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PREPARED BY THE ENGINEERING DEPT.		

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

TRANSMISSION & DISTRIBUTION SPECIFICATION

SPECIFICATION NO. E-038

FOR

PADMOUNTED
DISTRIBUTION SWITCH
OUTDOOR, 600 AMPS, THREE PHASE

EFFECTIVE DATE: 6/20/01	ISSUED:	APPROVED:

PADMOUNTED
DISTRIBUTION SWITCH
OUTDOOR, 600 AMPS, THREE PHASE

TABLE OF CONTENTS

1.0 SCOPE

1.1 This specification covers GPA requirements for padmounted, outdoor switches to be used on the 13.8 kV 60-Hertz distribution system.

1.2 The switch is intended for use in tropical weather conditions with a corrosive sea air atmosphere, with wind strength of 155 MPH and subject to moderate and severe earthquakes.

2.0 APPLICABLE PUBLICATIONS

The equipment specified herein shall be designed, manufactured, assembled and tested in accordance with all applicable portions of ANSI C57.12.28, Article 710-21(e) of the National Electrical Code and all other applicable ANSI, IEC, IEEE, NESC and NEMA standards including the latest revisions with respect to material, design and tests.

3.0 DEVIATIONS AND NON-CONFORMANCE REQUIREMENTS

3.1 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 GPA.

3.2 Units received with deviations or non-conformances that are not acknowledged per Section 3.1 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 the specification.

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 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.

4.0 SUBMITTALS

4.1 Shop drawings indicating details of construction and the outline of all connectors shall be submitted to GPA Engineering for review and approval.

Information required includes:

a. Mounting dimensions
b. Connection diagrams

c. Weights
d. Nameplate

4.2 GPA shall be allowed two (2) weeks to review and approve drawings provided in Section 4.1 without affecting the shipping date. Delays in delivery due to drawings that are disapproved during this review period are the responsibility of the Supplier.

4.3 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.

4.4 Instruction books shall be furnished which shall contain the description of components, parts and accessories, detailed installation instructions, complete instructions covering operation and maintenance of equipment, complete replacement parts list.

4.5 At least one complete set of drawings and instruction books per switch shall be provided at the time of delivery.

5.0 CERTIFIED LABORATORY TEST REPORTS

Certified tests shall be conducted in accordance with applicable standards. The Supplier shall furnish two (2) copies of certified test reports for all tests covered by this specification to the GPA Manager of Engineering within two (2) weeks of delivery.

6.0 RATINGS

6.1 The switch rating requirements are as follows:

Nominal line to line voltage (kV)	14.4
Maximum line to line voltage (kV)	17
BIL (kV)	95
Continuous Current Rating (A)	600
Interrupting Current Rating (A)	600
Two-time duty cycle fault-closing Amperes, RMS Asymmetrical	22,400

