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

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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.

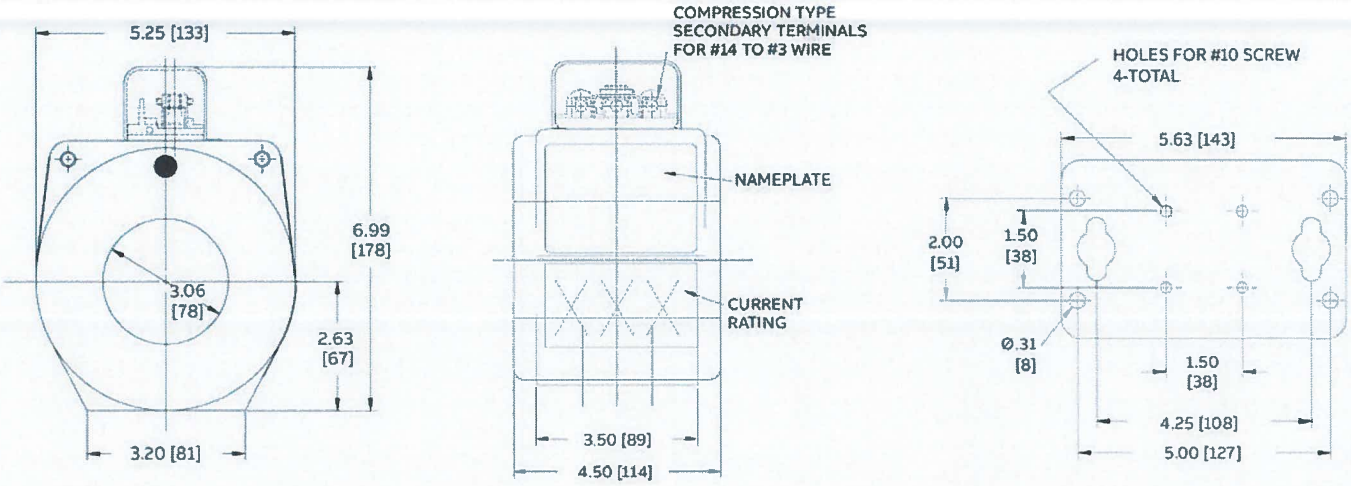
4.4 Once the bid is awarded, the vendor must submit final shop drawings to GPA for review and approval. GPA will have two (2) weeks to review and approve these documents without impacting the shipping schedule. Any delays in delivery caused by disapproved drawings during this review period will be the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

