



Product Specifications for Phase Over Phase GOABS(r)

1. General

- a) This specification covers the design, manufacture, and shipment of phase-over-phase, 1-way, 2-way, 3-way, and 4-way, gang-operated disconnecting switches, both air-break and load-break, for transmission switching applications
- b) All switches furnished shall conform to all applicable IEEE, NEMA, and ANSI standards
- c) The switch manufacturer shall furnish all parts required to install a complete operating switch, including switch frames, operating mechanism, and equipment mounting hardware; insulators, if required, will be specified separately
- d) The pole structure, dead-end assemblies, guying and grounding materials, through bolts and miscellaneous pole line hardware will be provided by Others
- e) This equipment will be field assembled and installed by Others

2. Applicable Standards and Specifications

- a) The following standards shall form a part of this specification unless otherwise stated:

ANSI C29.9	Wet-Process Porcelain Insulators
ANSI C37.32	Schedules of Preferred Ratings, Manufacturing Specifications, and Application Guide for High Voltage Air Switches
ANSI C37.34	Test Code for High-Voltage Air Switches
ASTM 123	Zinc Coating (Hot Dip) on Iron and Steel Hardware
NEMA SG6	Power Switching Equipment
- b) All switches furnished shall be in accordance with the latest versions of the appropriate specifications.
- c) The switch shall be a SEECO type "G" or "GL", or approved equivalent.

3. Materials and Workmanship

- a) The equipment shall be new and of standard commercial, first-grade quality as to materials, workmanship, and design, in accordance with the best engineering practice, and shall be such as has been proven to be suitable for the intended purpose.
- b) All welding shall be done by welders experienced in the process to be used and in a manner evidencing good workmanship.

4. Environmental Conditions

- a) Temperature - Equipment supplied shall be adequate for an operating range of -40 degrees C to +55 degrees C
- b) Humidity - Equipment supplied shall be operated under humidity of up to 95% at a temperature of 40 degrees C
- c) Environment - Equipment supplied shall provide reliable performance in environments with high exposure to salt, minerals, chemicals, or windborne particulate
- d) Ice - Equipment supplied shall operate adequate with a build-up of 3/4" clear ice



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5. Ratings and Type

- a) Type - Switches shall be group operated side-break switches with an integral design (2-way and 3-way switches), mounted horizontal upright on aluminum support structures, in a phase-over-phase configuration
- b) Ratings - Switches shall meet or exceed the following ratings

Rated Voltage	15 kV through 230 kV
Rated Maximum Voltage	15.5 kV through 242 kV
Rated Frequency	60 Hz
Rated Continuous Current	600 Amp through 3,000 Amp
Rated Momentary Current	40 kA through 100 kA
Rated Withstand Voltage (BIL)	110 kV through 1050 kV

6. Switch Design and Construction

- a) Jaw Contacts
 - i) All jaw contacts shall be silver to copper and designed so that wiping action is provided with a minimum of roughening or wear on the silver spherical contacts
 - ii) The design of the jaw contacts shall be such that the resultant magnetic forces during short circuit will tend to hold the blade in the closed position and maintain contact pressure; blade locks or other latching devices are not permitted
 - iii) Switch contacts shall be the high pressure line contact type with a minimum of 100 lbs pressure on each silver contact
 - iv) Contact pressure shall be maintained by separate back-up spring members independent of the main current path. Contact members shall be independently adjustable for proper contact deflection
 - v) Wear of contacts shall not result in diminished contact performance due to reduction of contact pressure. The number and size of contact fingers shall be sufficient to ensure adequate transfer of rated current from the blade to the jaw
 - vi) All contacts shall be self-aligning and self-adjusting and designed to ensure firm positive contact
- b) Switch Blade
 - i) Each switch blade shall form one solid piece and shall be so assembled that no part of the blade can move relative to another
 - ii) Ends of switch blades shall be completely closed except for drain holes
 - iii) Rotating-blade switches which require blade locks or latching devices are not permitted



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- c) Terminal Pads
 - i) Terminal pads on each end of the switch shall be located at the same height above the insulator
 - ii) Terminal pads shall have flat, machined surfaces
 - iii) Terminal pads shall have NEMA standard 2-hole arrangement for 600 ampere switches and NEMA standard 4-hole arrangement for switches rated 1200 to 2000 amperes

- d) Switch Assembly
 - i) Switches of the same rating and design shall have interchangeable parts
 - ii) The switch shall be so designed that when installed, its operation will not be prevented by accumulated water, sleet, ice, snow, dirt, or other atmospheric contamination.
 - iii) Metal live parts shall be non-rusting and corrosion resistant. All current carrying parts shall be non-ferrous.
 - v) Live parts shall be designed to use at least three of the four mounting holes in the insulator or insulator adapter.
 - vi) Bolts, screws, and pins shall be provided with lock washers, keys, or equivalent locking facilities
 - vii) No part of the switch blade or jaw assembly, except arcing horns, shall project lengthwise beyond the terminal pads

