.2.5. Bushing CT Nameplates shall be provided showing connection and ratio for each tap of each current transformer. These nameplates shall be mechanically fastened and located adjacent to GPA's connection terminals.

6.3 Tap Changers

6.3.1 High Voltage De-Energized Manual Taps

Externally operated, full KVA capacity, fixed taps shall be provided to regulate the high voltage + 2 1/2 % and + 5 % from the nominal voltage. The high voltage de-energized tap changer shall be operable by a wheel, crank, or lever accessible by an operator standing at ground level. The operating device shall have provisions for padlocking. Each tap position and associated voltage for that tap shall be clearly identified on a tap position nameplate mounted on the transformer wall directly adjacent to the operating device. The nameplate shall state "For De-Energized Operation Only".

6.3.2 Low Voltage Automatic Load Tap Changer

1. Manufacturer: ABB
2. Location: Low voltage winding
3. Regulating Range: 10 percent above to 10 percent below rated voltage in 16 steps of 5/8 percent in each direction.
4. Rating: Delivered full kVA capacity at all LTC positions and at all combinations of LTC positions.
5. Tap Selector Switch and Mechanism:
    a. Mount in oil-filled compartment separate from main transformer tank.
    b. Maintain physical isolation so it is not necessary to drain oil or break seal of main transformer tank when servicing LTC.
    c. Tank Accessories:
        i. Hinged maintenance door with oil-resistant gasket.
        ii. Drain, filter, and separating valves.
        iii. Magnetic level indicator with low level 125 vdc alarm contacts.
        iv. Breather.
        v. Manhole for inspection of contacts without lowering oil level.
6. Controls:
    a. Type: Automatic, solid state.
    b. Features:
        i. Adjustable bandwidth and voltage level.
        ii. High limit/ low limit blocking.
        iii. Line drop compensation.
        iv. Proper operation when operated isolated or in parallel and for real and reactive power flow in both directions through transformer.
        v. Controls for reduction in regulated output voltage of 2-1/2 or 5 percent, either manually at transformer control cabinet or remotely from supervisory control equipment.
        vi. Local and remote LTC control capability.
    c. Equipment:
        i. Current transformer for line drop compensation.
        ii. Position indicator with drag hands to indicate maximum travel.
        iii. Limit switches and stops to prevent travel beyond extreme tap position.
        iv. Crank or hand wheel for manual operation during maintenance.
        v. Positioning devices and off-position contacts.
        vi. Operation counter.

vii. Potentiometer for remote position indication to Control Room. Provide potentiometer with 1,280 ohms total resistance and 40 ohms resistance with each LTC step.
viii. Form C dry contacts wired to RTU for lower limit, upper limit, and hung-up alarms.
ix. Control circuit protective devices.
x. Control switches for RAISE-LOWER, AUTOMATIC-MANUAL, and LOCAL-REMOTE.
xi. OFF-Position contact wired to indicating light in main cabinet.
xii. Remote control switches for RAISE-LOWER, AUTOMATIC-MANUAL, and a Selsyn type indicator for mounting on the Owner's remote Control Panel.

6.4 Drain, Isolating, Vacuum and Filter Valves

6.4.1 A two inch, globe type, combination drain and lower filter valve shall be provided. This valve shall have a built-in 3/8 inch sampling device. A one inch upper filter valve shall also be provided.

6.4.2 If transformer is designed for vacuum filling, provision shall be made on the top of the tank for a vacuum connection.

6.4.3 Isolating valves and other necessary devices shall be provided to allow ready installation and removal of radiators and drainage of oil from radiators without draining oil from the main tank. Drain, filter, vacuum valves and their hand wheel shall be made of bronze.

6.5 Lifting Facilities

6.5.1 Lifting facilities shall be provided for lifting the cover separately and for lifting the core and coil assembly from the tank using four lifting cables.

6.5.2 Lifting facilities shall also be provided for lifting the complete transformer using four slings. The bearing surface shall be free from sharp edges.

6.6 Jacking Facilities

Jacking facilities shall be located near the extreme ends of the junctions of the transformer segments. Minimum dimensions and clearances for jacking provisions shall be specified on the outline drawing.

6.7 Pulling Facilities

Pulling eyes shall be provided for pulling the transformer along center line.

6.8 Transformer Base

6.8.1 The transformer base shall be designed to permit rolling or skidding of the transformer in any direction. The base shall be designed so that the transformer center of gravity, as normally prepared for shipment, shall not fall outside the base support for a tilt of the base of 15 degrees from the horizontal, with or without oil in the transformer.

6.8.2 The base shall be fabricated with an adequate number of anchor bolt holes designed to put the transformer base in direct contact, shear and tension, with the transformer concrete foundation at all anchor bolt locations.

Anchorage shall be ASTM A-307 anchor bolts 1" dia. x 16" L with heads embedded in concrete with an ultimate compressive strength of 3000 pounds per square inch. Anchor bolts shall be supplied by manufacturer.

6.9 Nameplate

A diagram nameplate shall be furnished and shall be located near eye level above the base of the transformer. The information furnished shall be in accordance with nameplate American National Standard C57.12.00, Section 5.12. The Supplier shall also stamp on the nameplate the Guam Power Authority Purchase Order Number.

6.10 Liquid Thermometer

The transformer shall have top oil gauges with alarm contacts and a 0-1 mA output shall be provided for top oil temperature.

6.11 Liquid Level Indicator

6.11.1 A magnetic liquid level indicator shall indicate level of insulating liquid. Two electrically separate, normally open alarm contacts shall be provided to indicate both high and low liquid levels.