6.2 The following switch diagrams are applicable. GPA shall specify the type required at the time of order.

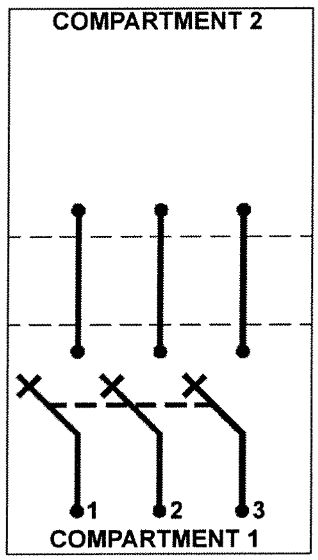

FIGURE 1

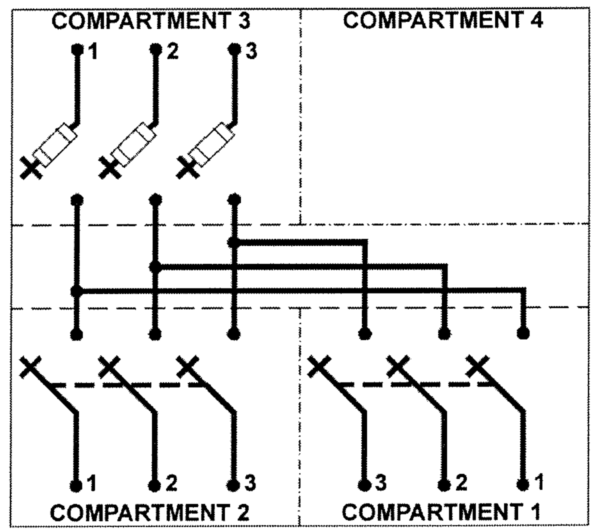

FIGURE 2

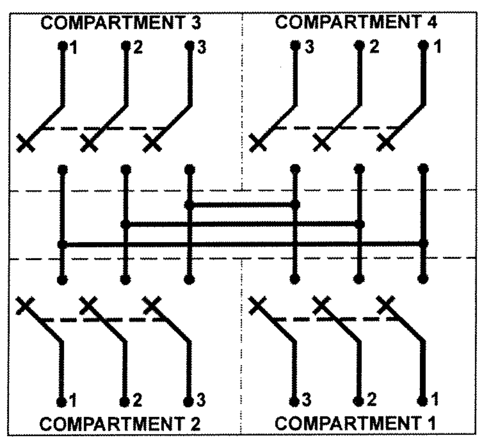

FIGURE 3

6.3 At the time of order, GPA shall provide the required dimensions of the switches to match existing concrete pads.

7.0 DESIGN

7.1 The switch shall be completely factory assembled as a single operational unit in a free standing and self-supporting enclosure. The switch enclosure shall contain interrupter switches, power fuses and all components necessary for operation.

7.2 The switch shall be designed and constructed in accordance with the minimum construction specifications of the fuse and switch manufacturer to provide adequate electrical clearances and adequate space for fuse handling.

7.3 Interrupter Switches

7.3.1 Interrupter switches shall have a two-time duty fault-closing rating equal to or exceeding the short-circuit rating of the pad-mounted gear. Tests substantiating the two-time duty-cycle fault-closing rating shall be performed at maximum voltage with current applied for at least ten cycles.

7.3.2 Interrupter switches shall be operated by means of an externally accessible ¾" hex switch operating hub. The switch-operating hub shall be located within a recessed stainless-steel pocket mounted on the side of the enclosure. The pocket shall include a padlockable stainless-steel access cover with a hood to prevent tampering. Stops shall be provided on the switch-operating hub to prevent overtravel and prevent damage to the interrupter switch quick-make quick-break mechanism. Labels indicating switch position shall be provided in the hub pocket.

7.3.3 Each interrupter switch shall have a folding switch-operating handle secured to the inside of the switch-operating hub pocket by a brass chain. The handle shall be stored behind the closed switch-operating hub access cover.

7.3.4 Interrupter switches shall utilize a quick-make quick-break mechanism installed by the switch manufacturer. The quick-make quick-break mechanism shall be integrally mounted on the switch frame and shall swiftly and positively open and close the interrupter switch independent of the hub speed.

7.3.5 Each interrupter switch shall be completely assembled and adjusted by the switch manufacturer on a single rigid mounting frame. The frame shall be of welded steel construction such that the frame intercepts the leakage path that parallels the open gap of the interrupter switch to positively isolate the load circuit when the interrupter switch is in the open position.

7.3.6 Interrupter switch contacts shall have stainless-steel springs to provide constant high contact pressure.

7.3.7 Interrupter switches shall be provided with a single blade per phase for circuit closing including fault closing, continuous current carrying, and circuit interrupting. Spring-loaded auxiliary blades shall not be permitted. Interrupter switchblade supports shall be permanently molded in place in a unified insulated shaft constructed of the same cycloaliphatic epoxy resin as the insulators.

7.3.8 Circuit interruption shall be accomplished by use of an interrupter that is positively and inherently sequenced with the blade position. The blade and interrupter shall not be able to come out of sequence. Circuit interruption shall take place completely within the interrupter, with no external arc or flame. Any exhaust shall be vented in a controlled manner through a deionizing vent.

