



# Type PVDB Outdoor Distribution Breaker Rated 15.5kV

## Guideform Specification

### 1.0 Scope

This specification covers the design, performance and rating of an Outdoor Vacuum Distribution Breaker rated 15.5kV.

### 2.0 Applicable Standards

The breaker shall meet applicable ANSI, NEMA and IEEE standards for AC High Voltage Circuit Breakers:

<u>ANSI Standard</u>	<u>Abbreviated Title</u>
C 37.04	Rating Structure
C 37.06	Preferred Rating/Capability
C 37.09	Test Procedures
C 37.10	Application Guide
C 37.11	Electrical Control
C 37.12	Guide Specification
C 57.13	Instrument Transformers
NEMA SG-4	High Voltage Breakers

### 3.0 Rating

- 3.01 The Type PVDB shall be three-phase, General Purpose, Outdoor, Oilless, AC, High Voltage and rated on a Symmetrical Current basis.
- 3.02 The rating and related required capability of the Type PVDB shall be as follows:
  - 3.02.1 Rated Maximum Voltage: 15.5kV RMS
  - 3.02.2 Rated Range Factor (K): 1.0
  - 3.02.3 Rated Frequency: 60 Hz
  - 3.02.4 Rated Interrupting Time: 5 cycles (3 cycles optional)
  - 3.02.5 Rated Dielectric Strength Withstand
    - 3.02.5.1 Dry 60 Hz Withstand (1 min): 50kV
    - 3.02.5.2 Wet 60 Hz Withstand (10 sec): 45kV
    - 3.02.5.3 Full Wave Impulse, Crest: (1.2 x 50 $\mu$ s): 110kV
    - 3.02.5.4 Chopped Wave Impulse, Crest 142kV/2 $\mu$ s, 126kV/3 $\mu$ s
- 3.03 Rated Continuous Current: 1,200A or 2,000A
- 3.04 Rated Short-Circuit Current: 20kA RMS or 25kA RMS
- 3.05 Maximum Symmetrical Interrupting Capability (3 Phase, L-L or L-Gnd): 20kA RMS or 25kA RMS.
- 3.06 Required Three Second Current Carrying Capability: 20kA RMS or 25kA RMS.
- 3.07 Required Closing and Latching Capability: 54kA or 68kA Crest, 32kA or 40kA RMS.
- 3.08 Asymmetry Factor (S): 1.1 for 5 cycle interruption or 1.2 for 3 cycle interruption.
- 3.09 Rated Capacitance Current Switching Capability
  - 3.09.1 Overhead Line: 2A RMS
  - 3.09.2 Isolated Current: 250A RMS 1200A RMS with optional dashpot
- 3.10 Rated Standard Duty Cycle: 0-0 sec -CO-15 sec -CO
- 3.11 Rated Reclosing Time: 20 cycles
- 3.12 Rated Permissible Tripping Delay (Y): 2 sec.
- 3.13 Temperature Limits per ANSI C 37.04 5.4.2
- 3.14 Ambient Temperature Limits -30°C to +40°C
- 3.15 Maximum Altitude 3300 ft. Derating required above 3300 ft.
- 3.16 Transient Recovery Voltage E2=29kV & T2=36 $\mu$ s for 15.5kV.

3.17 Radio Influence Voltage: 500  $\mu$ V @ 1,000k Hz (NEMA SG-4, Table 4-1)

3.18 An undervoltage trip device (48, 125, 250 VDC) is available as an option.

3.19 Control Voltages

3.19.1 The mechanism will be operated with motor charged, spring stored energy with control voltages available as follows:

3.19.1.1 Motor Voltages: 48, 125, 250 VDC or 120, 240 VAC

3.19.1.2 Close Voltages: 48, 125, 250 VDC or 120, 240 VAC

3.19.1.3 Trip Voltages: 48, 125, 250 VDC or 230 VAC (60 Hz) with Auto-Charged, Capacitor Trip Device, Type ST-230-3

3.19.1.4 Operating Control Voltage Range is per ANSI C37.06-1987, Table 9, for Outdoor Circuit Breakers

3.20 Seismic Capability - The standard breaker will have a seismic withstand capability of 0.2g static as defined in NEMA SG-4-3.18 for General Purpose Circuit Breakers.

3.21 Wind Load: 100 MPH sustained.

### 4.0 Bushings

4.01 Bushings are rated 110kV BIL (basic impulse initiation level) with a rated maximum line-to-ground voltage of 8.9kV.

4.02 The bushings shall be 25.0kV insulation class-external.

4.03 External creepage

4.03.1 Bushing creep is 17" minimum distance.

4.04 Bushing Design shall include space for mounting two CT's per bushing. See Section 5.0 for CT requirements.

4.05 The terminal end of the bushing conductor shall conform to ANSI C 57.19 to assure acceptance of standard cable terminals.

4.06 The bushing color will be ANSI 70, Munsell light gray.

4.07 Line pull will be per ANSI C37.04 6.2 (1).

### 5.0 Current Transformers

5.01 All bushing current transformers and Linear Couplers shall be removable without removing the bushings.

5.02 All CT or linear coupler secondary leads will be continuous to short-circuiting terminal boards and except for short lengths shall be protected by grounded metal or armored wire in the high voltage compartment.

5.03 Current Transformers will have "C" classifications and shall conform to ANSI C 57.13 and NEMA SG-4. Multiratio CT's shall have taps and tap designations per NEMA SG-4, Table 3-5.

5.04 The frequency rating shall be 60 Hz with an insulation class of 105°C minimum.

5.05 The continuous-thermal-current rating of all transformers shall be 1.33 minimum based on an outside ambient temperature of 30°C.