6.11.2 A third contact shall be provided to trip for low liquid level. This contact shall be electrically isolated from the alarm contacts and shall be set so that the trip operation is at a lower liquid level than the low level alarm.

6.12 Hot Spot Thermometer

A three-stage hottest spot winding temperature indicator relay shall be provided in each winding. The second stage contacts shall be wired in parallel to an auxiliary relay to obtain two (2) normally open contacts in addition to fan control contacts. A 0-1 mA output shall be provided for winding temperature.

The loss of cooling and over temperature trip and alarm scheme shall contain the items listed below.

a. Auxiliary contacts from second stage of winding temperature relay.

b. Loss of voltage relay (Device 27-1).

c. Timing relay to allow enough time for a source transfer before operation (Device 95).

d. Timing relay with instant transfer auxiliary switch self-resetting, 6-60 minutes, time delay pickup (Device 2-2). The equipment will be used to give an alarm with loss of voltage and high temperature and de- energize the transformer after a set period of time.

e. Auxiliary time delay relay to give alarm upon loss of voltage to pumps and or fans (Device 27-2).

6.13 Sudden Pressure Relay

A sudden pressure relay shall be provided. This relay shall be factory calibrated for the transformer on which the relay is to be used. The relay shall be provided with two electrically separated contacts for alarm and control. The sudden pressure relay shall be provided with an auxiliary lockout relay with hand reset. The auxiliary relay shall have a normally closed contact from the sudden pressure relay shunting the operating coil of the auxiliary lockout relay. The relay shall be suitable for 125 VDC operations. Relay assembly and location shall allow removal with the transformer energized.

6.14 Mechanical Pressure Relief Device

A self-sealing, mechanical pressure relief device shall be located on the cover. The relief device shall be furnished with alarm contacts and a visual operation indicator. The indicator shall be resettable with hot-sticks from ground level without the necessity of de-energizing the transformer.

6.15 Automatic Voltage Regulator (AVR)

Automatic Voltage Regulator (AVR) shall be provided and shall comply with GPA Specification No. E-055.

6.16 Fault Gas and Moisture Monitor

Fault gas and moisture monitor shall be GE Power Systems' HYDRAN M2 or newer version. The dissolved gas monitor (DGA) shall be used for continuous and on-line monitoring of moisture and gas-in-oil for the transformer.

The DGA shall have the following features:

a. Monitoring capability for H2, CO, C2H2, C2H4, and H2O.
b. Hourly and daily trend with alarm features
c. History logging of Data and Events
d. Dry Contacts for alarms
e. RS232 and Ethernet Connections
f. DNP 3.0 Protocol
g. NEMA 4X Enclosure
h. Analog and Digital Input / Output Card

Two each Hydran M2 sensor, Part No. 16270, shall be provided as spare.

6.17 LTC Transformer Oil Filtration System

The load tap changer filtration system shall be OIL FILTRATION SYSTEMS' LTCFS-6-S514D/2-120-N4-B or newer version. The LTC filtration system shall be used for continuous online filtration of dielectric oil of a load tap changer transformer featuring:

a. High Efficiency Particulate/ Carbon Removal Filter Element, which can remove particles as small as ½ micron in single pass.
b. Water Removal Element, capable of removing up to 0.25 gals of water.
c. Element Plugged Indication.
d. Variable Operation, system can be run continuously or at 1-4 intervals per day via solid state timer.
e. Automatic Safety Shut-Down and Isolation, if a leak is detected.
f. Cabinet Oil Leak Detection device.
g. Stainless Steel Cabinet.
h. Hour meter.
i. Inlet Make-Oil Adder Valve.
j. Flow Sight.
k. Acid Removal Filter.

6.18 Target Type Fault Indicator

The electromagnetic target type fault indicator shall be TK Series, Fuji Electric Ind. Co. Ltd., TKL 200-DC12-B or approved equal. The fault indicator shall have combinations of contacts that are utilized for output, a plug-in type indicating element with visible indication plate, and manual resetting. The indicators shall be installed inside the transformer control cabinet visible through window glass.

6.19 Core Ground

It is preferred that the core ground connection be above the oil and accessible from a manhole to facilitate testing of the core to tank insulation without lowering the oil. The connector shall be the slotted type with a captive nut connection. The location of core ground should be indicated on the transformer outline drawing.

6.20 Auxiliary Power Source

6.20.1 The auxiliary power will be single-phase 120/240 volt, 60 HZ A/C. The Supplier shall design the transformer cooling system including fans and pumps, LTC motor, controls and accessories to operate on both voltages. The Supplier shall inform GPA of the power requirements needed at the transformer. The terminals provided by the Supplier shall be adequate to receive Guam Power Authority's furnished A/C service conductors.

6.20.2 A 120 VAC, 15 ampere convenience outlet with ground fault protection shall be provided.

6.20.3 Provisions shall be made for an ungrounded 125 VDC incoming supply. All tripping, alarm, and associated devices shall be rated 125 VDC operations.

6.21 Centralized Termination and Control Devices Requirement

6.21.1 All equipment alarms, controls, protection and current transformers shall be brought to individual identified terminals centralized in a weather-proof control cabinet mounted on the equipment tank at a center of cabinet to base height of 5 feet 6 inches. Oil thermometer gauge, high voltage winding temperature gauge, and low voltage winding gauge shall also be located inside the weather proof cabinet. Adequate hinged doors shall be provided with weatherproof latching facilities. The latching assemblies shall be operated by handles that can be reached by an operator standing at ground level. Each handle shall have provisions for padlocking and be acceptable for weather-proofing the doors in the closed position.