7.3.9 Interrupter switches shall have a readily visible open gap when in the open position to allow positive verification of switch position

7.3.10 Ground studs shall be provided at all switch terminals, on the ground pad in each interrupter switch compartment and on the terminals and ground pad in any bus compartment. The momentary rating of the ground studs shall equal or exceed the short-circuit rating of the switch.

7.3.11 Base-mounted distribution-class surge arresters, metal-oxide type rated 12 kV shall be provided at all source switch terminals.

7.4 Insulators

The interrupter-switch and fuse-mounting insulators shall be of a cycloaliphatic epoxy resin system with characteristics and restrictions as follows:

7.4.1 Adequate leakage distance established by test per IEC Publication 507, First Edition, 1975.

7.4.2 Adequate strength for short-circuit stress.

7.4.3 The cycloaliphatic epoxy resin shall be homogeneous throughout each insulator to provide maximum resistance to power arcs. No change in mechanical or electrical characteristics shall take place because of arc-induced ablation. Any minor surface damage to insulators during installation or maintenance shall not be warrant insulator replacement.

7.5 High-Voltage Bus

7.5.1 Bus and interconnections shall consist of an aluminum bar of 56% IACS conductivity.

7.5.2 Bus and interconnections shall withstand the stresses associated with short-circuit currents up through the maximum rating.

7.5.3 Bolted aluminum-to-aluminum connections shall be made with a suitable number of 1/2"—13 galvanized steel bolts and with two Belleville spring washers per bolt, one

under the bolt head and one under the nut. Bolts shall be tightened to 50 foot-pounds torque.

7.5.4 Before installation of the bus, all electrical contact surfaces shall be prepared by machine abrading to remove any aluminum-oxide film. Immediately after this operation, the electrical contact surfaces shall be coated with a uniform coating of an oxide inhibitor and sealant.

7.6 Ground-Connection Pads

7.6.1 A ground-connection pad shall be provided in each compartment.

7.6.2 The ground-connection pad shall be constructed of 3/8" thick steel, nickel plated and welded to the enclosure. The ground-connection pad shall have a short-circuit rating equal to that of the switch.

7.6.3 Ground-connection pads shall be coated with a uniform coating of an oxide inhibitor and sealant prior to shipment.

7.7 Fuses

7.7.1 Fuses shall be disconnect style, solid-material power fuses, and shall utilize a fuse-unit-and-end-fitting construction. The fuse unit shall be readily replaceable.

7.7.2 Fusible elements shall be nonaging and nondamageable. Following a fuse operation, replacement of unblown companion fuses on suspicion of damage shall not be necessary.

7.7.3 Fusible elements for fuse units rated 10 amperes or larger shall be helically coiled to avoid mechanical damage due to stresses from current surges.

7.7.4 Fusible elements, that carry continuous current, shall be supported in air to help prevent damage from current surges.

7.7.5 Each fuse unit shall have a single fusible element to eliminate the possibility of unequal current sharing in parallel current paths.

7.7.6 Fuses shall have melting time-current characteristics that are permanently accurate to within a maximum total tolerance of 10% in terms of current. Time-current characteristics shall be available which permit coordination with protective relays, automatic circuit reclosers, and other fuses.

7.7.7 Fuses shall be capable of detecting and interrupting all faults down to minimum melting current, under all realistic conditions of circuitry, with line-to-line or line-to-ground voltage across the fuse, and shall be capable of handling the full range of transient recovery voltage severity associated with these faults.

7.7.8 All arcing accompanying operations shall be contained within the fuse, and all arc products and gases evolved shall be effectively contained within the exhaust control device during fuse operation.

7.7.9 Fuses shall be equipped with a blown-fuse indicator that shall provide visible evidence of fuse operation while installed in the fuse mounting.

7.7.10 Fuse-mounting jaw contacts shall incorporate an integral load interrupter that shall permit live switching of fuses with a hookstick.

