GUAM POWER AUTHORITY

Post Office Box 2977
Hagåtña, Guam 96932

TRANSMISSION AND DISTRIBUTION SPECIFICATION

Specification No. E-008

FOR

INSULATORS: SUSPENSION, VERTICAL TYPE, POST TYPE, SPOOL AND GUY-STRAIN

INSULATORS, SUSPENSION, VERTICAL TYPE, POST TYPE, SPOOL AND GUY-STRAIN

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1.0 SCOPE

This specification covers Guam Power Authority's requirement for the design and technical features of porcelain and polymer type insulators for the Overhead Distribution System at 13.8 kV and 34.5 kV.

2.0 SERVICE CONDITIONS AND OPERATION

The insulators 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.

3.0 CONFORMANCE TO SPECIFICATION REQUIREMENTS

3.1 Applicable Standards

The insulators shall be designed, manufactured and tested in accordance with the latest editions of the applicable, International Electrotechnical Commission (IEC), American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE) and National Electrical Manufacturers Association (NEMA).

NEMA/ANSI C29.13	Insulators – Composite Distribution Deadend Type
NEMA/ANSI C29.5	Wet-Process Porcelain Insulators – Low And Medium Voltage Types
NEMA/ANSI C29.4	Wet-Process Porcelain Insulators – Strain Type
NEMA/ANSI C29.3	Wet-Process Porcelain Insulators – Spool Type
NEMA/ANSI C29.11	Composite Insulators – Test Methods
IEC 61952	Insulators for overhead lines – Composite line post insulators for A.C. Systems with a nominal voltage greater than 1000 V – Definitions, testmethods and acceptance criteria.
IEC 62217	Polymeric HV insulators for indoor and outdoor use – General Definitions, test methods and acceptance criteria

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 Agreement 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 INSULATOR CLASS

4.1 Porcelain:

a. The insulators shall be made of good commercial grade wet process porcelain. The porcelain shall be uniform, high density with high dielectric and mechanical strength properties.

b. The entire surface that will be exposed after assembly shall be glazed free from imperfections. The standard color of the glaze shall be brown. The glaze shall be in compression form to substantially increase the strength of the insulator body, resist adherence of contaminating substances, and facilitate washing action of rain.

c. The sand band grip shall be bonded to the porcelain by glaze to provide a rough surface for permanently attaching the hardware and distributing load evenly through the porcelain from one part to the other. This high strength, compression sand shall be manufactured to match the characteristics of the porcelain body.

d. A resilient compound shall be applied between different components to serve as an elastic cushion to compensate for the different thermal coefficients.

e. The porcelain shall receive a severe electrical test before assembly to assure the soundness and a final electrical and mechanical test on the completely assembled unit before shipment, in accordance with Section 3.1.

4.2 Polymer:

a. Polymer insulators shall consist of a reinforced resin core, a sheath housing with weather sheds, and metal end fittings.

b. The insulator housing and sheds shall be made of non-tracking EPDM or Silicone Rubber.

c. The insulating body shall be chemically bonded together by high temperature and pressure.

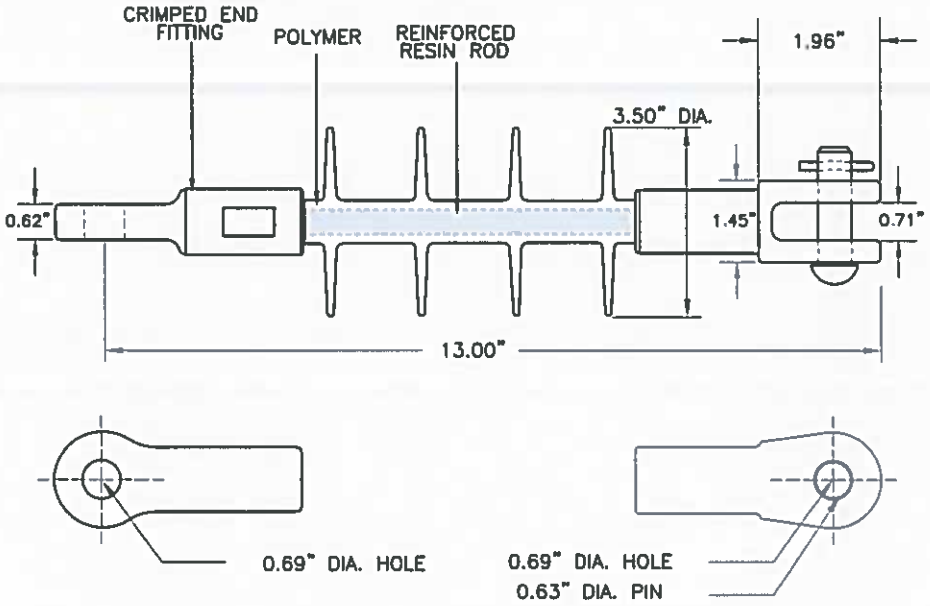
d. Sheds shall be of uniform or alternating diameters.

