

SIEMENS

Type SP and SPS Puffer Circuit Breaker

15.5 - 72.5 kV

1200, 2000 and 3000A



20, 31.5 and 40 kA
3 cycle



The Best-Selling Breaker In Its Class

Of all the SF6 circuit breakers made for 15 to 72 kV voltage classes, Siemens breakers are preferred by more utilities than any other! Why? There are a number of reasons: excellent design and product reliability, simple installation requirements, easy maintenance. Cost is certainly a factor, both on the invoice and in the field. Ready service and support also figure highly in our favor.

With the type SPS puffer circuit breaker — one with a spring-driven operating mechanism — you have another solid reason to choose Siemens.

Never before have so many advantages been so widely available.

Both the spring-operated type SPS breaker and the pneumatically-operated type SP breaker give you the high performance you need and the affordability you want. It's no wonder more than 12,000 are in the field today.

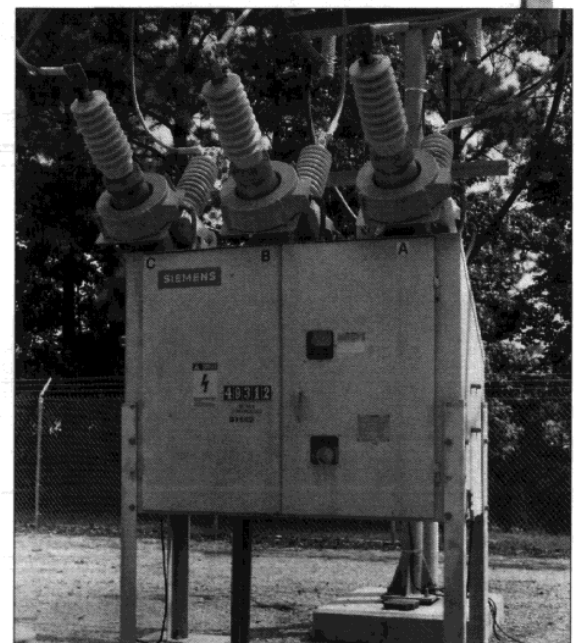
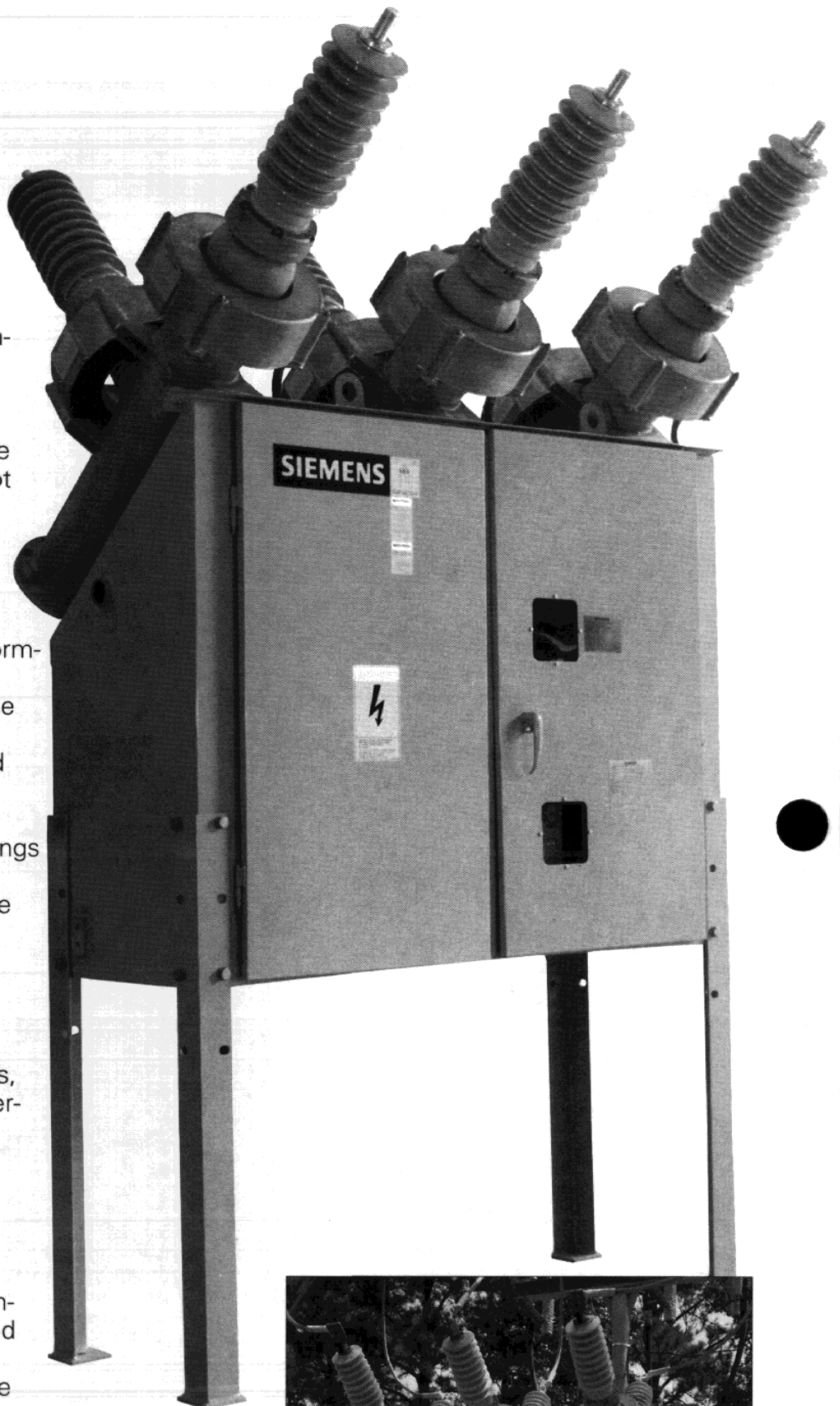
Excellent By Design