- e) Switch Mechanism
 - i) The mechanism shall be so designed that all three phases are in positive continuous control throughout the entire operating cycle
 - ii) Each rotating insulator stack shall have double roller or double ball bearings in the base bearing assembly. Bearing housings shall be weatherproof. Open type bearing assemblies must be rustproof and non-corroding, and they shall be designed to completely drain water and moisture accumulation.
 - iii) All roller or ball bearings shall be greaseless or maintenance free type
 - iv) Rotating insulator stacks with 5" bolt circles (115 kV and greater) shall have leveling provisions at the base of each stack; rotating insulator stacks with 3" bolt circles (69 kV and below) may employ shims for alignment
 - v) All operating pipes shall be sufficiently rigid to maintain positive control under the most adverse conditions, including a heavily iced switch and operating mechanism.
 - vi) It shall be impossible, after proper and final adjustment has been made, for any part of the mechanism to be displaced sufficiently, at any point in the travel, to allow improper functioning of the switch when the switch is opened or closed at any operating speed
 - vii) All ferrous parts, except springs, shall be hot-dip galvanized in accordance with ASTM A153, latest revision



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- f) Operating Mechanism
 - i) The operating mechanism shall be positively toggled when the switch is closed to ensure correct, complete switch operation and to provide operating personnel with visual confirmation
 - ii) All vertical operating shafts shall be supported on ball or roller thrust bearings. Guides shall be provided on the vertical shaft at regular intervals to ensure proper operation.
 - iii) Switches rated 230 kV and below shall be furnished with a horizontal swing handle. Geared mechanisms shall be acceptable, if required, to ensure proper operation.
 - iv) Provision shall be made for padlocking the mechanism in the open or closed position.
 - v) A flexible copper braid shunt shall be provided on the operating mechanism for ground connections by Others

- g) Switch Frames (Support Structures)
 - i) The switch frames shall be an all aluminum design with welded or welded and bolted construction
 - ii) The frame material shall be structural grade aluminum, 6061-T6
 - iii) The frame tension rating shall be 10,000 lbs working load, and 16,500 lbs ultimate
 - iv) Angled pull-offs at the tap are permitted with de-rated tensions. Consult the manufacturer for a schedule of angles and tensions

- h) Arcing Horns
 - i) Switches will be supplied complete with high-speed, snap-out arcing horns for the interruption of limited amounts of line charging and transforming magnetizing currents
 - ii) Horns to be constructed from beryllium or stainless steel with appropriate mechanical and electrical attributes to maintain function throughout the life of the switch without degradation of spring characteristics
 - iii) Horn shall be of a tapered design to provide maximum tip speed
 - iv) Arcing horn assembly shall include a mechanical stop (snubber) to prevent return/rebound of the horn and possible re-strike

7. Insulators

- a) Switches will be supplied without insulators unless specified otherwise on customer's RFQ or manufacturer's proposal
- b) Insulators will be wet-process porcelain and conform to ANSI C29.8 and C29.9. Polymer style insulators can also be supplied at customer request; consult the manufacturer for guidance on appropriate applications
- c) Insulators supplied will be standard strength, ANSI 70 sky-tone gray unless specified otherwise on customer's RFQ or manufacturer's proposal



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8. Interrupters

- a) Switches requiring load interruption capability shall utilize a vacuum interrupter to interrupt current and to provide a confined arc when switching load, line charging or transformer magnetizing currents
- b) The interrupter unit shall be designed to ensure high speed interruption regardless of the operational speed of the switch
- c) When not being operated, the interrupter unit shall be out of the current path so that it is not subject to fault currents
- d) When the interrupter employs a dielectric to enhance the interrupting rating of the enclosed vacuum bottle, accidental loss or disposal of the dielectric shall not pose a risk to the health of utility personnel or the environment; SF6 is not acceptable as a dielectric

9. Pole Structures

- a) Switches may be mounted on pole structures of various types, including wood, laminated wood, concrete, or steel
- b) Switch pole structures must be adequate for the intended purpose, and designed for the specific loads and line tensions of the switching application; tangent type line structures are generally discouraged. Consult the switch manufacturer for general guidance, if in doubt
- c) Wooden poles, class H1 minimum recommended, are appropriate for switches 69 kV and below
- d) Engineered structures of steel, concrete, or laminated wood, designed for the anticipated load and line tensions, are recommended for switches rated 115 kV and up
- e) For engineered structures, the maximum resultant deflection with worse case ice and wind loads applied is 2% of the structure height above grade
- f) Pole structures must be sized for height to insure adequate clearance for grade to phase, phase to phase, and phase to shield dimensions. These dimensions vary with the voltage of the equipment. Consult the manufacturer for a schedule of voltages and dimensions.

10. Nameplates

- a) All switches shall be equipped with a non-corrosive nameplate in accordance with ANSI C37.30, permanently attached with stainless steel screws or rivets
- b) Nameplate shall include the appropriate catalog number, electrical ratings, and manufacturer's sales order number for proper and complete identification of the switch

11. Shipping

- a) Switches shall be shipped knocked-down to minimize transportation costs and facilitate handling and storage
- b) Switch live parts shall be completely assembled, and then broken down for shipment. For switches rated 69 kV and below, base bearings and sub-bases will be assembled and bolted into position on switch frames
- c) Operating pipe will be shipped unassembled and banded together
- d) All other switch components shall be shipped in a wooden crate
- e) All shipping units will carry a detailed packing slip with part number identification, associated drawing number and call out, and quantity count; packing slip will also provide the manufacturer's sales order number and customer purchase order number
- f) All switches and accessories shall be shipped FOB factory, freight prepaid and add unless otherwise noted