e. The insulation surface area shall be of controlled weathering to produce a self-cleaning action of reduced surface contamination and avoid tracking.

f. End fittings shall be made of forged steel hot dipped galvanized and joined by compression process unless otherwise stated.

5.0 DEADEND INSULATORS

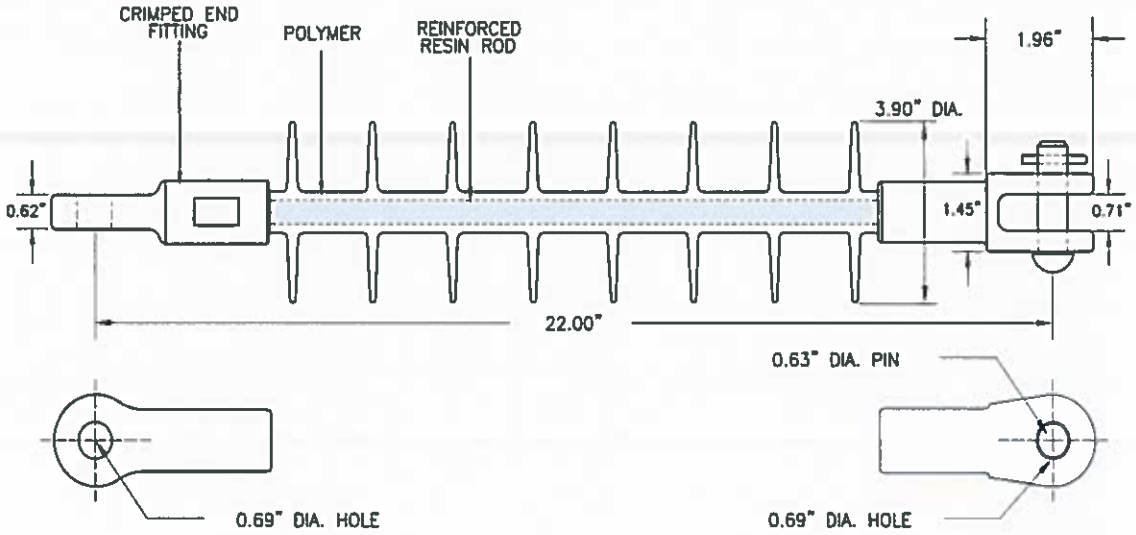
5.1 15 kV Deadend Insulator Technical Features and Rating:



INDEX NO. SSOI0776
(ARP ARP-15SKCE-S, ENERLINK CDI-DS-15 or equivalent)

a.	Phase to Phase Rating, kV	15
b.	Specified Mechanical Load, lbs.	15000
c.	Routine Test Load, lbs.	7500
d.	Leakage Distance, in.	16
e.	Dry Arc Distance, in.	7.40
f.	60 Hz Dry Flashover, kV	90
g.	60 Hz Wet Flashover, kV	65
h.	Critical Impulse Flashover Positive, kV	140
i.	Critical Impulse Flashover Negative, kV	150
j.	Tower End Fitting	Clevis
k.	Line Ending Fitting	Tongue
l.	Color	Grey
m.	Rod Diameter, in.	0.63
n.	Number of Sheds	4