Type SP and SPS puffer subtransmission breakers are designed for general-purpose and specialized applications at maximum rated voltages of 15.5 to 72.5 kV. Rated interrupting capacities are 20, 31.5 or 40 kA. The continuous current rating is 1200 amperes, 2000 amperes or 3000 amperes.

Both breaker types feature a dead tank design consisting of three cylindrical aluminum interrupting modules mounted on top of a mechanism and control cabinet. A single break interrupter is mounted within each interrupting module which contains SF6 gas at a pressure of 75 psig. Through-type current transformers are mounted externally on each interrupting module.

Features And Benefits

- Manufactured in the United States, including interrupter and mechanism
- Rupture disk for over-pressure conditions
- Temperature-compensated SF6 pressure switch for accurate operation over entire temperature range
- Worn interrupters are maintained, not replaced
- Interrupters are easily upratable; current transformers are easily interchangeable
- No pressurized epoxy vessels
- O-ring SF6 fittings guard against leakage and are superior to compression-type fittings
- Fully tested to ANSI standards, including 90 percent short-line fault tests
- Seismically qualified
- Shipped assembled, tested and timed, saving installation time and costs
- Readily available service network
- Maintenance/installation videos available
- Standard units in stock at factory allow quick shipments



The Interrupting Module

Each interrupting module contains SF6 gas at a pressure of 75 psig, along with a single break interrupter housed in a glass-epoxy filament-wound tube. Energy for interrupting fault current is provided by an opening spring within the control cabinet. Through this opening spring pressure, the interrupter momentarily increases SF6 gas pressure in the space between parting contacts in the interrupter, extinguishing the arc. Here's how it works:

Each interrupter unit contains a stationary current-carrying contact, an arcing horn, a moving contact and gas-compressing piston, a Teflon interrupting chamber and current-carrying finger contacts. So all three phases operate simultaneously, all moving contacts are mechanically linked.

In the closed position, current is transferred from the bushing conductor to the moving contact. From the piston of the moving contact, the current travels to stationary main contact fingers and exits the interrupter assembly through the other bushing.

On opening, the moving contact separates from the stationary contact fingers, transferring the arc to the moving and stationary arcing contacts.

