Type R Outdoor Circuit Breakers

Descriptive Bulletin

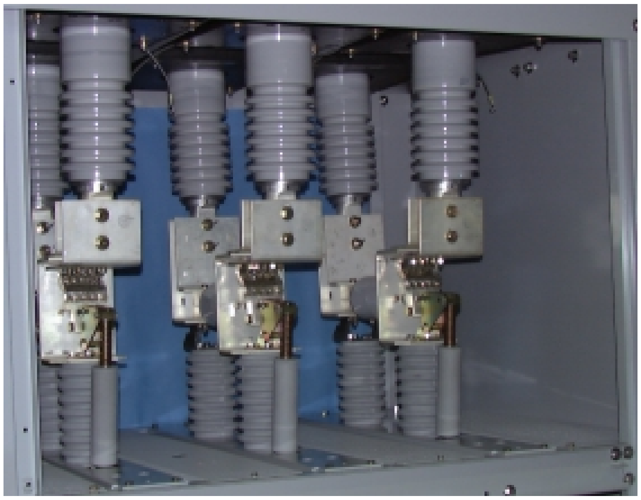
ABB

Construction

Type R-Vacuum Circuit Breakers

- ABB's Type R-Vacuum Circuit Breaker meets all applicable ANSI & NEMA standards.

The Type R-Vacuum Circuit Breaker is made up of three basic sections: the high voltage compartment, the mounting provisions, and the low voltage compartment.



High Voltage Compartment

- All components at line potential are contained in the high voltage (HV) section and are completely isolated from the control compartment. Insulating entrance bushings are attached to the roof assembly by bolt and compression type clamps. Removal or replacement of the bushings does not disturb existing vacuum bottle adjustments. Bushing current transformers (BCTs) mount inside the HV compartment. BCTs can be used for metering and/or protection applications. The number of BCTs that can be mounted in the HV compartment depends on the ratio and accuracy class.

- ABB's Type R-Vacuum Circuit Breakers can be equipped with optional high strike porcelain bushings with optional stud type terminals. Entrance bushings are attached to the roof using non ferrous corrosion resistant hardware and stainless steel compression type clamps.

Mounting Provisions

- Formed steel supports mount the vacuum breaker to its foundation, and are adjustable in height in three inch (75 mm) intervals.

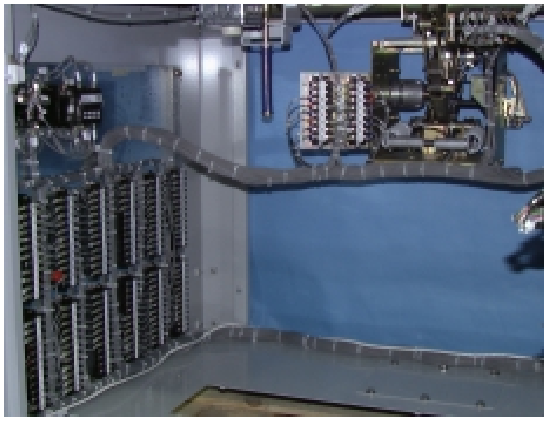
Low Voltage Compartment

- The low voltage compartment houses all of the control components and the operating mechanism. The side panels are used to mount terminal blocks for the BCT circuits. When specified, overcurrent and reclosing devices are mounted on a hinged front panel for easy access. Anti-condensation heaters are provided which also vent into the HV cabinet. All standard control voltage options are available, 120 to 240 VAC and 24 to 125 VDC.

- The stored energy mechanism drives a common crankshaft which operates all three phases. The auxiliary switch which provides 52a and 52b contacts for the control circuits is also driven directly from the crankshaft.