6.21.2 All meters and instruments which require resetting shall be mounted less than six (6) feet above the base of the transformer.

6.21.3 Alarm contacts shall be electrically separate, open during normal conditions, self-resetting, suitable for closing 5 amperes, carrying 3 amperes continuously, and opening 3 amperes at 125 volts DC.

6.21.4 Control contacts shall be electrically separate, open during normal conditions, self-resetting, suitable for closing 30 amperes, carrying 10 amperes continuously, and opening 3 amperes at 125 volts DC.

6.21.5 All alarm and control contacts shall be individually wired to the Target Type Fault Indicators TK Series. Another new set of alarm and control contacts shall be individually wired to the GPA Customer (RTU and Relay Panels).

6.22 Instrument and Control Wiring

6.22.1 THW or THWN wires used by the Supplier shall be of the machine-tool type with 3/64" polyvinyl chloride insulation rated 600 volts, 90-degree C. Other wires with insulation having characteristics which equal or exceed the above requirements for machine-tool type wire are acceptable. Control wire used by the Supplier shall be suitable for wet and dry location, flame retardant, moisture and heat resistant.

6.22.2 All secondary wire, regardless of type, shall be stranded. Wire shall have adequate current-carrying capacity. No. 12 AWG shall be used for control circuits, #10 for CT circuits and #18 for SCADA indication.

6.22.3 Those portions of any secondary wiring in the control box, or those portions of any secondary or control wiring or cable which pass through conduit, shall not be spliced. However, junction boxes with terminal blocks as specified above may be used to extend secondary wiring passing through conduits.

6.22.4 Ring-tongue terminals shall be used for secondary wiring. Spade, slotted spade, flanged spade, and hook terminals are not acceptable. Ring-tongue terminals shall be sufficiently strong to prevent their breakage under conditions of vibration inherent in the equipment in which they are installed.

6.22.5 Terminals shall have insulated ferrules whenever the spacing between the terminals, or their projection above or below the terminal board, or both, is such that they can make contact with one another.

6.22.6 All wires for external connection shall be properly identified and terminated at conveniently located, easily accessible terminal blocks. All terminal blocks furnished by the Supplier shall have No. 10 screws. The screws shall be secured directly into the contact strips and not into nuts embedded in the terminals blocks. The contact strips shall have sufficient thickness to assure that torque applied to the No. 10 screws to hold the terminal to the contact strips will not damage the threads in the tapped holes. The screws shall be firmly secured to the blocks and shall be separated by insulated barriers. Terminal blocks with clamp type fittings are not acceptable.

6.22.7 Ring-tongue terminals shall be fastened to the contact strips of terminal blocks with machine screws. Barriers shall separate the contact strips.

All circuits shall be protected by molded case circuit breakers. Breakers are to be ambient compensated. The breaker size, supplier's name and catalog number are to be shown on the drawings.

6.22.8 Ring-tongue terminals shall be fastened to the contact strips of terminal blocks with machine screws. Barriers shall separate the contact strips.

6.22.9 Hinge wiring and wiring that will be subjected to bending during maintenance or other operations shall be arranged such that the bending or twisting will be around the longitudinal axis of the wire.

6.22.10 Wiring shall not be spliced or tapped. All connections shall be made at the device terminals or on terminal blocks.

6.22.11 All future, spare, and unused contacts and devices shall be wired to terminal blocks.

6.22.12 A minimum of ten percent (10%) spare terminal points shall be provided.

6.22.13 All wirings external to enclosure or cabinet shall be in rigid steel conduits.

6.22.14 All wirings from the transformer components to the cabinets, which may require removal for shipment, shall be installed in place and in such a manner that it is only necessary to connect the wires to the cabinets after they are installed on the transformer.

6.22.15 Wiring Format

a. All terminals shall be numbered, and the numbers shall correspond to the numbers on the wiring diagram.

b. All wires shall be identified at their termination points with the opposite end designation identification by labeled plastic sleeves or equal. Identification shall correspond to the lettered device, numbered terminal format of the wiring diagrams.

6.22.16 System Phase Rotation

The system phase rotation for the island-wide system is GPA C-B-A or NEMA 1-2-3 and all equipment purchased under this contract shall be wired and connected NEMA 1-2-3. All phase markings shall be NEMA 1-2-3. Instrument and relay arrangement shall be 1-2-3 left to right with neutral relays underneath phase grouping. GPA will make the external connections of the incoming and outgoing lines such that GPA C-B-A is connected to NEMA 1-2-3. Phase markings C-B-A shall be reserved for GPA's use.

7.0 TANK

7.1 The main transformer tank shall be designed to withstand, without permanent deformation, pressures 25 % greater than the maximum operating pressures resulting from the system of oil preservation used. The maximum operating pressures (positive and negative) which the transformer tank is designed to withstand shall be indicated on the nameplate.

7.2 Vacuum Filling

If tank is designed for vacuum filling (essentially full vacuum) radiators and auxiliary compartments such as expansion tanks, when not designed for full vacuum filling, shall be so designated and isolating valves shall be provided.

7.3 Manholes

Provide one or more circular handholes and at least two circular manholes in the transformer top with neoprene or better gasket material and bolted covers. This facility must be of sufficient size to allow removal of bushing CTs and allow entrance of a person into the transformer tank (24 inch minimum manhole).

