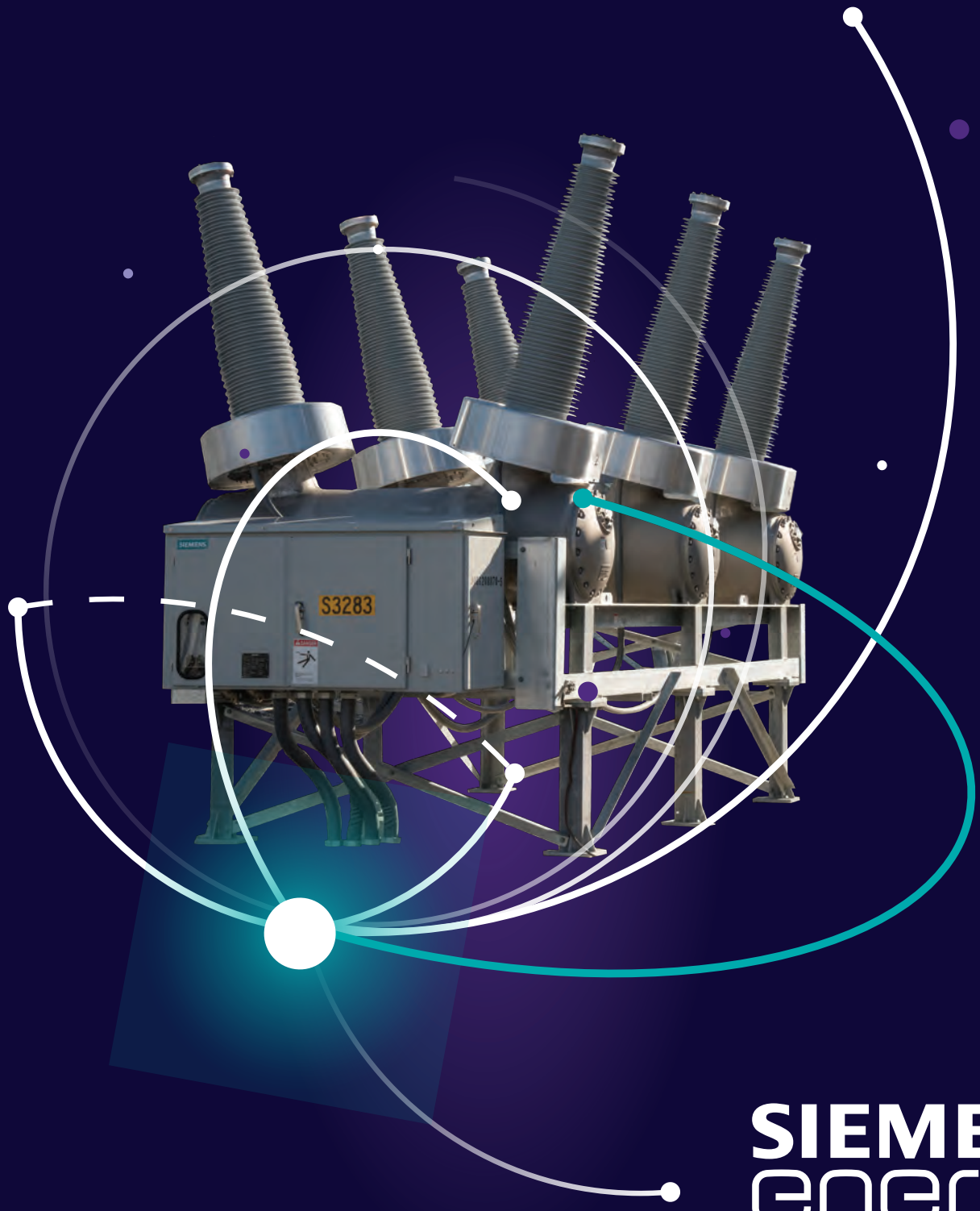
Siemens Energy High Voltage Dead Tank Circuit Breakers