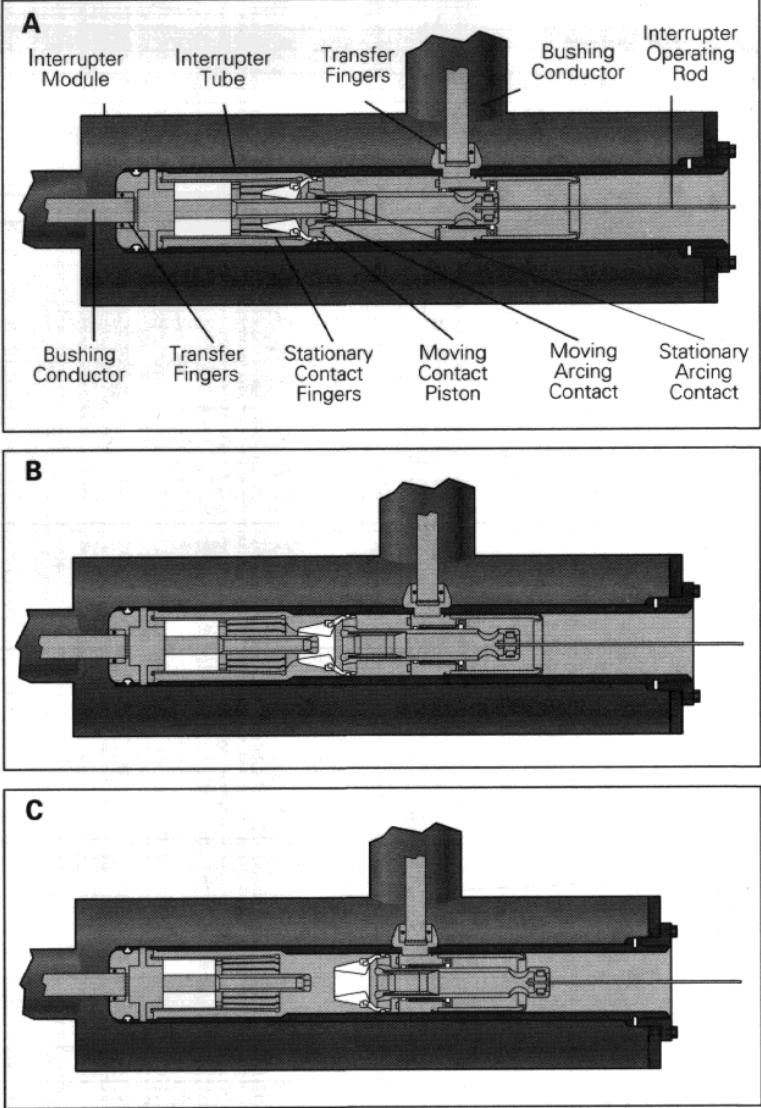
Energy for opening is stored in the tail spring. When tripped, this spring transmits its energy to a single horizontal linkage located in the cabinet. Motion is then transferred to operating rods and moving contacts.

The moving contact piston compresses the SF6 gas. When the arcing contacts part, compressed gas flows along the arc and hot gases sweep through the center of the moving and stationary contacts until interruption occurs.