7.4 Ground Pads

In addition to the surge arrester grounds pads, two ground pads, drilled and tapped for NEMA four-hole (1/2-inch bolts on 1 ¾-inch centers) connectors, shall be installed on diagonally opposite corners of the base. If the base is removable, the two pads shall be installed on the transformer tank wall near the base. Ground pads shall

be copper-faced steel, stainless steel, or nonferrous pads brazed or welded to the transformer.

8.0 TRANSFORMER OIL

The Supplier shall furnish an adequate quantity of mineral oil for the first fill of each transformer. Mineral oil shall be ASTM D3487 Type II. All furnished oil shall be INHIBITED with DBPC (Ditertiary Butyl Para-Cresol). The oil shall have the following minimum characteristics:

a. Flash Point: Cleveland Open Cup 132 Degrees C.
b. Fire Point: Cleveland Open Cup 145 Degrees C.
c. Specific Gravity at 60 Degree F: 0.865 to 0.910.
d. Viscosity: Saybolt Universal at 100 Degree F - 55 - 63 sec.
e. Acidity: 0.02 Mg KOH/gm 0.1 max.
f. Pour Point: -40 Degree F.
g. Corrosive Sulfur: None
h. Dielectric Strength (ASTM D877): 26 kV Min.
i. Power Factor at 68 Degree F: 0.0% Max.
j. Interfacial Tension: 40 Dynes/CM.
k. Non-PCB (Polychlorinated Biphenyl) Contaminated:
Manufacturer is to mark in a permanent manner that the dielectric fluid is "Non-PCB". Certified test report on residual oil remaining in the transformer after factory testing that indicates that the oil is free of **PCB.**

9.0 TRANSFORMER COOLING

9.1 Cooling Control

9.1.1 A hot-spot dial type thermometer shall be supplied to indicate the maximum hot-spot temperature of the windings. The instrument shall have adjustable alarm contacts and shall be placed at a convenient location, easily readable from ground level. The two stages of cooling shall be activated by the contacts on the dial type hot-spot thermometer. The contacts for cooling control within the hot-spot temperature device shall be readily accessible. This can be accomplished by providing all temperature device windings, oil, etc., with split removable bezel rings.

9.1.2 A manual-off-automatic selector switch shall be provided for the control of each stage of cooling equipment. In the "Automatic" position, the cooling equipment shall be activated by the temperature control. In the "manual" position the cooling circuit shall be energized. A contact shall be provided to indicate loss of power to cooling circuits for remote alarm purposes.

The contact shall be wired to a terminal strip in the control cabinet for Guam Power Authority's connection. A selector switch shall be provided to allow either cooling stage to be used as the first or preferred system.

9.1.3 Operation of the cooling system shall not be made by motor starting switches. If a capacitor is needed for starting, then the motor shall be capacitor start and run.

9.2 Heat Exchangers

Heat exchangers must have sufficient capacity to prevent a temperature rise in excess of that specified for each rating of the transformer. Due to severe corrosion problems, GPA prefers heat exchangers made of copper tube and copper fin construction. **ALUMINUM** heat exchangers are **NOT ACCEPTABLE**. Heat exchangers shall be removable from the main tank without the need to drain oil from the main tank.

9.3 Radiators

No accessories or pipes shall be installed above the radiators for easy installation and removal during maintenance.

Material of radiator:	Cold rolled Steel, SS41, and 1.0mm thickness	
Internal painting:	Coating with Celerol reaction primer	
Surface preparation:	Grit blasting to Sa 2.5 (SVENSK STANDARD SIS 0559081967) ASTM 2200 D IS 1477 PART 1	
Exterior paint:	Hot-Dip Galvanizing as per ISO-1461	60 Microns
	Epoxy Primer	20 Microns
	Epoxy Intermediate Coat	40 Microns
	Polyurethane Top Coat	40 Microns
	Total Thickness	160 Microns

9.4 Cooling Fans

All cooling fans shall be of the low speed type to reduce wind noise levels. Each fan shall be multi-bladed or multi-lobed with one common hub. Fans with more than one hub are not acceptable. Control of the cooling fans shall contain no motor starting switches and shall be plug-in type with an identified separate conductor case ground. Metal to metal ground for fans is not acceptable.

10.0 TESTING:

10.1 The Supplier shall make his plant available to the Guam Power Authority's representatives to inspect the transformer during construction, testing and/or packaging for shipment. Bidder shall include in his bid the factory acceptance test costs witness by the Guam Power Authority, which covers airfare, meals, hotel accommodation, and car rental during the entire testing period.

A factory test plan complete with acceptable reading values shall be submitted to the Guam Power Authority's Engineering Department for approval. The factory test equipment and test methods used shall conform to the applicable requirements of ANSI, NEMA, ASTM, NFPA, and UL standards. Factory tests will be witnessed by three (3) GPA representatives per one (1) each transformer unit.

Manufacturer's technical representative shall be on island to verify transformer connections and acceptance tests.

10.2 Two (2) hardcopies and One (1) soft copy in pdf format of certified test reports shall be supplied for the following tests:

1. **Standard Routine Tests** shall be performed as listed in the latest revision of ANSI C57.12.00.
   a. **Ratio Tests or TTR** on the rated voltage connection and on all tap connections.
   b. **Polarity and Phase Relation Tests** on the rated voltage connection.
   c. **Winding Resistance Measurement** shall be performed for each winding. The resistance shall be measured and recorded with hot and cold windings.
   d. **Winding Insulation Resistance and Polarization Index (PI) Tests** shall be performed for each winding.
   e. **Core Insulation Resistance Test** shall be measured between the core and ground for duration of 1 minute.
   f. **Insulation Power Factor Tests and Winding Capacitance Test** shall be performed in accordance with ANSI/IEEE C57.12.90.