SIEMENS energy

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Since 1964

Over 160,000 installed circuit breakers of the current platform in the international marketplace proves Siemens Energy customers rely on us to deliver reliable performance by utilizing the best breaker technology and materials available

Globally standardized design includes*:
- FA spring-spring operating mechanism
- No maintenance or adjustments required on the operating mechanism
- 3AP Arc-Assist self-blast interrupter
- Rupture disks for each interrupter
- Porcelain and composite bushing offerings Standard provision for up to four CTs per bushing Tanks meeting ASME pressure requirements

Application-based design considerations include*:
- Pre-insertion resistors (PIR)
- Point-on-wave controlled switching with phase synchronizing device (PSD)
- Metering accuracy CTs
- Extra-creep bushings
- Dual trip coils
- Tank heaters for low temperature applications
- High kA short-circuit current ratings

*For a complete list of application-based design components and considerations, please contact your local representative.

From quality comes quality

Siemens Energy combines the latest in circuit breaker technology with the economies of scale and a streamlined process at our manufacturing facility in Jackson, Mississippi.

Our facility is certified to:
- ISO 9001:2015 (Quality)
- OHSAS: 18001:2007 (Occupational Health & Safety)
- ISO 14001:2015 (Environmental)

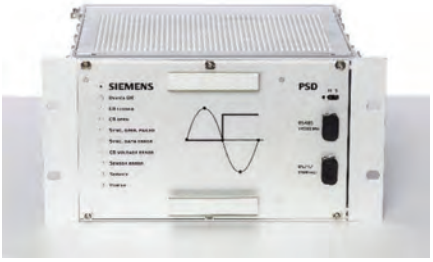
The manufacturing process is designed to provide measurable quality and cost containment. To ensure product performance and customer satisfaction, every circuit breaker is tested to ANSI and IEC standards in one of the world's largest high-voltage laboratories.

All of our live and dead tank circuit breakers, as well as our gas-insulated switchgear, are equipped with common components. Longevity, reliability, and a broad range of solutions for diverse climate zones around the world distinguish Siemens Energy high voltage circuit breakers from all others.

Siemens Energy circuit breakers meet the needs of the world's most complex electrical power systems

The application of a circuit breaker directly correlates to the operating conditions that will be serviced over the breaker's lifetime. Siemens Energy's circuit breaker portfolio was designed to adapt to your current and future needs across all applications. From transmission line protection to specialized controlled switching applications and high kA requirements, Siemens Energy circuit breakers can be configured to meet the needs of the application.

High kA short-circuit capabilities are becoming increasingly important for circuit breaker applications in evolving power systems. Where high kA ratings are necessary, extreme transient recovery voltage (TRV) conditions and high X/R ratios are common. To meet the needs of these applications, Siemens Energy offers robust, time-tested technology that you can rely on to meet the current and future needs of your power system.



Independent pole operation (IPO) configured circuit breakers in conjunction with phase synchronizing device (PSD) controlled switching can provide increased system reliability as a result of reduced voltage fluctuations and lower harmonic stress. IPO circuit breakers with PSD are also known to extend the service life of the circuit breaker's interrupter components by reducing switching over-voltages and inrush currents.

Pre-insertion resistors (PIR) limit TRV impacts on circuit breakers in transmission line protection applications. These components are capable of smoothing reclosing operations by dissipating trapped charge on the affected transmission line phase(s). Siemens Energy PIR technology can be configured with various resistance values and externally adjustable pre-insertion times to meet the needs of your system.

SPS2 15 kV – 72.5 kV

Siemens Energy SPS2 15.5 kV – 72.5 kV dead tank circuit breakers utilize the time-tested FA spring-spring operating mechanism and 3AP arc-assist interrupter common to the entire SPS2 portfolio (15 kV – 550 kV).

The SPS2 dead tank circuit breaker can be configured with independent pole operation (IPO) and phase synchronizing device (PSD) for reliable switching in the most demanding electrical power systems.