5.6 35 kV Deadend Insulator Technical Features and Rating:

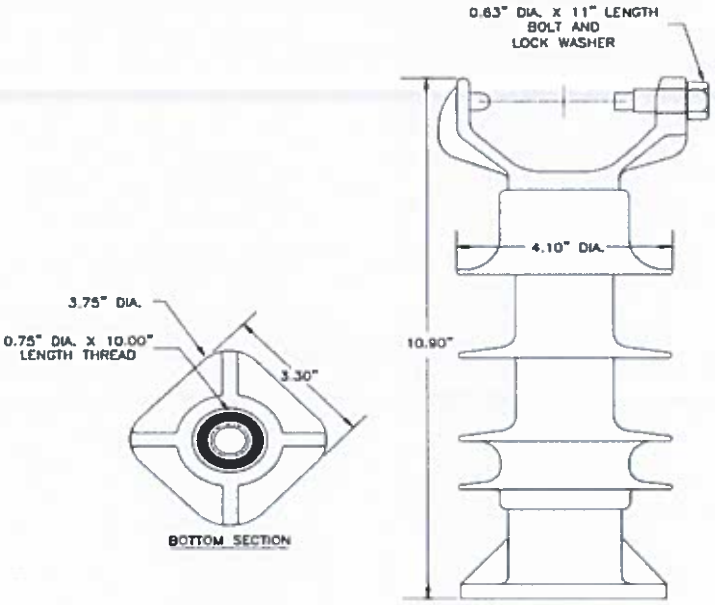


INDEX NO. SSOI0777
(MacLean Cat. No. DS-35M or equivalent)

a.	Phase to Phase Rating, kV	35
b.	Specified Mechanical Load, lbs.	15000
c.	Routine Test Load, lbs.	7500
d.	Leakage Distance, in.	36.5
e.	Dry Arc Distance, in.	15
f.	60 Hz Dry Flashover, kV	170
g.	60 Hz Wet Flashover, kV	140
h.	Critical Impulse Flashover Positive, kV	270
i.	Critical Impulse Flashover Negative, kV	275
j.	Tower End Fitting	Clevis
k.	Line Ending Fitting	Tongue
l.	Color	Grey
n.	Number of Sheds	8

6.0 VERTICAL LINE POST INSULATORS

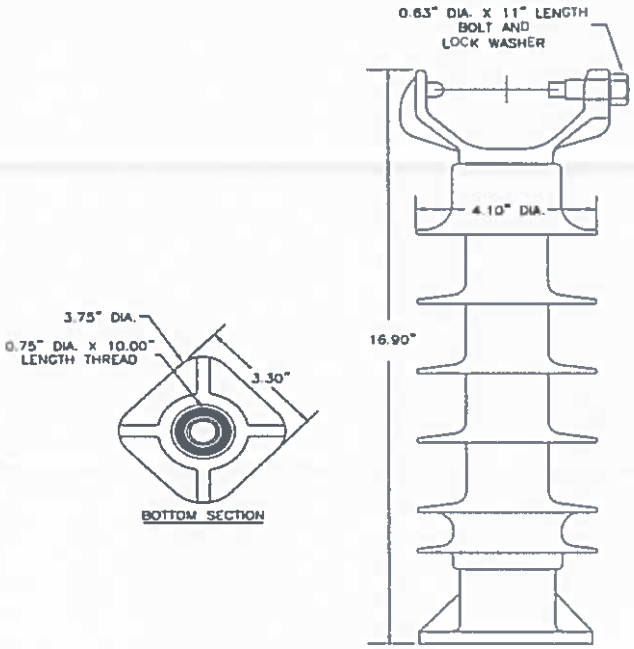
6.1 15 kV Vertical Line Post Insulator Technical Features and Rating:



INDEX NO. SSOI0783
(MacLean Cat. No. NPVN 10 XB 005 S0 or equivalent)

a.	Phase to Phase Rating, kV	15
b.	Maximum Design Cantilever Load	1200
c.	Maximum Design Tension	2500
d.	Tower End Fitting, Galvanized Ductile Iron	Stud Base
e.	Line End Fitting, Galvanized Ductile Iron	Vertical Clamp-Top Trunnion
f.	Number of sheds	4
g.	Leakage Distance, in.	16.1
h.	Dry Arc Distance, in.	8.3
i.	60 Hz Dry Flashover, kV	100
j.	60 Hz Wet Flashover, kV	55
k.	Critical Impulse Flashover Positive, kV	180
l.	Critical Impulse Flashover Negative, kV	215
m.	Rod Diameter, in.	1.50
n.	Mounting Stud	.075" x 10 Stud Base

6.2 35 kV Vertical Line Post Insulator Technical Features and Rating:



INDEX NO. SSOI0784
(MacLean Cat. No. NPVN 10 XB 006 S0 or equivalent)

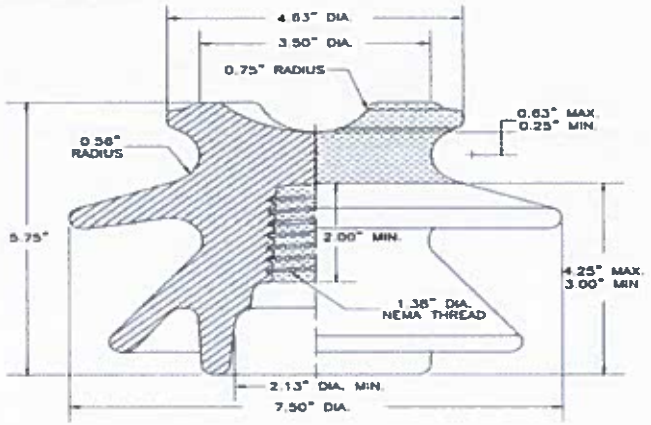
a.	Phase to Phase Rating, kV	35
b.	Maximum Design Cantilever Load	1200
c.	Maximum Design Tension	2500
d.	Tower End Fitting, Galvanized Ductile Iron	Stud Base / 90°
e.	Line End Fitting, Galvanized Ductile Iron	Vertical Clamp-Top Trunnion
f.	Number of sheds	8
g.	Leakage Distance, in.	22.4
h.	Dry Arc Distance, in.	13.2
i.	60 Hz Dry Flashover, kV	141
j.	60 Hz Wet Flashover, kV	122
k.	Critical Impulse Flashover Positive, kV	239
l.	Critical Impulse Flashover Negative, kV	309
m.	Rod Diameter, in.	1.50 min
n.	Mounting Stud	0.75" X 10 Stud Base

7.0 PIN TYPE INSULATOR FOR NEUTRAL

7.1 Thimble shall be made of zinc and made to be sure-fit for high voltage applications. A cork washer shall be installed to serve as a buffer between the top of the thimble and pin,and as a protection from shock for the porcelain.

7.2 The groove for the wire shall be symmetrically-rounded to prevent conductor abrasion and concentration of mechanical load. Ample space shall also be provided for ease in applying tie wires.

7.3 **Technical Features:**



INDEX NO. SSOI0714
(LAPP Insulators Cat. No. 8248R-70 or equivalent)