2. **Dielectric Tests**

   a. **Lightning Impulse Test** shall be performed in accordance with ANSI/IEEE C57.12.90. Oscillographic records of the test shall be included in the test reports. The minimum height of each individual tract (at maximum deflection) shall be 30 millimeters. Front of Wave Impulse shall be performed. Test sequence shall consist of reduced full wave, full chopped wave, and full wave.

   b. **Low Frequency Test** shall be performed in accordance with ANSI/IEEE C57.12.90. Test shall be performed on auxiliary devices, control, and current transformer circuits.

   c. **Partial Discharge (Corona) Test** at full induced-test voltage level. The measurement shall be less than 500pC at one (1) hour voltage level for 60 minutes. Equipment and general method used shall be in accordance with ANSI/IEEE C57.12.14, C57.12.90, and C57.113.

3. **Audible Sound Level Test** in accordance with NEMA TR-I shall be performed for each stage of cooling.

4. **Regulation, Efficiency, and Losses.** The regulation of each transformer shall be determined for unity (1.0) and eight-tenths (0.8) power factor lagging.

   The efficiency and losses of each transformer shall be determined as indicated in the bid data. The guaranteed efficiency and tested total losses shall include losses in all windings.

   Measurement of Impedance Voltage, Excitation Current, and Zero-Phase Sequence Impedance shall also be determined.

5. **Bushing Tests**

   a. **Design Tests.** Certification that each type, style, and model bushing furnished has passed the test requirements of ANSI C57.19.00 and ANSI C57.19.01 shall be furnished.

6. **Other Tests**

   a. **Applied Voltage Test** shall be performed to confirm insulation status between windings and between windings and earth. Transformer shall withstand specified voltage during 1 minute.

b. **Induced Voltage Test** shall be performed to check the insulation status between turns of windings.

c. **Temperature Rise Tests.** Temperature tests will be required to check the temperature rise of windings.

d. **Leak Test** shall be performed to check leakage or reduction of pressure from welding points. Transformer is filled with oil and applies N2 gas to tank.

e. **Dissolved Gas in Oil Analysis Test** shall be performed to check the condition of oil and inside of the transformer using DGA equipment.

f. **Oil Breakdown Voltage Test** shall be performed by gathering oil samples from the main tank, main conservator, and OLTC tank.

g. **Dew Point** of the air (or gas) in the tank shall be determined just prior to shipment and at the final shipping destination.

10.3 The Supplier shall include the following information in the test report.

a. Winding hot spot temperature rise in degree C, over the average winding temperature rise at the 30 MVA, 65-degree C rating.

b. Winding Thermal Time Constant.

c. Type of material used in the primary and secondary winding.

11.0 LOSS EVALUATION:

11.1 Each bidder shall submit with his bid the guaranteed average load and no-load losses on each transformer submitted on this bid. Guaranteed load losses shall be provided at the transformer's self-cooled (OA) rating and a reference temperature of 85-degree C (65-degree rise + 20-degree C ambient). The requirements and definitions of ANSI Standard C57.12.00, Sections 5.9 and 9.3, shall apply.

11.2 Guaranteed losses will be evaluated by the Guam Power Authority to determine the equivalent cost for owning and operating each transformer. The value of the transformer no-load and load losses will be determined by GPA at the time of purchase to arrive at the projected Total Cost of Ownership (TCO) as follows:

$$TCO = IC + [A \times (P_o + P_{co})] + [B \times (P_k + P_{cs} - P_{co})]$$ Where:

- P_o = No Load Losses (NLL) in kW
- P_{co} = Power Consumption of Cooling Equipment at No Load Operation
- P_k = Load Losses (LL) in kW
- P_{cs} = Power Consumption of Cooling Equipment at Rated Power Operation
- IC = Initial Transformer Cost
- $A = t \times C_{n/2} \times (1 - (1/(1+i))^n)/i$
- $B = u \times t \times C_{n/2} \times (1 - (1/(1+i))^n)/i$
- $u = k^2$
- t = Operating Hours per Year **(24 Hours/Day X 365 Days/Year = 8760 Hrs.)**
- i = Discount Rate **(5% Used By GPA for Money Certificates Issued)**
- n = Expected Lifetime of the Transformer in Years **(GPA Uses 25 Years)**
- $C_{n/2}$ = Is the Cost of energy at the Mid-Life of the Transformer

Note: If Annual increase of energy price is assumed to be constant, $c_{n/2}$ can be calculated using C, j & n.

$$C_{n/2} = (c + (c \times (1+j)^n))/2$$

- c = Is the Initial Cost of Energy ($0.1007) **(Calculated from the weighted average energy rate from the Revenue Report with Fuel-Non Fuel Data Dec 2017)**
- j = Is the Annual Increase of Energy Price (1.0985%). **(Calculated from the Base Rate Increase from 1998 to 2018)**
- k = Is the Average Loading of the Transformer During its Lifetime (32%) **(Calculated using data from the GPA Substation Analysis 2018)**

Note: Load Losses = Total Losses – No Load Losses

11.3 The Manufacturer shall test each transformer for load and no-load losses. This test data shall be certified as correct and submitted to the Authority prior to or at the time of shipment.