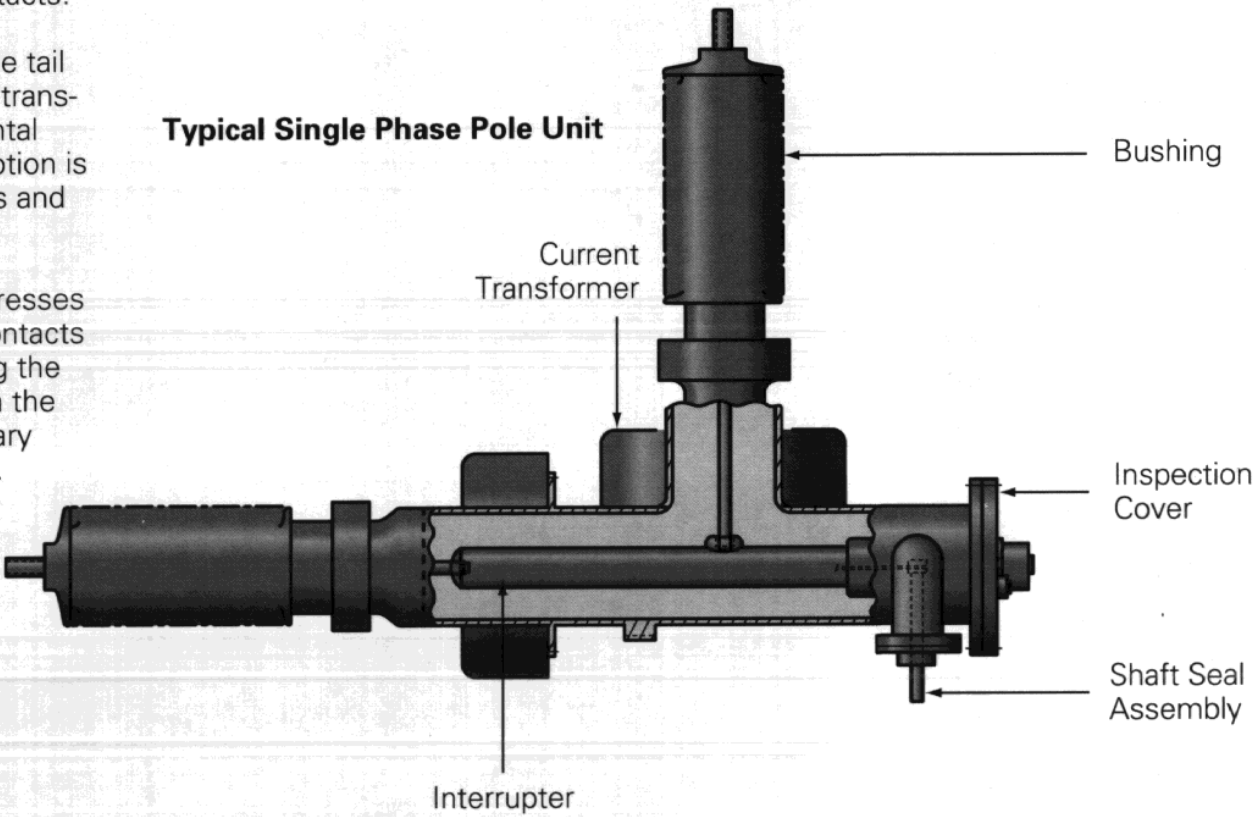
At the end of this sequence, the SF6 gas reverts back to the steady state pressure of 75 psig, ready for the next operation.

We designed the interrupters to make inspections easy, with a bolted cover providing quick access to the assembly.

And because interrupters are mechanically interchangeable, the SP and SPS breakers can be field-updated through all (20, 31.5, 40 kA) ratings.



A Interrupter Assembly Closed
B Interrupter Assembly Partially Open
C Interrupter Assembly Open



Bushing Current Transformers

Only porcelain weathercases are used on the Siemens SP and SPS models. The reasons are simple: long life, low maintenance, low repair requirements.

Porcelain offers key maintenance benefits because it's highly resistant to all weather conditions. And porcelain has a proven field record for dependability and reliability.

Six standard 50" creepage bushings are provided on SP and SPS type breakers. To accommodate special needs, optional designs may be ordered. For instance, insulators are available for altitudes to 10,000 feet, as are extra creep designs suitable for high contamination zones. SP and SPS bushings are also manufactured to withstand a cantilever mechanical load of up to 150 pounds.

Bushings are mechanically interchangeable. This means that 1200 amp breakers can easily be uprated to 2000 and 3000A.