The SPS2 15 kV – 72.5 kV dead tank circuit breakers are designed to meet rigorous Class M2 mechanical endurance (10,000 operations) and Class C2 capacitive switching certifications, ensuring virtually maintenance-free operation over its life.

Standard Features

- FA spring-spring operating mechanism
- Gang or IPO on common frame
- Operation to -40° C without tank heaters

Optional Features Available

- PSD for point-on-wave switching
- Composite bushings / extra creep bushing
- Up to four CTs per bushing

All breakers are manufactured and tested in the USA.

Type	SPS2-15.5	SPS2-25.8	SPS2-38	SPS2-48.3	SPS2-72.5
Related Max kV	15.5	25.8	38	48.3	72.5
Rated continuous current (A, rms)	up to 3500	up to 3500	up to 3500	up to 3500	up to 3500
Rated short circuit current at rated (kA)	up to 40	up to 40	up to 40	up to 40	up to 40
Interrupting Time Cycle	3	3	3	3	3
Lightning Impulse withstand voltage	110	150	200	250	350
Chopped wave, 2µs (kA)	142	194	258	322	452
Closing and latching capability (kA)	up to 108	up to 108	up to 108	up to 108	up to 108

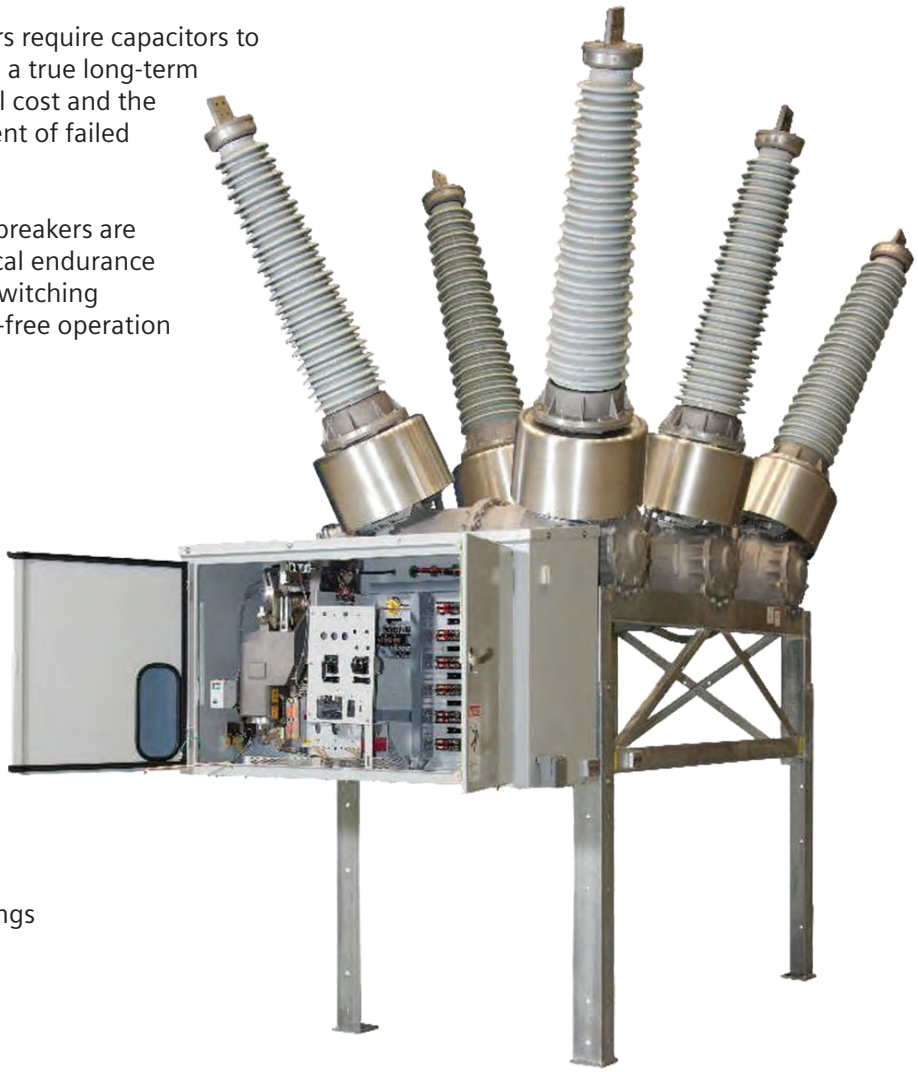
SPS2S 123 kV – 170 kV

Continuous development of the SPS2 design has led to a refined designation of SPS2S for 123 – 245 kV-rated breakers. This reflects upgrades made to reduce foundation footprint for all kA classes, allowing for easy replacement of existing circuit breakers in evolving power systems.

With 40, 50, and 63 kA designs available, the SPS2S 123 kV – 170 kV circuit breakers can be configured for all applications, including transmission line switching, transformer switching, and capacitor bank switching.

None of Siemens Energy SPS2S circuit breakers require capacitors to reach their kA requirement. This design offers a true long-term value by eliminating both the initial additional cost and the potential maintenance expense for replacement of failed capacitors.

The SPS2S 123 kV – 170 kV dead tank circuit breakers are designed to meet rigorous Class M2 mechanical endurance (10,000 operations) and Class C2 capacitive switching certifications, ensuring virtually maintenance-free operation over its life.



Standard Features

- FA spring-spring operating mechanism
- Gang or IPO on common frame
- No capacitors necessary

Optional Features Available

- PSD for point-on-wave switching