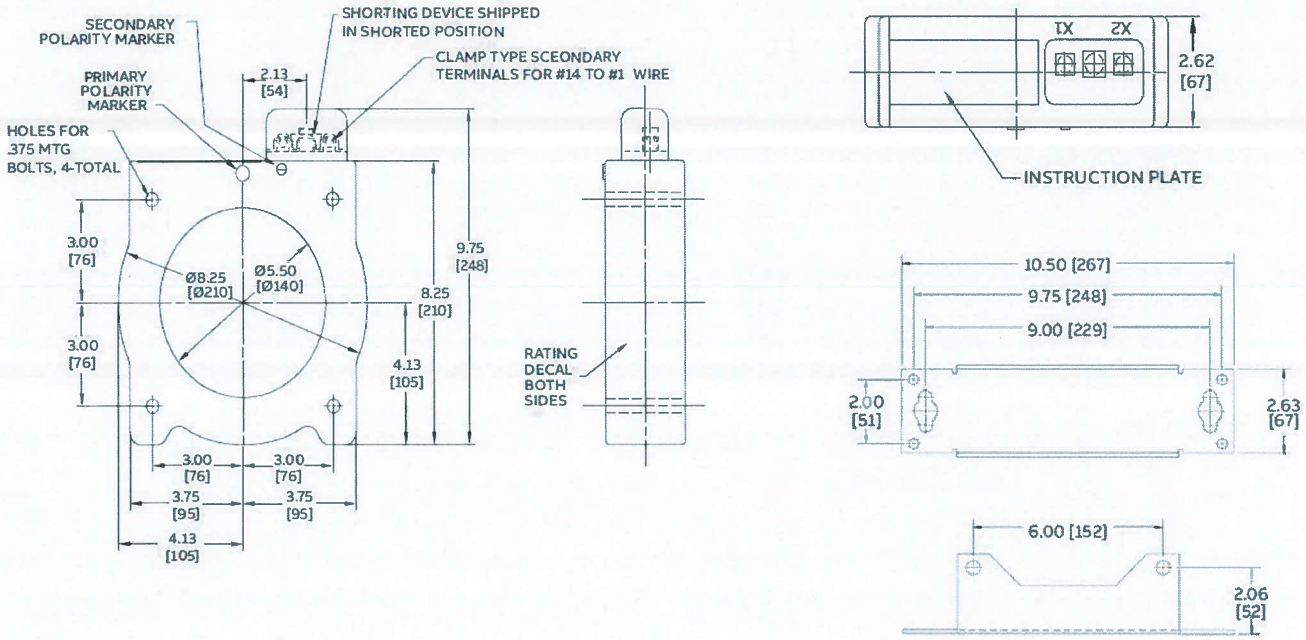
5.0 CURRENT TRANSFORMER DESIGN

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.

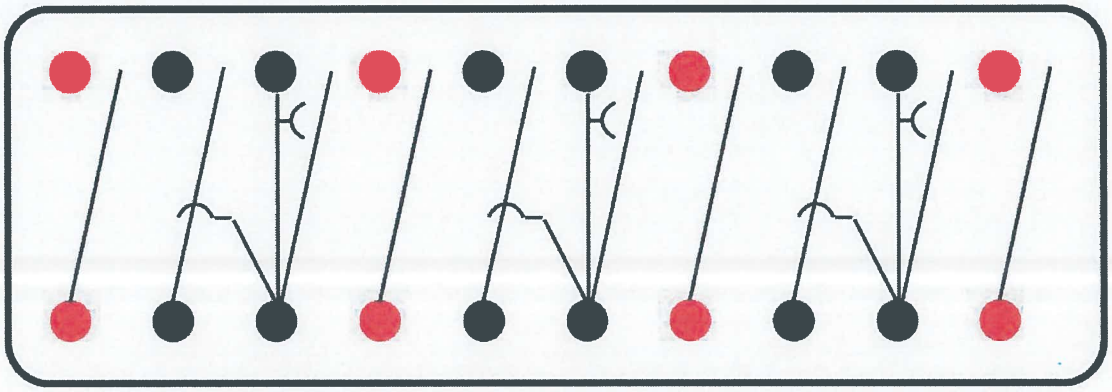
5.5.3 All units are built with a flat, corrosion-resistant aluminum base to ensure stability and long-term durability in diverse environments.

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

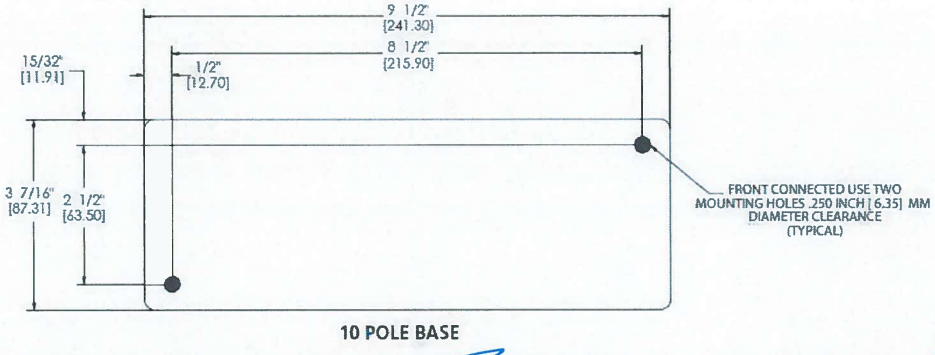
6.1 ILLUSTRATION

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