Bushing Current Transformers

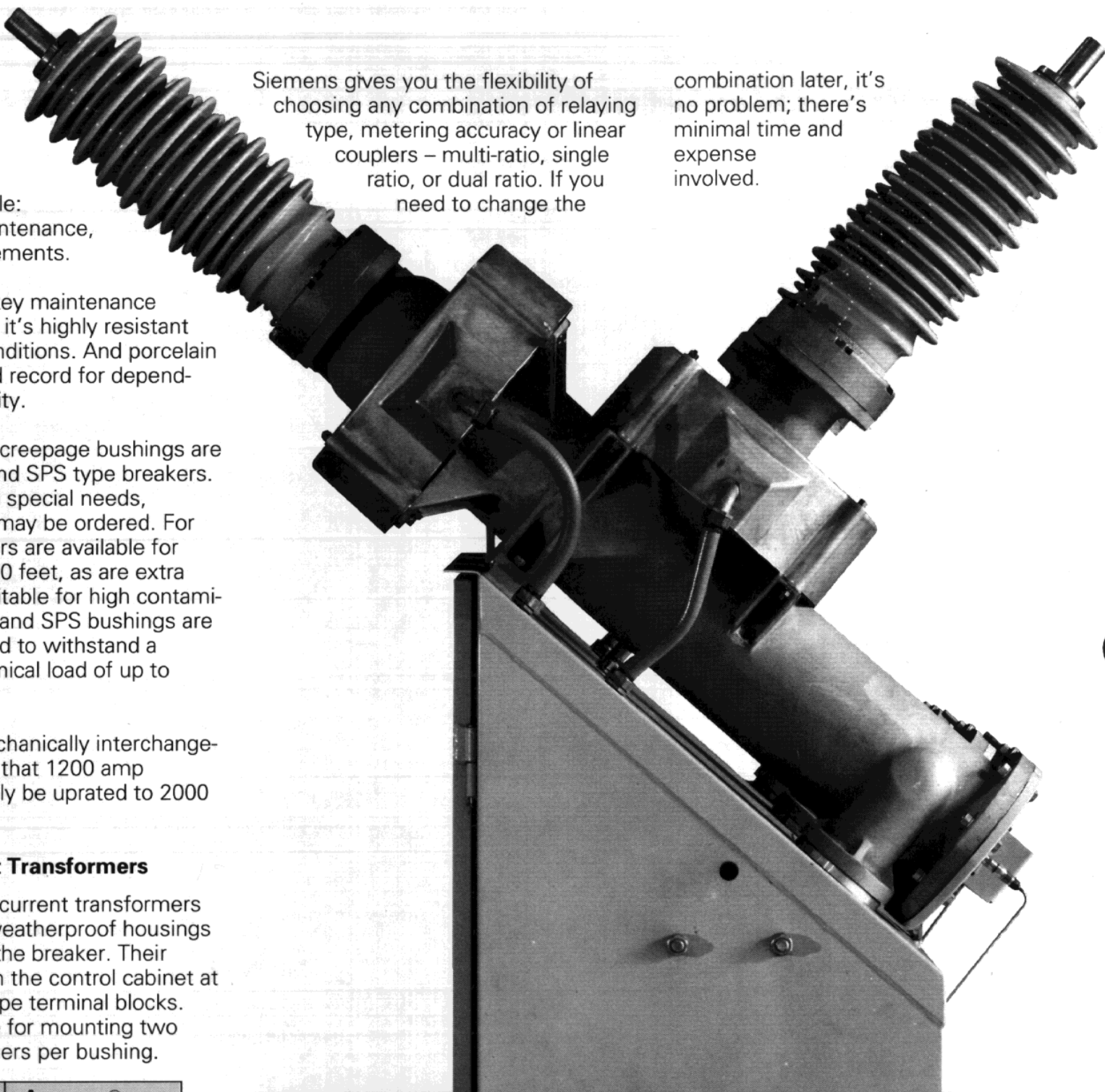
External bushing current transformers are mounted in weatherproof housings on both sides of the breaker. Their leads terminate in the control cabinet at short circuiting type terminal blocks. Space is available for mounting two current transformers per bushing.

Ratio ①	Accuracy ②
600:5 MR	C-100
600:5 MR	C-200
1200:5 MR	C-200
1200:5 MR	C-400
2000:5 MR	C-400
2000:5 MR	C-800
3000:5 MR	C-800
300:5 SR	0.6B-0.5
600:5 SR	0.3B-0.5
600/1200:5 DR	0.3B-0.5/0.3B-1.0
1200:5 SR	0.3B-1.0
2000:5 SR	0.3B-2.0

① Ratio ② Accuracy
MR = Multiple Ratio C = Relay Accuracy
SR = Single Ratio B = Meter Accuracy
DR = Dual Ratio

Siemens gives you the flexibility of choosing any combination of relaying type, metering accuracy or linear couplers – multi-ratio, single ratio, or dual ratio. If you need to change the

combination later, it's no problem; there's minimal time and expense involved.



Gas Handling System



When you first install it, and later, whenever you inspect it, you'll find there's minimal gas handling associated with the Siemens SF6 puffer breaker. Thanks to a design that features low gas pressure and volume (just 15.0 pounds), you can forget about the complications of gas carts, vacuum pumps, tank filters and special drying equipment.

The breaker is shipped with 5 psig of positive pressure, so there's no need to evacuate the pole unit for installation. Another advantage to this shipping method? It provides a double check for possible leakage.

To transfer gas into the common gas system, you simply connect a bottle of SF6 to the fill valve located in the control cabinet. No vacuum pumps or gas carts are required. With the fill valve opened, gas is completely transferred to the interrupters, up to 80 psig at 70°F (20°C), as indicated on the pressure gauge.