- Composite bushings / extra creep bushings
- Slip-over CTs

All breakers are manufactured and tested in the USA.

Type	SPS2S-123	SPS2-25.8	SPS2-38
Related max kV	123	145	170
Rated continuous current (A, rms)	up to 4000	up to 4000	up to 4000
Rated short circuit current at rated (kA)	up to 80	up to 80	up to 80
Interrupting Time Cycle	3	3	3
Lightning Impulse withstand voltage	550	650/750	750/900
Chopped wave, 2µs (kA)	710	838	968
Closing and latching capability (kA)	up to 170	up to 170	up to 170

SPS2S 245 kV

With versions ranging from 40 – 90 kA, BIL options up to 1050 kV, 2 or 3-cycle interruption time, and IEC 693 high seismic rated designs available, Siemens Energy's SPS2S 245 kV circuit breaker portfolio is the most adaptable in its class.

Like the SPS2S 123 – 170 kV breakers, the SPS2S 245 63 kA circuit breaker was designed with a minimized footprint allowing for easy replacement of existing circuit breakers in evolving power systems.

The SPS2S 245 kV dead tank circuit breakers are designed to meet rigorous Class M2 mechanical endurance (10,000 operations) and Class C2 capacitive switching certifications, ensuring virtually maintenance-free operation over its life.

Standard Features

- FA spring-spring operating mechanism
- Gang or IPO on common frame

Optional Features Available

- PSD for point-on-wave switching
- Composite bushings / extra creep bushings
- Tank heaters for low ambient temperature environments
- Slip-over CTs

All breakers are manufactured and tested in the USA.

Type	SPS2-245	SPS2-25.8
Related Max kV	245	245
Rated continuous current (A, rms)	up to 4000	up to 4000
Rated short circuit current at rated (kA)	up to 63	up to 90
Interrupting Time Cycle	2 or 3	2 or 3
Lightning Impulse withstand voltage	Up to 1050	Up to 1050
Chopped wave, 2µs (kA)	1160	1160
Closing and latching capability (kA)	up to 170	up to 243

SPS2S 362 kV

Siemens Energy SPS2 362 kV circuit breakers have standard IPO configuration and 2-cycle interruption time to meet the needs of all extra high voltage (EHV) circuit breaker applications.

Siemens Energy's unique common frame version is designed to simplify the installation process. Typically, a Siemens SPS2 362 kV common frame circuit breaker can be installed on an existing foundation in less than one day.