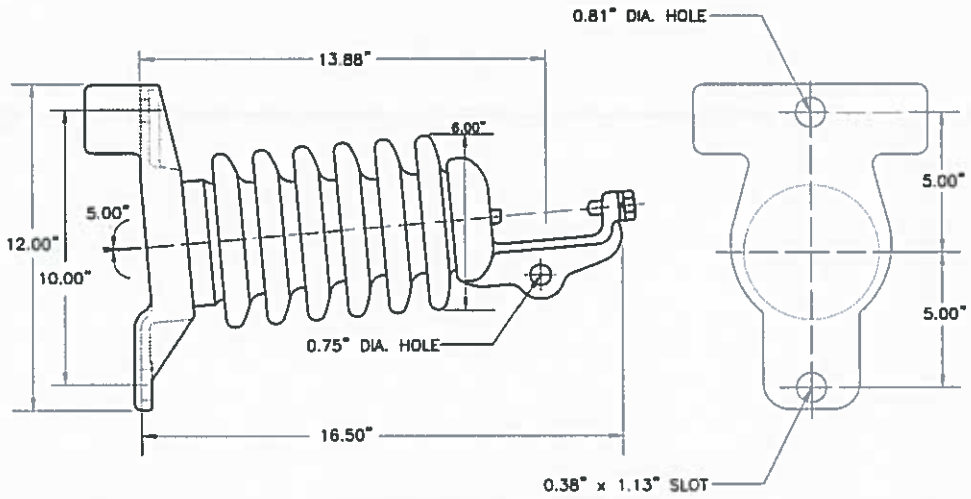
a.	Typical Voltage Class, kV	23
b.	Cantilever Strength, lbs.	2500
c.	Critical Impulse Flashover Positive, kV	150
d.	Critical Impulse Flashover Negative, kV	190
e.	60 Hz Dry Flashover, kV	95
f.	60 Hz Wet Flashover, kV	60
g.	60 Hz Puncture Voltage, kV	130
h.	Leakage Distance, in.	13
i.	Dry Arc Distance, in.	7
j.	Minimum Pin height, in.	6
k.	60 Hz Test Voltage, kV	15
l.	Maximum RIV at 1000 kHz, microvolts	100
m.	Maximum RIV at 1000 KC, Plain, microvolts	5500
n.	Maximum RIV at 1000 KC, Radio-Free, microvolts	50

8.0 POST TYPE INSULATOR:

8.1 The metal parts, except for the cotter pins, shall be made of good commercial grade malleable iron, or open hearth, or electric furnace steel, galvanized in accordance to ASTM A153/A153M-09 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware, or the latest revision thereof. Cotter pins shall be made of a suitable corrosion resistant and tampered material.

8.2 Caps shall be of corrosion resistant and heavy duty galvanized malleable material.

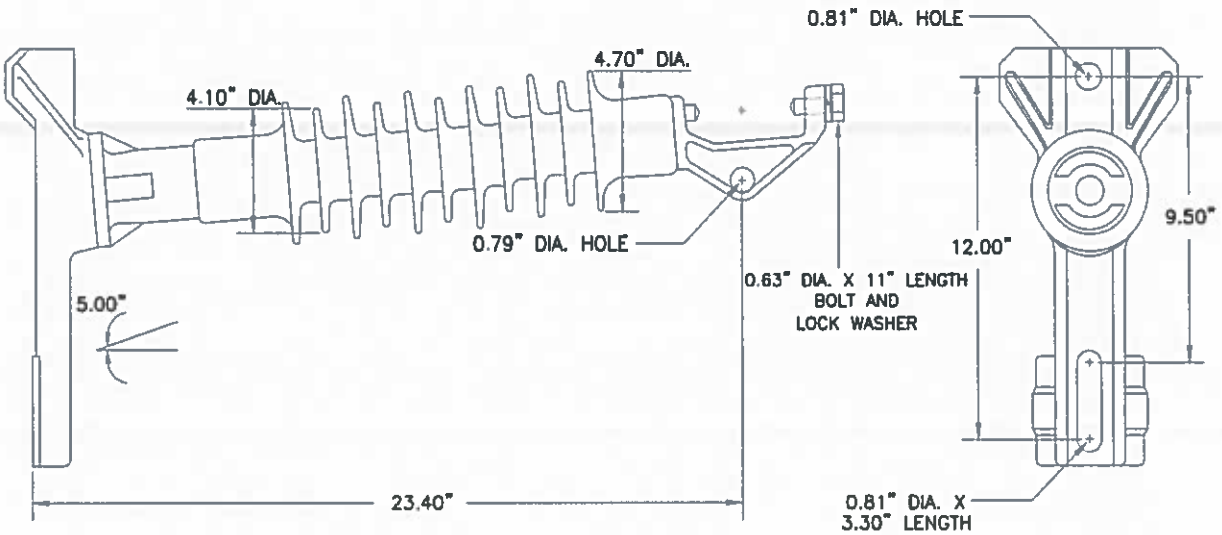
8.3 Porcelain Line Post Insulator Clamp Top Technical Features:



INDEX NO. SSOI0715
(LAPP Insulators Cat. No. 4735-70 or equivalent)

a.	Phase to Phase Rating, kV	35
b.	Critical Impulse Flashover Positive, kV	180
c.	Critical Impulse Flashover Negative, kV	205
d.	60 Hz Dry Flashover, kV	110
e.	60 Hz Wet Flashover, kV	100
f.	Cantilever Strength, lbs.	2800
g.	Specified Tensile Load, lbs.	5000
h.	Leakage Distance, in.	22
i.	Dry Arc Distance, in.	9.5
j.	Maximum RIV at 1000 kV, microvolts	100
k.	Test Voltage-RMS to Ground, kV	22

8.4 Polymer Line Post Insulator Clamp Top Technical Features and Rating:



INDEX NO. SSOI0717
(MacLean Cat. No. NPKG 20 XG O13 S0 or equivalent)

a.	Phase to Phase Rating, kV	35
b.	Maximum Design Cantilever Load, lbs	1200
c.	Maximum Design Tension, lbs	2500
d.	Tower End Fitting, Galvanized Ductile Iron	Gain Base GB-12 / 5°
e.	Line End Fitting, Galvanized Ductile Iron	Horizontal Clamp-Top Trunnion
f.	Mounting Angle, degrees	5
g.	Number of Sheds	11
h.	Leakage Distance, in.	32
i.	Dry Arc Distance, in.	14
j.	60 Hz Dry Flashover, kV	150
k.	60 Hz Wet Flashover, kV	125
l.	Critical Impulse Flashover Positive, kV	250
m.	Critical Impulse Flashover Negative, kV	300
n.	Rod Diameter, in.	1.75

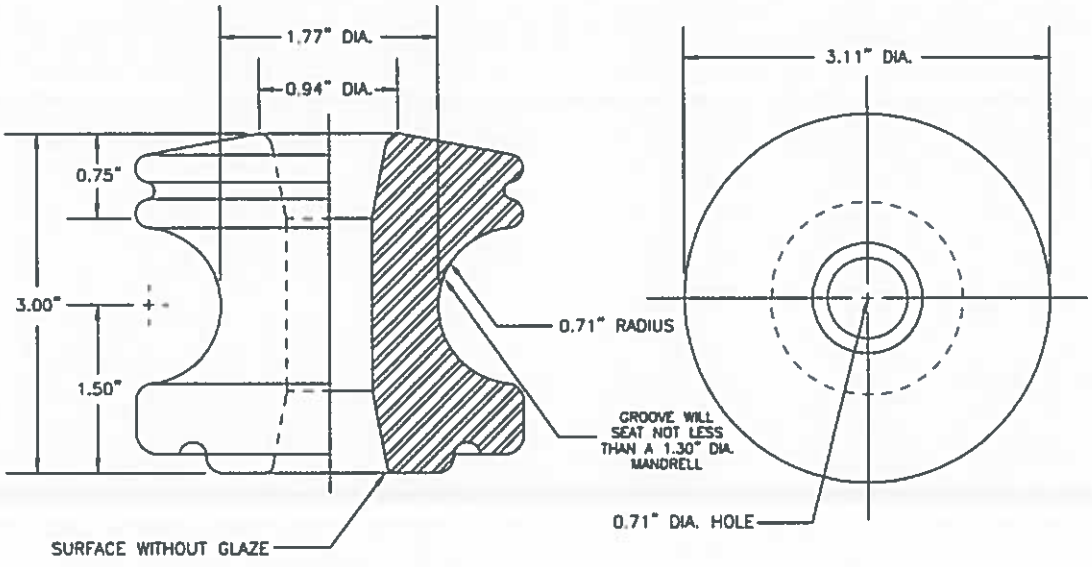
9.0 SPOOL TYPE INSULATOR

9.1 Insulators shall fit standard secondary racks, insulated clevis, insulator fork and bracket bolts commonly used for distribution service.

