

SUBSTATION VACUUM CIRCUIT BREAKER (25.8 / 27KV)

For more than four decades, Myers Power Products has led the switchgear market in quality for the electric industry, delivering highly reliable products for utilities and other high demand industries. By combining the latest developments in circuit breaker technology with world-renowned quality, the Powersub™ Type FVR Vacuum Substation Circuit Breakers from Myers Controlled Power are the most advanced medium-voltage circuit breakers available.

Part 1: General

This specification applies to an outdoor, three pole, single throw, free standing, 25.8 / 27 kV vacuum circuit breaker.

A. References

- ANSI/IEEE C37.20.2 - Standard for Metal-Clad and Station-Type Cubicle Switchgear.
- ANSI/IEEE C37.04 and .06 - Standard ratings and preferred ratings for Class S2 Outdoor AC Medium-Voltage Circuit Breakers.
- ANSI/IEEE C37.11 - Requirements for electrical control for AC High-Voltage Circuit Breakers rated on a symmetrical current basis or a total current basis.
- ANSI/IEEE C37.09 - Standard Design and Production Testing
- ANSI Z55.1 - Gray Finishes for Industrial Apparatus and Equipment.
- ANSI/IEEE C57.13 - Requirements for Instrument Transformers.
- NEMA SG4 - Alternating Current High Voltage Circuit Breakers.

B. Submittals

Submit shop drawings indicating outline dimensions, enclosure construction, shipping splits, lifting and supporting points, electrical single line diagram, and equipment electrical ratings.

C. Operation and Maintenance Data

Include circuit breaker recommended spare parts list.

D. Quality Assurance

Qualified manufacturer shall be a company specializing in medium voltage substation vacuum station breakers with at least five years documented experience. The breaker shall be manufactured in a facility that is Quality Systems Registered by Underwriters Laboratories, Inc. to ISO 9001.



E. Delivery, Storage, and Handling

The items below apply to the **installing contractor only**.

- Accept equipment on site and inspect for shipping damage.
- If circuit breaker is stored before being put into operation, protect equipment from weather and moisture. Maintain heat within enclosure in accordance with manufacturer's instructions.

Part 2: Products

A. Manufacturers

The vacuum station breakers shall be manufactured by Myers Controlled Power.

B. Station Breaker Ratings

The breaker shall meet the following ratings and electrical characteristics:

| Characteristic | Rating | |
|---|---|----------|
| Required Maximum Voltage | 27kV, RMS | |
| Insulation Level (BIL) | 125KV | 150KV |
| Low Frequency, RMS (Dry, 1 Minute) | 60kV | 80kV |
| Impulse Crest, RMS (Fullwave) | 125kV | 150kV |
| Impulse Crest, RMS (Chopped Wave, 2 Microsec.) | Not Required | Optional |
| Impulse Crest, RMS (Chopped Wave, 3 Microsec.) | Not Required | Optional |
| Rated Continuous Current | []* Amps (Specify 600, 1200, or 2000.) | |
| Rated Short Circuit Current | []*kA, RMS (Specify 8, 12.5, 16, 18, 20, 25, or 31.5) | |
| Rated Interrupting Time | 3 cycles | |
| Rated Reclosing Time | 18 cycles (**) | |
| Rated Permissible Tripping Delay, Y | 2 seconds | |
| Max. Symmetrical Interrupting Current | []* kA, RMS | |
| 3-Second Short Time Current Rating | []* kA, RMS | |
| Duty Cycle | O - .300s – CO – 15 s - CO | |



| Characteristic | Rating |
|--------------------------|--|
| Closing Control Voltage | [] V (DC)(AC) (Specify 48,125,250VDC or 120,240VAC) |
| Tripping Control Voltage | [] V (DC)(AC) (Specify 24,48,125,250VDC or 120,240VAC) |
| Motor Voltage | [] V (DC)(AC) (Specify 48,125,250VDC or 120,240VAC) |
| Heater Voltage | [] VAC (Specify 120 or 240VAC) |

(*) – Refer to rating selection table below.