The Siemens Energy FA spring-spring operating mechanism and 3AP arc-assist interrupter are core components of each circuit breaker that provide exceptional reliability and long service lifetime with virtually no maintenance.

The SPS2 362 kV dead tank circuit breakers are designed to meet rigorous Class M2 mechanical endurance (10,000 operations) and Class C2 capacitive switching certifications, ensuring virtually maintenance-free operation over its life.

Standard Features

- FA spring-spring operating mechanism
- IPO configuration
- 63 kA without TRV capacitors
- Single-break up to 63 kA

Optional Features Available

- PSD for point-on-wave switching
- Composite bushings
- Pre-insertion resistors with externally adjustable insertion time
- Tank heaters for low ambient temperature environments
- Common frame version

All breakers are manufactured and tested in the USA.

Type	SPS2S-362
Related Max kV	362
Rated continuous current (A, rms)	up to 5000
Rated short circuit current at rated (kA)	up to 80
Interrupting Time Cycle	2
Lightning Impulse withstand voltage	1300
Chopped wave, 2µs (kA)	1680
Closing and latching capability (kA)	up to 216

SPS2 550 kV

Each pole of the SPS2 550 kV circuit breaker is equipped with a dual-break 3AP2 arc-assist interrupter to ensure reliable circuit interruption in the midst of large voltage transients and high reactive power switching requirements.

Siemens Energy is pleased to offer the only 550 kV breaker operated by a spring-spring mechanism capable of reliable 2-cycle interruption and reclosing operations.

The SPS2 550 kV circuit breaker is designed to meet rigorous Class M2 mechanical endurance (10,000 operations) and Class C2 capacitive switching certifications, ensuring virtually maintenance-free operation over its life.

Standard Features

- FA spring-spring operating mechanism
- Shipped with CTs and CT covers installed
- No line-to-ground capacitors necessary for 63 kA