5.06 The short time mechanical and thermal rating will conform to the breaker interrupting rating.

5.07 The current transformer shall not reduce the dielectric withstand of the breaker when mounted on the breaker primary bushings.

5.07.1 Standard Relay Accuracy Class:

Full Turns Ratio	Accuracy Class
600/5	C100
1200/5	C200
2000/5	C400
3000/5	C400

5.07.2 Single Ratio Metering Accuracy Class

Ratio	Accuracy	
	Class	Breaker Rating
300:5A	0.6I30.5	1200 Ampere Only
400:5A	0.6I30.5	1200 Ampere Only
600:5A	0.6I30.5	1200 Ampere Only
800:5A	0.6I30.5	1200 Ampere Only
1200:5A	0.3I30.5	1200 Ampere and 2000 Ampere
1500:5A	0.3I30.5	1200 Ampere and 2000 Ampere
2000:5A	0.3I30.5	1200 Ampere and 2000 Ampere
3000:5A	0.3I30.5	1200 Ampere and 2000 Ampere

5.07.3 Linear couplers shall be available for 1200 amp and 2000 amp breakers.

5.07.4 Polarity shall be toward the external bushing terminals, unless specified otherwise.

## 6.0 Housing

- 6.01 The circuit breaker will be designed for convenient installation and to permit reasonable access to all parts for inspection, maintenance and adjustment.
- 6.02 All parts of the mechanism will be within the breaker weatherproof housing. The housing will be outdoors, vented, designed to be proof against driving rain or snow, insects, and vermin.
- 6.03 Heaters will be provided to minimize condensation within the housing. Two heaters, operated at one-half voltage, giving a total of 150 watt output will be furnished in each breaker.
- 6.04 Special consideration shall be given to the housing design to prevent loss of electrical continuity between critical parts (i.e., roof and housing to ground pad) due to aging, corrosion or painting of joints or attached panels. (See 6.08)
- 6.05 The breaking housing shall be protected with cathodic electrodeposition of epoxy paint with an additional exterior coating of light gray (ANSI 61) acrylic enamel. Color options include dark gray (ANSI 24), sky gray (ANSI 70) or Berkshire medium green.
- 6.06 The minimum clearance from the lowest live part of the bushing to the breaker is 8'6" minus zero plus 6 inches.
- 6.07 Housing support legs shall be available in nominal heights of 12, 18 standard, 24, 30 and 36" and shall have provision for anchoring to the foundation pad.
- 6.08 The housing shall have two copper boss ground pads, located diagonally at the bottom of the housing, each capable of carrying full short-circuit capability. Each boss shall accommodate terminals for 1/0 to 300MCM cables. An electrical conducting path from roof to ground pad is mandatory.
- 6.09 A manual pull-to-trip device is located external to the housing with suitable labeling. A manual reset must be actuated before the breaker can subsequently be operated.
- 6.10 Provisions will be made to padlock the doors of the low voltage compartments.

## 7.0 Interrupting Module

- 7.01 The interrupting assembly and mechanism module will be fixed (bolted in) in the Housing Assembly but arranged so as to be removable as a unit for maintenance or replacement if desired.
- 7.02 A mechanically actuated operation counter, a close/open indicator, a charged/discharged indicator, and a nameplate will be visible through a window in the low voltage compartment door.
- 7.03 A primary contact erosion indicator will be provided for ease of visual inspection to determine contact wear.
- 7.04 Means for measuring and adjusting the primary contact wipe and gap shall be available.
- 7.05 The mechanism shall have provision for mounting of a keylock or padlock to lock the breaker trip-free.
- 7.06 A means shall be provided for slow-closing the breaker mechanism during maintenance operations.

## 8.0 Protection, Indication and Control (PIC)

- 8.01 All PIC devices and terminal blocks shall be mounted within the weatherproof low voltage compartment.
- 8.02 A hinged panel shall be provided behind a weather-proof door for mounting the protective relay package. This panel, when swung open, shall provide easy access to the wiring terminals of the relays and to related terminal boards. Stops will be provided to hold these panels in the opened position.
- 8.03 Space shall be available for relays as specified by customer order. As a minimum, space shall be available for mounting the following items:
  - 5 - protective relays — S1 or C1 case
  - 1 - reclosing relay — S2 case
  - 1 - thermal demand ammeter
  - 3 - GE Type AB40 AC Ammeters
  - 2 - SBM or SB1 type switches
  - 2 - PK-2 test blocks — 4 point or 6 point
  - 3 - ET-16 indicating lights per switch
  - 1 - toggle switch for reclosing relay, if required
  - 1 - 120VAC duplex receptacle and ground fault interrupter
- 8.04 Provision shall be made for mounting auxiliary control power devices, auxiliary relays, control wiring terminal blocks and fused pull-out disconnects.
- 8.05 All control wiring shall be 600 volt insulation; oil, water and flame resistant, #14awg copper stranded wire. Current transformer lead wires shall be #10awg copper stranded.
- 8.06 Standard wire terminations shall be locking spade compression type.
- 8.07 Optionally, an incandescent lamp and control switch shall be mounted in the low voltage compartment to illuminate the auxiliary device panel and interrupter mechanism.
- 8.08 A pocket will be provided to store prints, instruction books, etc. on the low voltage compartment door. Provision will be made to mount maintenance tools on the same door.
- 8.09 In addition to the auxiliary switch contacts provided on the mechanism (2 "a" and 2 "b") for customer use, an optional stationary mounted auxiliary switch is offered with 6 stage/12 contacts (6 "a" and 6 "b"), or a 3 stage/6 contacts (3 "a" and 3 "b"), or 10 stage/20 contacts (10 "a" and 10 "b").



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GIZ-3116B 0195 BL