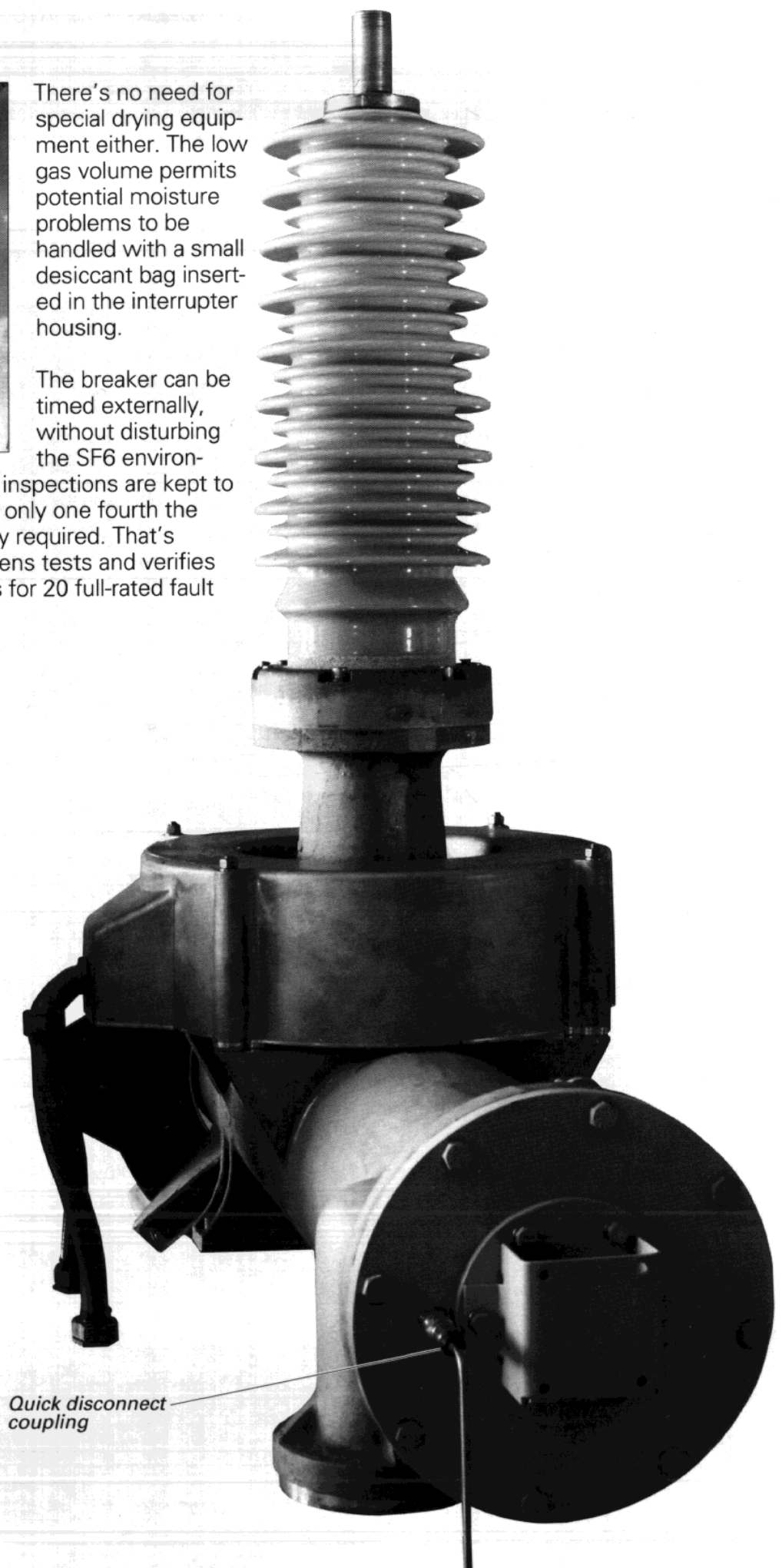
While not standard on puffer breakers from some manufacturers, Siemens SP and SPS models have an SF6 rupture disc to automatically relieve any pole unit overpressure condition. This important feature can prevent catastrophic breaker damage in the event of a sustained, internal fault. The rupture disc is located on each inspection cover, shielded by a deflector plate to prevent possible injury to personnel.

For easy accessibility, interrupter pole units are at ground potential. And each individual pole unit has a "quick disconnect" coupling so that it can be isolated for easy installation and servicing.