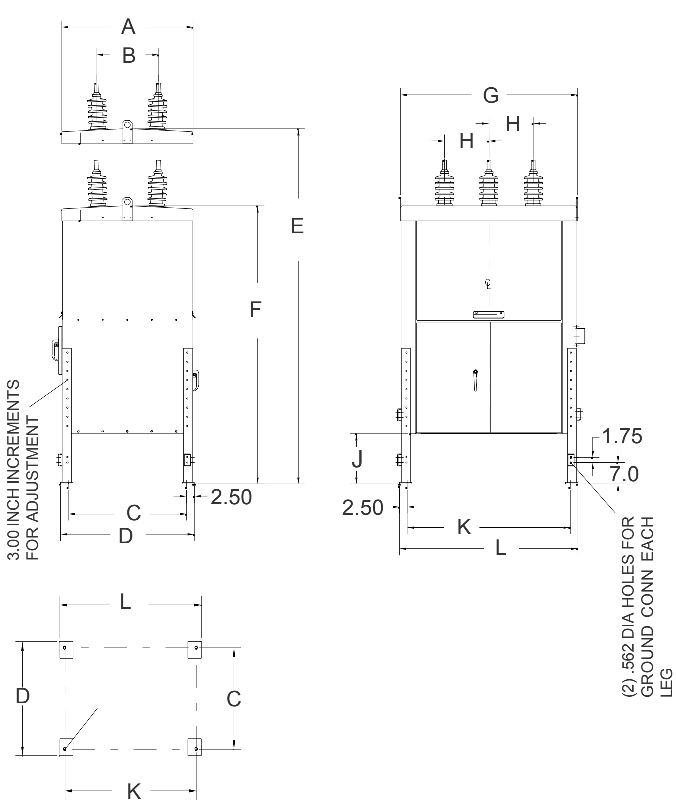
- The control cabinet contains the relays, meters, and switches for the breaker. Typically the panel consists of a microprocessor control that offers three phase overcurrent protection, ground protection and reclose capability. To locally open and close the breaker, a control switch is included. Other devices such as meters, test switches and outlets can be provided as options. The current signal for the relays and meters comes from the BCTs in the high voltage compartment. ABB's R-Breaker is available without control panels. These are known as basic breakers.

- The low voltage internal circuitry connects the devices in the low voltage compartments with the control power. Some of the devices are the charging motor, trip and close coils and relays.

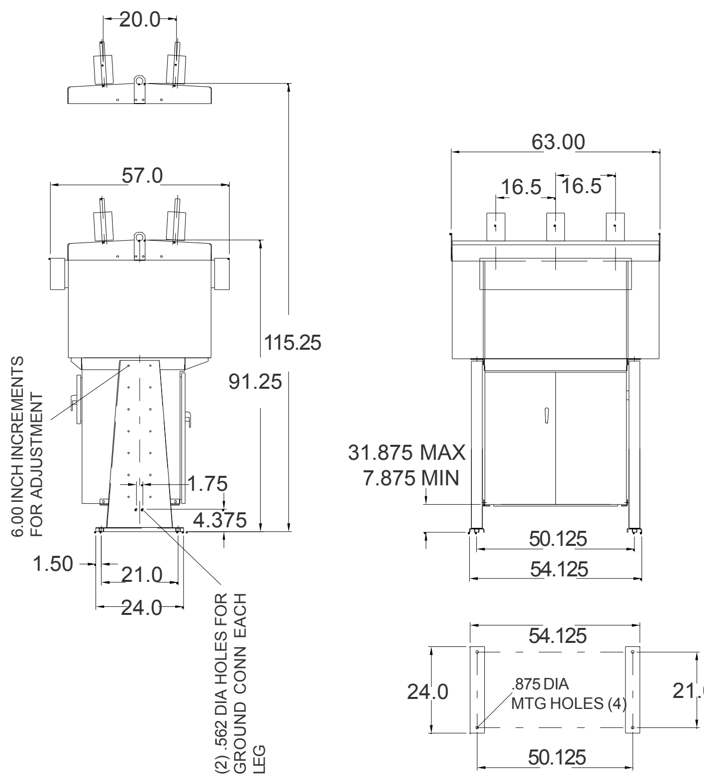


Dimensions

15 kV, 600-2000 A, 110 kV BIL
27 kV, 1200 A, 125/150 kV BIL



15 kV, 3000 A, 110 kV BIL
27 kV, 2000 A, 150 kV BIL



Dimensional Information

15 kV	A	B	C	D	E	F	G	H	J	K	L
2000 A, 110 kV BIL	43.00	20.50	38.686	43.686	109.062	91.062	58.00	14.50	34.438 MAX	53.312	58.312
27 kV									16.438 MIN		
1200 A, 125/150 kV BIL	43.00	20.50	38.686	43.686	109.062	91.062	58.00	14.50	34.438 MAX	53.312	58.312
15 kV									16.438 MIN		
600-1200 A, 110 kV BIL	36.00	17.00	31.375	36.375	105.813	87.813	47.25	13.00	44.438 MAX	42.75	47.75
									16.438 MIN		

15 kV, 3000 A 110 kV BIL and 27 kV, 2000 A, 150 kV BIL see drawing above

Dimensions in inches

Stored Energy Mechanism Control Power Requirements

Rated Control Voltage	Spring Run Amperes	Charge Motor Time Sec.	Close and Trip Coil Resistance Ohms	Close* or Trip Amperes	Voltage Range Close	Voltage Range Trip
24 VDC			3.1	8		14-28
48 VDC	9.0	6	8.0	6	36-56	28-56
125 VDC	5.0	6	12	2.4	90-140	70-140
250 VDC	5.0	6	52	4.8	180-280	140-280
120 VAC	5.0	6	3.1	38.1**	104-127	Cap Trip
240 VAC	5.0	6	8.0	30.0**	208-254	Cap Trip