9.2 Insulators shall be symmetrical for even load distribution, and have rounded, heavy sections to protect against breakage.

9.3 Insulators shall have tapered ends and holes to safe guard against mechanical failure.

9.4 Technical Features and Rating:



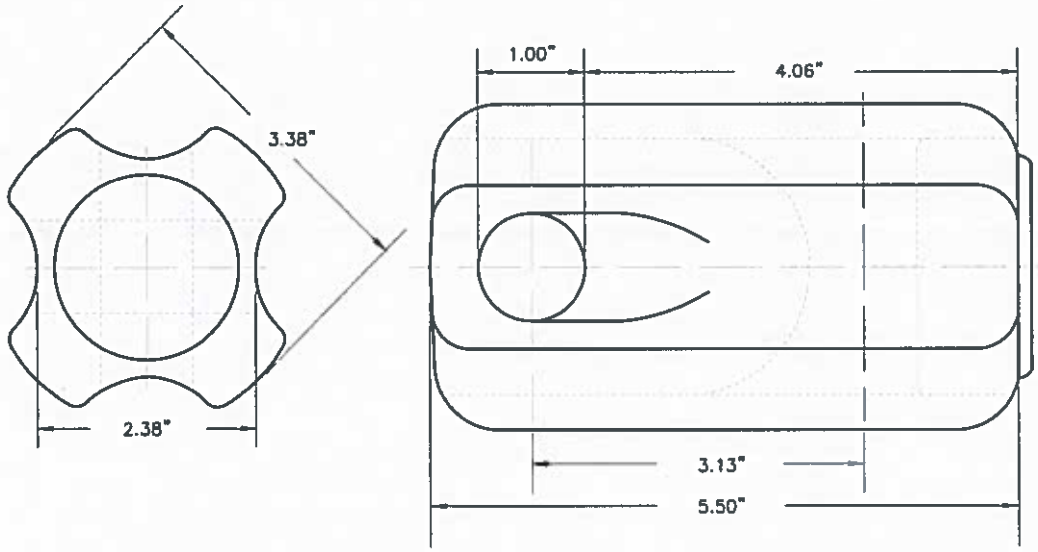
INDEX NO. SSOI0745
(LAPP Insulators Cat. No. 8442-70 or equivalent)

a.	Specified Tensile Load, lbs.	3000
b.	60 Hz Dry Flashover, kV	20
c.	60 Hz Wet Flashover Vertical, kV	10
d.	60 Hz Wet Flashover Horizontal, kV	12

10.0 GUY-STRAIN INSULATOR

10.1 Insulators shall be symmetrical for even load distribution, and have rounded, heavy sections to protect against breakage.

10.2 Technical Features and Rating:



INDEX NO. SSOI0772
(LAPP Insulators Cat. No. 8506-70 or equivalent)

a.	Specified Tensile Load, lbs.	20000
b.	60 Hz Dry Flashover, kV	35
c.	60 Hz Wet Flashover, kV	18
d.	Leakage Distance, in.	2.25
e.	Maximum Cable Diameter, in.	0.63

11.0 SHIPPING REQUIREMENTS

11.1. The Supplier shall pay particular attention to the proper packaging and bracing of the insulators to assure its safe arrival. Material and an equipment shall be placed and crated in suitable material to prevent damage and injury during shipment and handling operations.

11.2. All small parts and unit components shall be separately boxed or bundled to prevent damage due to rubbing of parts against another. Each item, boxed, bundled, or palletized, shall be plainly and individually identifiable for content according to item number, GPA P.O. Number, and Supplier's Identifying Number.

11.3. The insulators shall be securely blocked to prevent shifting during transit. When required, pallet banding straps shall be reinforced polymer bands that do not damage insulator surfaces.

11.4. Instructions for handling, shipping, packaging and storing shall be provided by the manufacturer to prevent damage, loss, deterioration, and substitution of materials and equipment.

11.5. 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.

12.0 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.