(a) The integral load interrupter housing shall be of the same cycloaliphatic epoxy resin as the insulators.

(b) The integral load interrupter shall continuously be in the current path. Auxiliary blades or linkages shall not be used.

(c) Live switching shall be accomplished by a firm, steady opening pull on the fuse pull ring with a hookstick. No separate load-interrupting tool shall be required.

(d) The integral load interrupter shall require a hard pull to unlatch the fuse to reduce the possibility of an incomplete opening operation.

(e) Internal moving contacts of the integral load interrupter shall be self-resetting after each opening operation to permit any subsequent closing operation to be performed immediately.

(f) Circuit interruption shall take place completely within the integral load interrupter with no external arc or flame.

(g) The integral load interrupter and the fuse shall be provided with separate fault-closing contacts and current-carrying contacts. The fuse hinge shall be self-guiding and, together with the fault-closing contacts, shall guide the fuse into the current-carrying contacts during closing operations. Circuit-closing inrush currents and fault currents shall be picked up by the fault-closing contacts, not by the current-carrying contacts or interrupting contacts.

(h) Integral load interrupters for fuses shall have a one-time duty-cycle fault-closing capability equal to the interrupting rating of the fuse, and a two-time duty-cycle fault-closing capability of 13,000 amperes rms asymmetrical at 14.4 kV.

7.7.11 Fuse terminal pads shall be provided with a two-position adapter to accommodate a variety of cable-terminating devices.

7.7.12 Ground studs shall be provided at all fuse terminals. One ground stud shall also be provided on the ground pad in each fuse compartment. The momentary rating of the ground studs shall equal or exceed the short-circuit ratings of the switch.

7.7.13 Cable guides shall be provided to help orient cables at fuse terminals.

8.0 CONSTRUCTION

8.1 Enclosure

8.1.1 The enclosure shall be of unitized monocoque (not structural-frame-and-bolted-sheet) construction to maximize strength, minimize weight, and inhibit corrosion.

8.1.2 The basic material shall be 11-gauge hot-rolled, pickled and oiled steel sheet.

8.1.3 All structural joints and butt joints shall be welded, and the external seams shall be ground flush and smooth. The gas-metal-arc welding process shall be employed to eliminate alkaline residues and to minimize distortion and spatter.

8.1.4 To guard against unauthorized or inadvertent entry, enclosure construction shall not utilize any externally accessible hardware.

8.1.5 The base shall consist of continuous 90-degree flanges, turned inward and welded at the corners, for bolting to the concrete pad.

8.1.6 The door openings shall have 90-degree flanges, facing outward, that shall provide strength and rigidity as well as deep overlapping between doors and door openings to guard against water entry.

8.1.7 Enclosure top side edges shall overlap with roof side edges to create a mechanical maze which shall allow ventilation to help keep the enclosure interior dry while discouraging tampering or insertion of foreign objects.

8.1.8 A heavy coat of insulating "no-drip" compound shall be applied to the inside surface of the roof to minimize condensation of moisture thereon.

8.1.9 Insulating interphase and end barriers of NEMA GPO3-grade fiberglass-reinforced polyester shall be provided for each interrupter switch and each set of fuses where required to achieve BIL ratings. Additional insulating barriers of the same material shall separate the front compartments from the rear compartments and isolate the tie bus.

8.1.10 Full-length steel barriers shall separate side-by-side compartments.

8.1.11 Interrupter switches shall be provided with dual-purpose front barriers. These barriers, in their normal hanging positions, shall guard against inadvertent contact with live parts. When the switch is open, it shall be possible to lift the barriers out and insert them into the open gap. These barriers shall meet the requirements of Section 381G of the National Electrical Safety Code (ANSI Standard C2).

8.1.12 Interrupter switches shall be provided with window panels to allow viewing of the switch position without removing the dual-purpose front barriers. Window panels shall be removable to facilitate phasing and shall be secured to the enclosure with stainless-steel hardware.