Specifications

Type R - Vacuum Circuit Breaker Typical Specifications

Voltage Class (kV)	15 kV												27 kV									
Continuous Current Amperes	600				800		1200			2000		3000	1200					2000				
Breaker Type	R-1	R-2	R-3	R-4	R-2	R-3	R-2	R-3	R-4	R-3	R-4	R-4	R-1	R-1	R-2	R-3	R-3	R-1	R-1	R-2	R-3	R-3
Rated Maximum Voltage (kV)	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Voltage Range Factor K***	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Frequency (Hz)	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Low Frequency Withstand Dry 60 Hz for 1 Min Wet 60 Hz for 10 Sec Full Wave Withstand (BIL)	50 45 110	50 45 110	50 45 110	50 45 110	50 45 110	50 45 110	50 45 110	50 45 110	50 45 110	50 45 110	50 45 110	50 45 110	60 50 125	60 50 150	60 50 125	60 50 125	60 50 150	60 50 125	60 50 150	60 50 125	60 50 125	60 50 150
Interrupting Time (Cycles)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Permissible Tripping Delay Y (Sec)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Closing Time (Cycles)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Reclosing Time (Sec)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Short Circuit Interrupting Current kA, RMS, Sym kA, RMS, Asym	12.0 15.0	16.0 19.2	20.0 24.0	25.0 30.0	16.0 19.2	20.0 24.0	16.0 19.2	20.0 24.0	25.0 30.0	20.0 24.0	25.0 30.0	25.0 30.0	12.5 15.0	12.5 15.0	16.0 19.2	20.0 24.0	20.0 24.0	12.5 15.0	12.5 15.0	16.0 19.2	20.0 24.0	20.0 24.0
Close & Latch (Initial Current Loop) kA, RMS, Asym	19.4	24.8	31.0	28.8	24.8	31.0	24.8	31.0	28.8	31.0	38.8	38.8	19.4	19.4	24.8	31.0	31.0	19.4	19.4	24.8	31.0	31.0
Close & Latch (kA Peak)	33.8	43.2	54.0	67.5	43.2	54.0	43.2	54.0	67.5	54.0	67.5	67.5	33.8	33.8	43.2	54.0	54.0	33.8	33.8	43.2	54.0	54.0
Short Time Current (3 Sec) kA, RMS, Sym	12.0	16.0	20.0	25.0	16.0	20.0	16.0	20.0	25.0	20.0	25.0	25.0	12.5	12.5	16.0	20.0	20.0	12.5	12.5	16.0	20.0	20.0
Transient Recovery Voltage (kV Peak)	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5
Load Current Switching Capability (Amperes)	600	600	600	600	800	800	1200	1200	1200	2000	2000	3000	1200	1200	1200	1200	1200	2000	2000	2000	2000	2000
Transient Inrush Current (kA Peak)	50	50	50	50	50	50	50	50	50	50	50	50	20	20	20	20	20	20	20	20	20	20
Transient Inrush Frequency (Hz)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	4240	4240	4240	4240	4240	4240	4240	4240	4240	4240

- *Operating Duty (Standard Duty Cycle) = 0-0.3 Sec.; C0 15 Sec.; C0-15 Sec. C0*
- *Capacitance Current Switching, open wire line charging system current up to 600 Amperes RMS*
- *Isolated cable charging current up to 600 Amperes RMS *****
- *Grounding of system, capacitor bank system and capacitor bank grounded or ungrounded*
- *Isolated Capacitor Bank Switching Current and Back to Back Shunt Capacitor*
- *Bank Switching Current is 600 Amperes RMS for all ratings*
- *Transient Overvoltage Factor is 2.5 for all ratings*
- *Capacitor Current Switching Life is 1500 operations for all ratings*
- *Contact Resistance is <350 micro ohms for all ratings*

** These are the worst Case inrush values for sizing protection or batteries only. Opening time is .0415 seconds from the time the opening coil is energized until main contact break. Closing time is .0996 seconds from the time the close coil is energized until main contact make.*

*** Closing current only. AC voltage tripping is not recommended. Stored energy capacitor trip devices are used with AC control voltage.*

**** Breaker can be applied on all voltages up to and including the rated maximum voltages.*

***** 1200 Amperes available upon request.*

Operating Mechanism

● ABB's R-Breaker operating mechanism is a stored energy type, spring close-spring open. A motor driving through a ratchet mechanism is used to charge the main closing springs. Energy is stored in the trip spring during the closing sequence to ensure adequate tripping energy whenever it is required.

The operating mechanism drives directly to the main shaft which connects all three phases. Each phase is operated from this shaft through an independently adjustable linkage.