11.4 The Authority will review and consider actual load and no-load losses for each transformer. In the event that the average evaluated losses for like units exceed the average guaranteed losses, the Manufacturer will be penalized at the above rates for the differences. Load and no-load loss penalties will be assessed independently. Bonuses will not be awarded for actual average losses which are less than guaranteed. In addition, any transformer with no-load losses or total losses greater than the tolerances indicated in ANSI Standard C57.12.00 shall be rejected by the Authority.

12.0 OIL PRESERVATION SYSTEM:

12.1 The transformer shall have a conservator (expansion tank) type oil preservation system.

12.2 There shall be no contact between oil in the expansion tank and air. This shall be accomplished by use of a nitrile air cell (diaphragm not allowed) vented to the outside air. The expansion tank shall be of sufficient volume to operate through an ambient temperature range of minus 35-degree C to plus 50-degree C without causing the low oil level alarm contacts to close at the lower limit and without exceeding the recommended full oil level at the upper limit. A shut-off valve, capable of holding the full head of oil in the expansion tank, shall be provided in the oil line between the expansion tank and the main transformer tank.

13.0 FINISHING REQUIREMENTS:

All metal surfaces shall be thoroughly cleaned of rust, welding scale, and grease, and shall be treated to effect a bond between the metal and paint which will prevent the formation of rust under the paint. A priming coat shall be applied immediately after the bonding treatment. A final finish shall consist of two coats of paint. The exterior final coat shall be ANSI 70 Gray.

14.0 SHIPPING REQUIREMENTS:

14.1 Because of severe transportation conditions, the Supplier shall pay particular attention to the proper packaging and bracing of the apparatus to assure its safe arrival. Manufacturer shall install a tilt monitor prior to shipping and results should be within safe recommendations.

14.2 The Supplier shall prepare all materials and equipment for shipment in such a manner as to protect from damage in transit. All small parts and unit components shall be separately boxed or bundled to prevent galling due to rubbing of one part against another. Each item, box or bundle shall be plainly and individually identifiable for content

according to item number, GPA P.O. Number, and Supplier's Identifying Number.

14.3 A complete itemized Bill of Lading, which clearly identifies and inventories each assembly, sub-assembly, carton, package, envelope, etc., shall be furnished and enclosed with each item or items at the time of shipment.

14.4 Openings in the transformer tank or radiators resulting from the removal of parts for shipment shall be identified and securely sealed against the entrance of moisture and foreign materials. Covers shall be of sufficient strength to resist puncture.

14.5 Delivery of transformer shall be to actual jobsite as identified by the Guam Power Authority Manager of Engineering.

15.0 STATEMENT OF COMPLIANCE:

The Supplier shall provide a signed statement verifying that the products being supplied fully comply with the specification stated herewith. Items not in full compliance with this specification will be identified with a description of the deficiency and any proposed substitutions must be approved by the Guam Power Authority Engineering Department, as described in Section 3.2.1.

16.0 WARRANTY:

The Supplier shall warrant the satisfactory and successful operation of the equipment furnished under this specification at the rating, under the conditions, and for the service specified. The Supplier shall further warrant this equipment against defects of design, material and workmanship. All workmanship and parts shall have a warranty of at least (1) year from the date of equipment's commissioning.

Re: GPA-047-25 T-7 Transformer Replacement -Q&A

Daniele Peter Reyes

Wed 8/6/2025 8:14 AM

To:Edwin Borja <erborja@gpagwa.com>;

Cc:Irwin Loyola <iloyola@gpagwa.com>; Alexander Salomon <absalomon@gpagwa.com>; Dawn Fejeran <dfejeran1@gpagwa.com>;

Hafa Adai,

Acknowledge receipt of email below. Thank you.

Best Regards,
Daniele Reyes
Buyer II
Guam Power Authority
Procurement Division
Telephone No.: 648-3054

From: Edwin Borja
Sent: Tuesday, August 5, 2025 9:59 AM
To: Daniele Peter Reyes
Cc: Irwin Loyola; Alexander Salomon; Dawn Fejeran
Subject: Re: GPA-047-25 T-7 Transformer Replacement -Q&A

Hafa Adai, Daniele,

As per our telecon a while ago, please see the updated answer below on Q10, as follows:

> **Q#10.** In your Item 11L of Technical Specifications TS-4, page 109 or 1042, you have indicated Owner-Furnished Equipment and Materials, Section 16051 Owner-furnished Equipment and Materials – Can you please let us know what are these equipment and materials?
> **(Please see the attached copy of the packing list, section 16051 Owner-Furnished Eqpt/Materials, section 16355 (Power Transformer 34.5/13.8KV 30 MVA), and**
> **GPA Specs no. 034 for your reference.)**

Thanks Again,
Edwin

From: Edwin Borja
Sent: Tuesday, August 5, 2025 9:34:17 AM
To: Daniele Peter Reyes
Cc: Irwin Loyola; Alexander Salomon; Dawn Fejeran
Subject: Re: GPA-047-25 T-7 Transformer Replacement -Q&A

Good Morning, Daniele,
Thank you for the acknowledgment.
By the way, TS sec 16355 also mentioned the details of Substation Transformer
as per GPA Specs No. E-034; please see the attachment.

Regards,
Edwin Borja

From: Daniele Peter Reyes
Sent: Tuesday, August 5, 2025 8:20 AM
To: Edwin Borja
Cc: Irwin Loyola; Alexander Salomon; Dawn Fejeran
Subject: Re: GPA-047-25 T-7 Transformer Replacement -Q&A

Hafa Adai Edwin,

This is to acknowledge receipt of attached documents in response to bidder's inquiries. Thank you.