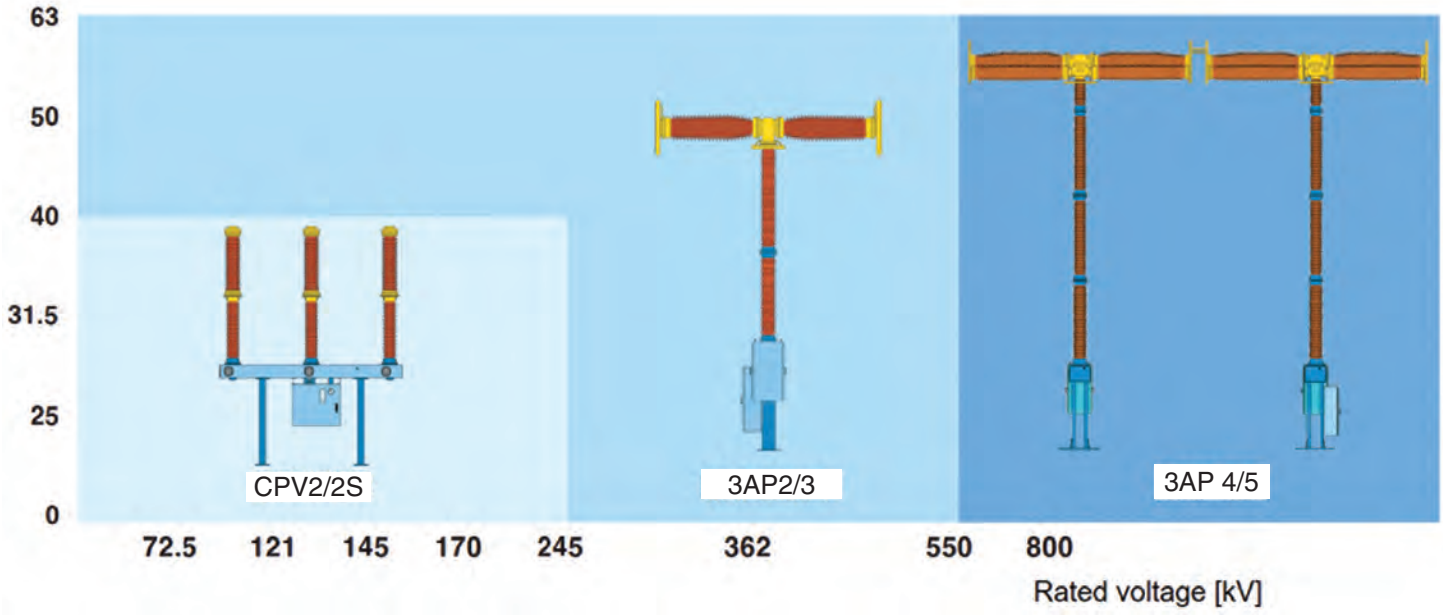
Optional Features Available

- PSD for point-on-wave switching
- Composite bushings / extra creep bushings
- Plug-and-play control wiring for ease of installation

All breakers are manufactured and tested in the USA.

Type	SPS2-550
Related Max kV	550
Rated continuous current (A, rms)	up to 5000
Rated short circuit current at rated (kA)	up to 63
Interrupting Time Cycle	2
Lightning Impulse withstand voltage	Up to 1800
Chopped wave, 2µs (kA)	2320
Closing and latching capability (kA)	up to 170

Live tank option – **CPV 2/2S, 3AP 2/3, 3AP4/5**



Siemens Energy live tank circuit breakers / circuit switchers are an ideal solution for applications that require two or three-cycle circuit interruption and have limited space. These products save space and provide fast protection at an economical cost. Commonly, these breakers are utilized in power transformer switching applications that require reliable switching devices to provide millions of dollars of substation transformer assets. By utilizing the FA spring-spring operating mechanism, the live tank breaker portfolio offers the same industry-leading reliability standard as the SPS2 dead tank circuit breaker portfolio.

Boasting a small footprint, the live tank CPV2/CPV2S, 3AP 2/3, 3AP 4/5 are considered the preferred model for retrofit installations where a circuit switcher is recommended to replace an existing fault interruption device. Fast two or three- cycle interruption time significantly reduces system disturbances and minimizes potential for damage to key system components. Units rated up to 170 kV ship fully assembled for ease of installation. 245 kV rated units and above ship in sub-assemblies that have been engineered to optimize installation time and cost.

All breakers are manufactured and tested in the USA.

Type	CPV2/CPV2S					3AP 2/3		3AP 4/5
Related Max kV	72.5	121	145	170	245	362	550	800
Rated continuous current (A, rms)	4000	3150	3150	4000	4000	5000	5000	5000
Rated breaking current, up to (KA)	40	40	40	40	40/63	40	63	63
Lightning Impulse withstand voltage BIL , (kV)	350	550	650	750	900/1050	1300	1800	2100
Power Frequency withstand voltage	160	260	310	365	460	555	860	1150

Blue Circuit Breaker®

Siemens Energy recognizes climate change as a megatrend that is changing the world. SF_6, the insulating gas utilized in most modern gas insulated equipment (GIE) boasts a global warming potential of 23,500x that of CO_2. In a revolutionary development for high voltage GIE, Siemens developed CLEAN AIR vacuum technology that is capable of reliable short-circuit interruption at voltage levels above 69 kV with absolutely zero CO_2 emissions over the lifetime of the equipment.

Tested to the same IEEE / IEC standards as SF_6 product equivalents, Siemens Energy Blue Circuit Breaker® products offer high reliability and performance that is expected of HV GIE. Other inherent benefits of vacuum-interruption include applicability at low ambient temperatures, higher full-fault duty than equivalent SF_6 products (rated for up to 30 interruptions at rated short-circuit currents), and maintenance-free operation due to hermetically sealed vacuum interrupter components.

Driven by the reliable FA spring-spring mechanism, Blue Circuit Breaker® will utilize time-tested components to provide class M2 mechanical endurance (10,000 operations) and Class C2 capacitive switching certifications.