As a safety feature, a latch check switch located on the mechanism will permit electrical closing only when the mechanism is fully reset.

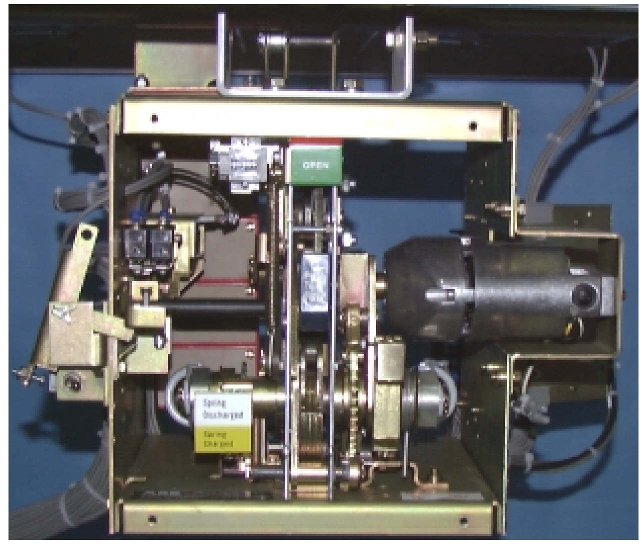
A visible flag on the mechanism front cover plate indicates the spring condition as "SPRING CHARGED" or "SPRING DISCHARGED." This positive indication tells operating personnel whether the mechanism has properly stored the energy required to close the breaker during maintenance operations.

The operator can manually close the breaker by actuating the "PUSH TO CLOSE" button which discharges the closing springs. This feature benefits the user in that the breaker can be manually closed into an energized circuit for load pickup when control power is not available.

A manual trip lever allows the breaker to be tripped quickly under emergency conditions from the exterior of the cabinet.

As an added safety feature, a 69 device blocks electric closing after manual trip.

A cyclometer operations counter, which indicates the number of trip operations, is located behind the window in the mechanism cabinet, permitting the user to determine if operations have occurred, saving the time of opening the housing door.



Microprocessor Control

● Design of all functions is very flexible and normally tailored to meet the required specification. A typical control package mounted on the hinged panel might include: A multifunction microprocessor relay with phase and ground overcurrent protection, reclose, and a control switch with red and green indicating lights. The microprocessor control eliminates the need for multiple electromechanical devices, providing fewer wires and less maintenance. This simplifies the design and improves the reliability of the breaker and the distribution system.

DPU2000R

MSOC

Advantages of Vacuum Interruption

Maintenance

The absence of oil as an insulating and interrupting medium minimizes the maintenance and servicing required. The mechanical life is 2500 operations.

Installation

The forces generated during interruption are only those of the operating mechanism. This greatly simplifies foundation requirements.

Duty Cycle

No derating of interrupting capability is required, regardless of the reclosing duty cycle.

Safety

The use of air as the primary insulation minimizes the hazard from fire or explosion.

Environment

Arc extinction is silent and the sound level of the mechanism is low. Quiet operation is particularly desirable near hospitals, residential areas and shopping centers.

No oil or gas to be handled or disposed.

Ratings*

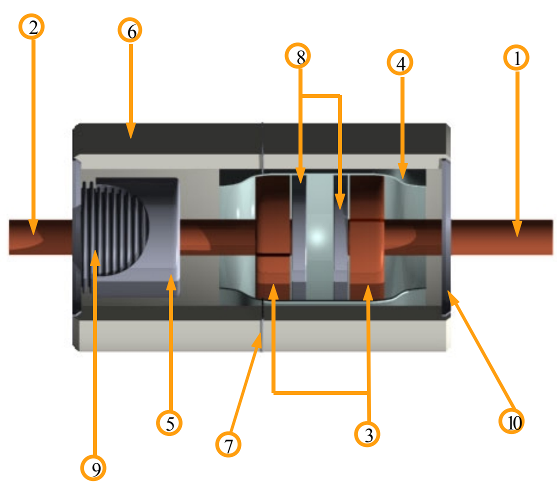
- **15.5 through 27.0 kV**
- **600 through 3000 Amps**
- **12 through 25 kA**
- **Capacitor and Reactor Switching**
- **110 / 125 / 150 BIL**

* see specification table for specific ratings

Typical Vacuum Interrupter Design (contacts shown in the open position)

1. Fixed contact stem
2. Moving contact stem
3. Fixed and moving contact subsystems
4. Vapor (or ion) shield
5. Bellow shield
6. Ceramic enclosure (envelope) shown as two ceramic cylinders joined in the middle
7. Metal-to-ceramic sealed joints
8. Contacts
9. Metal bellows
10. Metal end plates

Contacts shown in open position



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