(**) – If system application requires 20 cycles, user to specify an auxiliary timing relay

C. FVR Circuit Breaker Rating Selection Table

| kV | | Ka, RMS | |
|------------|-----------------------|---|------------------------|
| BIL | Cont. Current | Short Circuit, 3-Second & Sym. Interrupt. | Close and Latch (peak) |
| 125 or 150 | 600A, 1200A, or 2000A | 8 | 32 |
| | | 12 | 32 |
| | | 16 | 43 |
| | | 18 | 48 |
| | | 20 | 54 |
| | | 25 | 68 |
| 150 | 1200A, or 2000A | 31.5 | 85 |

- The breaker shall be rated for an ambient temperature range of –30 degrees to +40 degrees Celsius. A -50 degrees to +40 degrees Celsius rating is optional.
- The breaker shall be rated for Seismic Zone 4.
- The breaker shall be rated to withstand a wind load of 90 mph imposed upon the structure supporting the terminal connection. A 150mph rating is optional.

- The breaker shall be rated for use at altitudes up to 3300 ft. above sea level without de-rating. For altitudes higher than 3300 ft., the rated dielectric strength and rated maximum voltage and current shall be multiplied by altitude correction factors to obtain values at which applications may be made.

D. Fabrication

Mechanical construction requirements are as follows:

- For continuous current ratings of 2000A and below, the enclosure shall be “ARC-RESISTANT” design, based on EEMAC standards.
- The enclosure shall be weatherproof and designed in a modular construction isolating line potential components from secondary control devices.
- The high voltage compartment shall house the vacuum interrupter assemblies supported on standoff insulators.
- The enclosure shall be provided with lifting eyes for lifting the entire unit during loading and unloading.
- The breaker shall be shipped completely assembled. Breakers shall not be shipped with legs unattached.
- Ground pads, 2”x 3.5” with provisions for NEMA 2-hole connectors, shall be welded on each side of the enclosure for external ground connections. #4 cables from the roof and HV & LV compartments shall be connected internally to the ground pads to insure a solidly grounded enclosure, with negligible difference in ground potential between compartments. Enclosure grounding shall not depend on bolted connections or “star washers”.
- The breaker legs shall be painted and have an adjustable height range of 24 inches for 125kV BIL enclosures and 21 inches for 150kV BIL enclosures. Height adjustments shall be in three inch increments. Total height of breaker shall vary from 101.88” minimum to 125.88” maximum for the 125kV BIL enclosures and from 105.25” minimum to 126.25” maximum for 150kV BIL enclosures.
- Leg assemblies shall have a galvanized base channel.
- Outer doors shall have padlockable handles for preventing access to all controls in the enclosure. Doors are to be gasketless and vertically hinged. Provisions for holding all doors in the open position 180 degrees on the 125kV BIL breaker and 160 degrees on the 150kV BIL breaker shall also be provided. It shall be documented that the breaker passed rain testing.
- The low voltage cabinet bottom shall have an 8” x 14” removable cover for entrance of user’s control conduit. Conduit entry location shall be clearly marked on detail drawings.
- All external hardware shall be stainless steel.

E. Components

E.1 Interrupter

- The vacuum interrupters shall be hermetically sealed in high vacuum, protecting contacts from moisture and contaminated atmosphere.
- The interrupters shall be rated for $K = 1.0$ duty.
- The interrupters shall be maintenance free.
- Circuit breaker shall have readily accessible provisions for measuring the contact wear for each pole.

E.2 Operating Mechanism

- The mechanism shall be spring-charged stored-energy with electrical charging motor.
- The mechanism and control circuits shall be located in the low voltage compartment. The mechanism shall not be mounted in a separate housing.
- The mechanism shall be designed with an integral, manual charging handle. Charging handle shall not be removable.
- The mechanism shall be mechanically and electrically trip free and non-pumping for both manual and automatic operations.
- The following shall be clearly visible on the mechanism when the outer door is closed:
 - A non-resettable, mechanical 5-digit operation counter which increases on each trip operation
 - A mechanical indicator to indicate the open and closed positions of the circuit breaker.
 - A mechanical indicator to indicate the status of the closing springs.
 - Open and close push-buttons for operating the breaker.
- The standard design shall have a 12 contact auxiliary switch, of which five with DC control and six with AC control, are used for internal breaker wiring. When specified, an additional auxiliary switch with six "a" and six "b" contacts shall be provided for external use.
- The mechanism shall be designed with a latch-check switch as standard.
- When specified, the mechanism shall be equipped with a dual-trip coil.