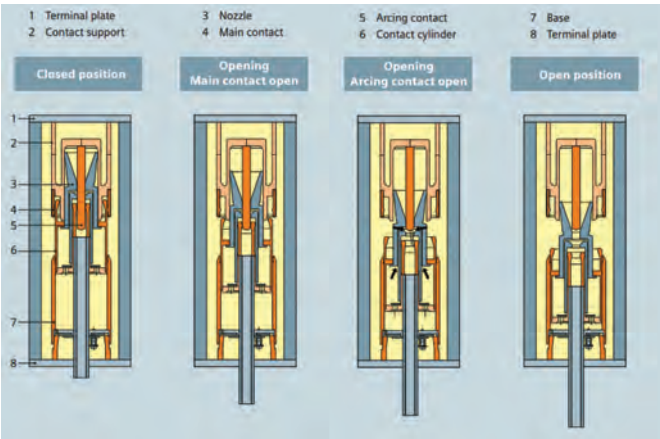
Siemens Energy plans to offer Blue Circuit Breaker® and circuit switchers in accordance with the accompanying release schedule.

For more information on Blue Circuit Breaker® products, contact your local representative.

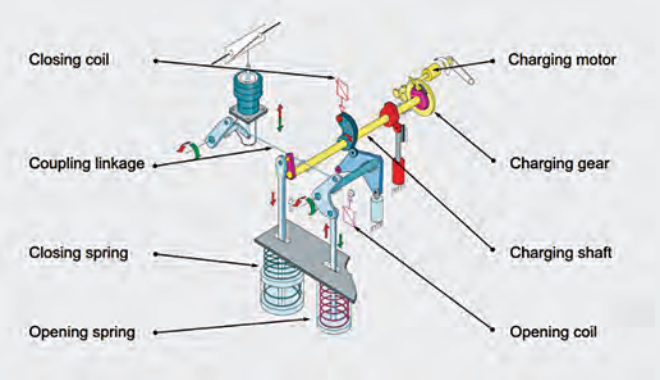
All breakers are manufactured and tested in the USA.

Type	Short Circuit Current (kV)	Continuous Current (A)	Release Date
72.5 kV LT	40	**3150**	2018
72.5 kV DT	40	**3150**	2021
123 kV DT	40	**3150**	2021
145 kV DT	40	**3150**	2023
145 kV DT	63	**3150**	On Demand
245 kV DT	40	**3150**	On Demand
245 kV DT	63	**3150**	On Demand

3AP arc-assist interrupter and FA spring- spring operating mechanism



Siemens Energy utilizes the field-proven 3AP arc-assist interrupter. Arc-assist interruption technology is the core of Siemens' HV switchgear because it has a substantially smaller operating mechanism energy requirement in comparison to preceding puffer interrupter technology. Each interrupter consists of a main contact assembly and an arcing contact mounted inside a pole unit housing. During opening operations, the puffer action in the compression cylinder of the interrupter is sufficient for low current faults and switching operations. During high current interruptions, heat from the arc causes the pressure to rise in the heating volume chamber. The resulting high pressure gas from the heating volume extinguishes the arc.



The FA spring-spring operating mechanism is unique in the industry because of its scalable design that is applied in Siemens Energy's entire circuit breaker portfolio for rated voltages between 15 kV to 800+ kV. Unlike all hydraulic or pneumatic operating mechanisms, the FA spring-spring design is inherently maintenance-free for the breaker's installed lifetime.

		Voltage Ratings					
Interrupter Unit	**Operation**	72.5 W	145kV	170 kV	245 kV	362 kV	550 kV
	Gang	FA 2	FA 2	-	-	-	-
Static Self-Compression	**Independent Pole Operation (IPO)**	FA 1	FA 1/2	-	-	-	-
	Gang	-	-	FA2	FA 4/5	-	-
Dynamic Self-Compression	**Independent Pole Operation (IPO)**	-	-	FA 2	FA 2	FA 4/5	FA5

Notes

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