Best Regards,
Daniele Reyes
Buyer II
Guam Power Authority

Procurement Division
Telephone No.: 648-3054

From: Edwin Borja
Sent: Monday, August 4, 2025 3:53 PM
To: Daniele Peter Reyes
Cc: Irwin Loyola; Alexander Salomon; Dawn Fejeran
Subject: Re: GPA-047-25 T-7 Transformer Replacement -Q&A

Hi Daniele,

Please see the attached Tech. Specs sections 16051 & 16355
for your perusal.

Thanks,
Edwin

From: Edwin Borja
Sent: Thursday, July 31, 2025 4:37:12 PM
To: Daniele Peter Reyes
Cc: Irwin Loyola; Alexander Salomon; Dawn Fejeran
Subject: Re: GPA-047-25 T-7 Transformer Replacement -Q&A

Good Afternoon, Daniele,

Please disregard the previous email from a couple of hours ago.
Below is our updated response to the contractor's inquiries in blue text.

Q#1. Project location is inside Piti Substation. Therefore, access is controlled by GPA. Will a GPA representative provide the contractor access at all times?
Yes, GPA rep will provide the contractor access as per requested scheduled date(s) and time duration).
Will a GPA representative be onsite at all times?
(Yes, GPA representative will be onsite at all times as scheduled accordingly).
Is this chargeable to the contractor?
(**No, it is not chargeable to the contractor for normal working hours).**
What about for outside of normal hours?
(**The outside of normal hours is chargeable)**

Q#2. We are requesting that GPA provide notice that the new T-7 is free of any damage that could delay the project. This includes bushings, gauges, marshalling cabinet, terminal blocks, etc.
(The Owner Furnished T-7 Transformer is free from damage per our inspection on 12/30/2022, see attached copy of packing list)
Will GPA be responsible for any damages or missing parts that may occur and discovered during assembly and installation of the power transformer?
(Yes, GPA should be responsible.)

Q#3. GPA informed that the nitrogen has been depleted from the main tank. Therefore, a leak has occurred and moisture may be present inside. What steps will GPA take to remedy this situation?
(GPA will not be taking any steps. The contractor will be performing dryout and heating/ degassing off oil. That is a step on installing oil into transformer.)

Q#4. Can GPA provide assistance for the vacuuming and oil filling of T-7 transformer?
(Yes, GPA can assist with the vacuuming and oil filling of the T-7 transformer; however, our vacuum equipment, pump, and oil storage tank are chargeable, including the labor)

Q#5. Please provide the specifications for the CT's, power cables, control wires and terminal blocks/shorting blocks.
[Please see the attached GPA Specification as follows:

- **For CTs, refer to E-057 (CT and test switch)**
- **For Wiring & Accessories, refer to 6.7 of E-029 (13.8 KV Switchgear)/E-030 (34.5 KV switchgear)**
- **For power cables, refer to E-001 (15KV Cable)/ E-045 (35 KV cable)**

Q#6. We are kindly requesting for a copy of the TP-7 breaker drawings to ensure that new CT's will fit to include the placement of terminal blocks.
GPA does not have a copy of TP-7 breaker/switchgear cubicle record drawing since it was only turnover by the Navy to GPA. We only have the attached copy of the TP-7 schematic diagram.
Also request for any as-built drawings for Piti Substation.
(We only have the attached copy of the Piti Substation record drawings.)

Q#7. Will power outage requests with Navy or Navy contractors be required?
(Power outage requests with the Navy maybe required which will be depends on the contractor's safety work assessment)
Is the winning contractor responsible for coordination and payment of charges?
Yes, it is the winning contractor that is responsible for coordination and payment of the charges with the Navy

Q#8. Are GPA power outages chargeable to the winning contractor?
(Yes, GPA power outages request are chargeable to the winning contractor only if extend the regular working hours)

Q#9. Forwarded herewith is a copy of Exemption letter from the Secretary of the Navy, we would like to know if this waiver of the UXO and MEC investigation is applicable to this project.
(The UXO and MEC exemption is not applicable. Please refer to Appendix V Exhibit 1 of the bid package for more details. The contractor will be responsible to coordinate with Navy in regards to this matter.

Q#10. In your Item 11L of Technical Specifications TS-4, page 109 or 1042, you have indicated Owner-Furnished Equipment and Materials, Section 16051 Owner-furnished Equipment and Materials – Can you please let us know what are these equipment and materials?
Please see the attached copy of the packing list and section 16051 Owner-Furnished Eqpt/Mat. and section 16355 (Power Transformer 34.5/13.8KV 30 MVA) for your reference

11. Does GPA plans to install air-conditioning unit on the substation building? Will this be part of this project?
(It is not part of the project.)

Note: The Tech. Spec sections 16051 and 16355 were reflected in TS-4, page 102 of 1042 of the bid package, unfortunately it's content were missing, that is why I attached these missing pages for contractor's reference.

Si Yu'os Ma'åse',

EDWIN R. BORJA
Guam Power Authority | Power to Serve
Engineering | Substation & Transmission
P.O. Box 2977 Hagåtña, GU 96932-2977
671.648.3006 | Fax 671.648.3167
erborja@gpagwa.com | www.guampowerauthority.com

From: Daniele Peter Reyes
Sent: Tuesday, July 29, 2025 11:39 AM
To: Edwin Borja
Cc: Irwin Loyola; Alexander Salomon; Dawn Fejeran
Subject: GPA-047-25 T-7 Transformer Replacement

Hafa Adai Edwin,

Kindly acknowledge receipt of inquiries received from bidder below in *red* for your office review and response. Thank you.