E.3 Bushings

- Six (6) roof bushings shall be provided. The material shall be porcelain and ANSI # 70 light gray in color.
- Bushing terminals shall be threaded stud type and capable of accepting either 4-hole NEMA stud to flat connectors (Type FD) or stud to cable connectors (Type NDR). Connectors shall be sized per user's cable size and # of cables per phase.
- Bushings shall have a minimum rating of 27kV, 125kV BIL or 150kV BIL. Minimum bushing creepage distance shall be 24.5" for 125kV BIL and 27.25" for 150kV BIL.

- When specified, 5-tap, multi-ratio current transformers shall be supplied for each bushing. Ratio and accuracy are to be determined by the user. All secondary leads shall be terminated on short-circuit type terminal blocks in the low voltage compartment and can be accessible at all times with the breaker energized.
- Each bushing shall be capable of mounting three standard-accuracy, two double-accuracy, or one triple-accuracy 1200:5 multi-ratio CT.

E.4 Controls

- Control wire shall be #14 AWG Type SIS for general control and #12 AWG Type SIS for CT circuits. Wire color shall be gray.
- Terminal blocks for control circuits and user's external connections shall be provided with terminal marking strips labeled in accordance with the wire diagrams.
- When required, short circuit terminal blocks shall be provided with shorting screws and common shorting bar for each individual current transformer.
- Control circuit shall be provided with fused switches or low voltage circuit breakers for disconnecting external low voltage supply circuits.
- An anti-pump relay shall be provided to inhibit multiple close-open operations in the event that a continuous close signal is applied.
- One pistol grip control switch, Electroswitch Series 24, engraved TRIP-CLOSE shall be supplied.
- Red and green indicating lamps for closed or open status of the breaker shall be supplied.
- Space heaters, rated 240VAC, shall be supplied to prevent moisture condensation in the breaker enclosure. Heaters shall be thermostatically controlled and located in the low voltage compartment. The heater control circuit shall be provided with fused switches or low voltage circuit breakers for disconnecting external low voltage supply circuit.
- An emergency manual trip, ANSI Device Number 69, shall be provided and shall be readily accessible on the exterior mechanism side of the breaker. It shall be labeled "MANUAL TRIP OPEN" and the actuating handle shall be painted red. The device shall be operable from the exterior of the breaker without the necessity of opening any doors, panels, etc. Actuation of the device will block any electrical closing of the breaker until the switch has been manually reset.

E.5 Factory Finishing

The enclosure shall be painted ANSI #70 light gray with a TGIC polyester powder coat protective paint finish. Total paint thickness on exterior surfaces shall be 3.0 mils. Production samples shall have passed 2,500 hours minimum of salt spray testing per ASTM B-117 and ASTM D-1654 Procedure 'A' with a rating of six or higher.

Part 3: Execution

A. Examination

- Visually inspect circuit breaker for evidence of damage and verify that surfaces are ready to receive work.
- Visually inspect to confirm that all items and accessories are in accordance with specifications and drawings.
- Verify field measurements are as [shown on drawings] [shown on shop drawings] [instructed by manufacturer].
- Verify that required utilities (e.g., control voltage for heater circuits on outdoor switchgear) are available, in proper location, and ready for use.
- Beginning of installation means installer accepts existing surface conditions.

B. Installation

Install in accordance with manufacturer's instructions, applicable requirements of the NEC and in accordance with recognized industry practices.

C. Field Quality Control

- Field inspection and testing will be performed by [the installing contractor] [a separate contractor furnished by the owner].
- Visually inspect for physical damage.
- Perform start-up tests in accordance with manufacturer's instruction manual.
- Perform low-frequency withstand (Hi-Pot) tests in accordance with ANSI/IEEE C37.20.2.