8.1.13 Each fuse shall be provided with a dual-purpose front barrier. These barriers, in their normal hanging positions, shall guard against inadvertent contact with live parts. When the fuses are in the disconnect position, it shall be possible to lift these barriers out and insert them into the open gaps. These barriers shall meet the requirements of Section 381G of the National Electrical Safety Code (ANSI Standard C2).

8.1.14 The enclosure shall be provided with an instruction manual holder.

8.1.15 Lifting tabs shall be removable. Sockets for the lifting-tab bolts shall be blind-tapped. A resilient material shall be placed between the lifting tabs and the enclosure to help prevent corrosion by protecting the finish against scratching by the tabs. To further preclude corrosion, this material shall be closed-cell to prevent moisture from being absorbed and held between the tabs and the enclosure in the event that lifting tabs are not removed.

8.1.16 To guard against corrosion, the entire exterior of the enclosure shall be fabricated from 11-gauge Type 304 stainless steel.

8.1.17 Inner barrier panels that meet the Rural Electrification Association's requirements for "dead-front" and the requirements of Section 381G of the National Electrical Safety Code (ANSI Standard C2) shall be provided—one for each door opening providing access to high voltage. These panels shall be secured in place with recessed pentahead bolts. When so secured, they shall guard against inadvertent contact with live parts.

8.1.17 Doors shall be constructed of 11-gauge hot-rolled, pickled and oiled steel sheet.

8.1.19 Door-edge flanges shall overlap with door-opening flanges and shall be formed to create a mechanical maze that shall guard against water entry and discourage tampering or insertion of foreign objects, and allow for ventilation to help keep the enclosure interior dry.

8.1.20 Doors shall have a minimum of two extruded-aluminum hinges with stainless-steel hinge pins, and interlocking extruded-aluminum hinge supports for the full length of the door to provide strength, security, and corrosion resistance. Mounting hardware shall be stainless steel, and shall not be externally accessible to guard against tampering.

8.1.21 In consideration of controlled access and tamper resistance, each door shall be equipped with an automatic three-point latching mechanism.

(a) The latching mechanism shall be spring loaded, and shall latch automatically when the door is closed. All latch points shall latch at the same time to preclude partial latching.

(b) A pentahead socket wrench or tool shall be required to actuate the mechanism to unlatch the door and, in the same motion, recharge the spring for the next closing operation.

(c) The latching mechanism shall have provisions for padlocking that incorporate a means to protect the padlock shackle from tampering and that shall be coordinated with the latches such that it shall not be possible to unlatch the mechanism until the padlock is removed, and it shall not be possible to insert the padlock until the mechanism is completely latched closed.

8.1.22 Doors providing access to fuses shall have provisions to store spare fuse units.

8.1.23 Each door shall be provided with a zinc-nickel-plated steel door holder located above the door opening. The holder shall be hidden from view when the door is closed, and it shall not be possible for the holder to swing inside the enclosure.

8.2 Finish

8.2.1 Full coverage at joints and blind areas shall be achieved by processing enclosures independently of components such as doors and roofs before assembly into the unitized structures.

8.2.2 All exterior seams shall be filled and sanded smooth for neat appearance.

8.2.3 All surfaces shall undergo a thorough pretreatment process comprised of a fully automated system of cleaning, rinsing, phosphatizing, sealing, drying, and cooling before any protective coatings are applied.

8.2.4 After pretreatment, protective coatings shall be applied that shall help resist corrosion and protect the steel enclosure. To establish the capability to resist corrosion and protect the enclosure, representative test specimens coated by the enclosure manufacturer's finishing system shall satisfactorily pass the following tests:

(a) 4000 hours of exposure to salt-spray testing per ASTM B 117 with underfilm corrosion not to extend more than 1/32" from the scribe as evaluated per ASTM D 1645, Procedure A, Method 2 (scraping) and loss of adhesion from bare metal not to extend more than 1/8" from the scribe.