Best Regards,
Daniele Reyes
Buyer II
Guam Power Authority
Procurement Division
Telephone No.: 648-3054

From: Daniele Peter Reyes
Sent: Tuesday, July 29, 2025 11:17 AM
To: monito.co@bensonguam.com; Justina Merfalen; Dawn Fejeran
Cc: 'Hardy'; 'Perry Taladoc'; 'Perry Taladoc'
Subject: Re: GPA-047-25 T-7 Transformer Replacement - RFI

Hafa Adai,

This is to acknowledge receipt of inquiries below. A formal response shall be forthcoming. Thank you.

Best Regards,
Daniele Reyes
Buyer II
Guam Power Authority
Procurement Division
Telephone No.: 648-3054

From: monito.co@bensonguam.com <monito.co@bensonguam.com>
Sent: Tuesday, July 29, 2025 10:54 AM
To: Daniele Peter Reyes; Justina Merfalen; Dawn Fejeran
Cc: 'Hardy'; 'Perry Taladoc'; 'Perry Taladoc'
Subject: GPA-047-25 T-7 Transformer Replacement - RFI

CAUTION: This email came from an external source. Please do not click on links or open attachments from senders you do not trust.
Dan,

We have the following questions for subject project, please send us your response soonest:

1. Project location is inside Piti Substation. Therefore, access is controlled by GPA. Will a GPA representative provide the contractor access at all times? Will a GPA representative be onsite at all times? Is this chargeable to the contractor? What about for outside of normal hours?
2. We are requesting that GPA provide notice that the new T-7 is free of any damage that could delay the project. This includes bushings, gauges, marshalling cabinet, terminal blocks, etc. Will GPA be responsible for any damages or missing parts that may occur and discovered during assembly and installation of the power transformer?
3. GPA informed that the nitrogen has been depleted from the main tank. Therefore, a leak has occurred and moisture may be present inside. What steps will GPA take to remedy this situation?
4. Can GPA provide assistance for the vacuuming and oil filling of T-7 transformer?
5. Please provide the specifications for the CT's, power cables, control wires and terminal blocks/shorting blocks.
6. We are kindly requesting for a copy of the TP-7 breaker drawings to ensure that new CT's will fit to include the placement of terminal blocks. Also request for any asbuilt drawings for Piti Substation.
7. Will power outage requests with Navy or Navy contractors be required? Is the winning contractor responsible for coordination and payment of charges?
8. Are GPA power outages chargeable to the winning contractor?
9. Forwarded herewith is a copy of Exemption letter from the Secretary of the Navy, we would like to know if this waiver of the UXO and MEC investigation is applicable to this project.
10. In your Item 11L of Technical Specifications TS-4, page 109 or 1042, you have indicated Owner-Furnished Equipment and Materials, Section 16051 Owner-furnished Equipment and Materials – Can you please let us know what are these equipment and materials?
11. Does GPA plans to install air-conditioning unit on the substation building? Will this be part of this project?

Thanks much,
Monito
AYM International, Inc.
Email: monito.co@bensonguam.com
Cellphone: 671-687-2788

This email was scanned by Bitdefender Disclaimer Notice: The information contained in this communication is intended solely for the use of the individual or entity to whom it is addressed and others authorized to receive it. It may contain confidential or legally privileged information. If you are not the intended recipient you are hereby notified that any disclosure, copying, distribution or taking any action in reliance on the contents of this information is strictly prohibited and may be unlawful. If you have received this communication in error, please notify us immediately by responding to this email and then delete it from your system. Guam Power Authority is neither liable for the proper and complete transmission of the information contained in this communication nor for any delay in its receipt.

This email was scanned by Bitdefender Disclaimer Notice: The information contained in this communication is intended solely for the use of the individual or entity to whom it is addressed and others authorized to receive it. It may contain confidential or legally privileged information. If you are not the intended recipient you are hereby notified that any disclosure, copying, distribution or taking any action in reliance on the contents of this information is strictly prohibited and may be unlawful. If you have received this communication in error, please notify us immediately by responding to this email and then delete it from your system. Guam Power Authority is neither liable for the proper and complete transmission of the information contained in this communication nor for any delay in its receipt.

This email was scanned by Bitdefender Disclaimer Notice: The information contained in this communication is intended solely for the use of the individual or entity to whom it is addressed and others authorized to receive it. It may contain confidential or legally privileged information. If you are not the intended recipient you are hereby notified that any disclosure, copying, distribution or taking any action in reliance on the contents of this information is strictly prohibited and may be unlawful. If you have received this communication in error, please notify us immediately by responding to this email and then delete it from your system. Guam Power Authority is neither liable for the proper and complete transmission of the information contained in this communication nor for any delay in its receipt.

This email was scanned by Bitdefender Disclaimer Notice: The information contained in this communication is intended solely for the use of the individual or entity to whom it is addressed and others authorized to receive it. It may contain confidential or legally privileged information. If you are not the intended recipient you are hereby notified that any disclosure, copying, distribution or taking any action in reliance on the contents of this information is strictly prohibited and may be unlawful. If you have received this communication in error, please notify us immediately by responding to this email and then delete it from your system. Guam Power Authority is neither liable for the proper and complete transmission of the information contained in this communication nor for any delay in its receipt.