(b) 1000 hours of humidity testing per ASTM D 4585 using the Cleveland Condensing Type Humidity Cabinet with no blistering as evaluated per ASTM D 714.

(c) Oil resistance testing consisting of a 72-hour immersion bath in mineral oil with no shift in color, no streaking, no blistering, and no loss of hardness.

(d) 3000 cycles of abrasion testing per ASTM 4060 with no penetration to the substrate.

Certified test abstracts substantiating the above capabilities shall be furnished upon request.

8.2.5 After the finishing system has been properly applied and cured, welds along the enclosure bottom flange shall be coated with a wax-based anticorrosion moisture barrier for added corrosion resistance.

8.2.6 A resilient closed-cell material, such as PVC gasket, shall be applied to the entire underside of the enclosure bottom flange to protect the finish from scratching during handling and installation and to isolate the bottom flange from the alkalinity of a concrete foundation to help protect against corrosive attack.

8.2.7 After the enclosure is completely assembled and the components are installed, the finish shall be inspected for scuffs and scratches. Blemishes shall be touched up by hand to restore the protective integrity of the finish.

8.2.8 The finish shall be olive green, Munsell 7GY3.29/1.5.

8.3 To guard against corrosion, all hardware, all operating-mechanism parts, and other parts subject to abrasive action from mechanical motion shall be of either nonferrous materials, or galvanized or zinc-nickel-plated ferrous materials. Cadmium-plated ferrous parts shall not be used.

8.4 Nameplates and Labeling

8.4.1 The switch shall be provided with a permanent nameplate showing all of the required information, including the manufacturer's name, catalog number, model number, month and year of manufacture and serial number. The nameplate shall be mounted on the outside of each door.

8.4.2 A ratings label shall be mounted on the inside of each door indicating the following: voltage ratings; main bus continuous rating; short-circuit ratings (amperes rms symmetrical and Mva three-phase symmetrical at rated nominal voltage); the type of fuse and its ratings including duty-cycle fault-closing capability; and interrupter switch ratings including duty-cycle fault-closing and short-time (momentary, amperes rms asymmetrical and one-second, amperes rms symmetrical).

8.4.3 A three-line connection diagram showing interrupter switches, fuses with integral load interrupter, and bus along with the manufacturer's model number shall also be provided on the inside of each door and on the inside of each switch-operating-hub access cover.

8.4.4 Hazard-Alerting Signs

(a) All external doors shall be provided with "Warning—Keep Out—Hazardous Voltage Inside—Can Shock, Burn, or Cause Death" signs.

(b) The inside of each door shall be provided with a "Danger—Hazardous Voltage—Failure to Follow These Instructions Will Likely Cause Shock, Burns, or Death" sign. The text shall further indicate that operating personnel must know and obey the employer's work rules, know the hazards involved, and use proper protective equipment and tools to work on this equipment.

(c) Interrupter switch compartments shall be provided with "Danger" signs indicating that "Switches May Be Energized by Backfeed."

(d) Fuse compartments shall be provided with "Danger" signs indicating that "Fuses May Be Energized by Backfeed."

(e) Barriers used to prevent access to energized live parts shall be provided with "Danger—Keep Away—Hazardous Voltage—Will Shock, Burn, or Cause Death" signs.

9.0 QUALITY CONTROL

The Supplier shall have a quality control program to ensure compliance with the requirements of this specification. The program shall be documented and available for GPA's review if requested.

Documentation of the quality control program shall indicate where in the production and manufacturing process the quality checks are taken, describe the purpose of the checks, and describe the nature of the check, i.e. if check is visual only or if electrical or mechanical testing is used.

10.0 PACKING AND SHIPPING

10.1 The switch shall be placed and crated with suitable material to prevent damage and injury during shipment and handling operations.

10.2 The switch shall be securely blocked to prevent shifting during transit.

10.3 The Supplier shall have adequate work and inspection instructions for handling, interim storage, preservation, packaging, and shipping to protect the quality of the switch and prevent damage, loss, deterioration and substitution of products.