There's no need for special drying equipment either. The low gas volume permits potential moisture problems to be handled with a small desiccant bag inserted in the interrupter housing.

The breaker can be timed externally, without disturbing the SF6 environment.

Internal inspections are kept to a minimum — only one fourth the number usually required. That's because Siemens tests and verifies its interrupters for 20 full-rated fault interruptions.



Quick disconnect coupling

Spring Charged Operating Mechanism

Perhaps the most impressive feature of the type SPS puffer breaker is how little maintenance it requires. No other manufacturer offers a spring loaded breaker that compares with its easy maintenance. Day after day. Year after year.

The SPS breaker is equipped with a stored - energy, SE-4 spring drive operating mechanism for opening and closing. A motor charges the closing spring through a ratchet and pawl arrangement. When energy from the spring is discharged, the mechanism allows the breaker to change position and complete an open-close-open cycle as desired.

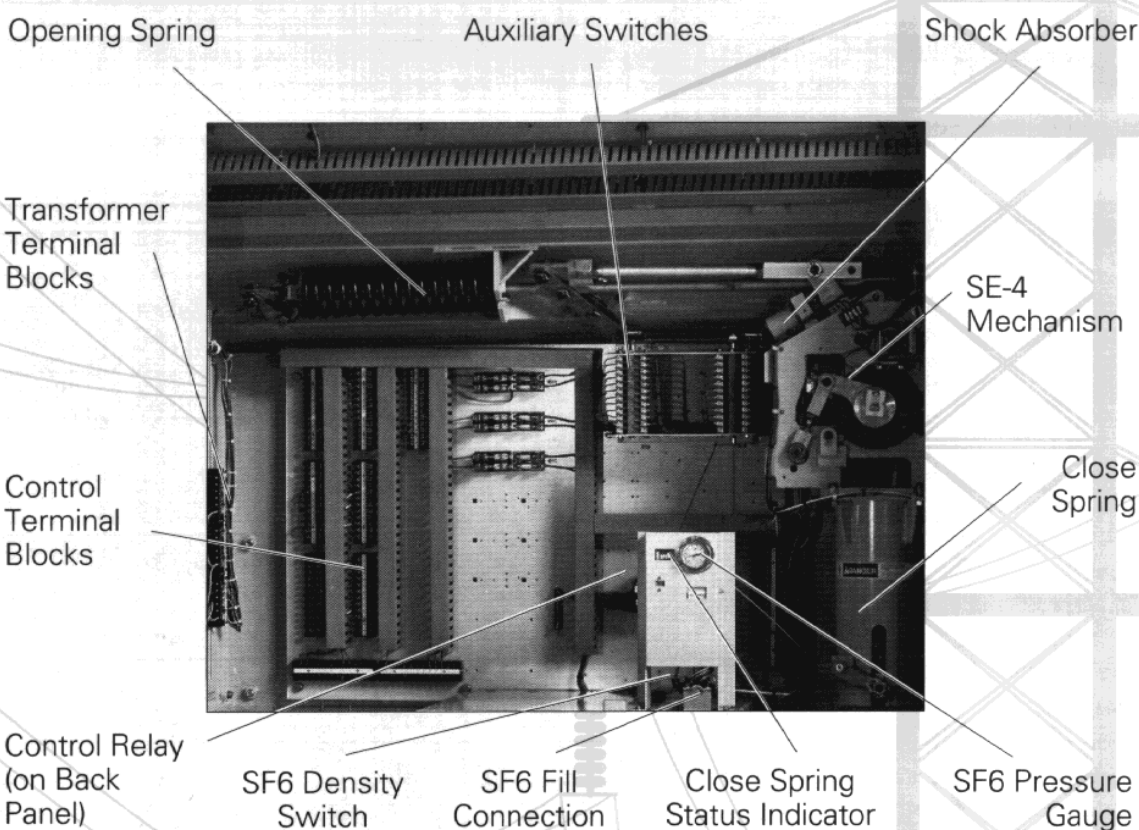
Because of the simplicity of the SPS breaker's design and the reliability of its operation, maintenance requirements are kept beneficially low. You'll appreciate other features as well. The SPS breaker (like the pneumatically-operated SP breaker) is equipped with O-ring SF6 fittings to minimize the possibility of SF6 gas leaks. These O-ring fittings are superior to compression-type fittings.

Siemens also provides an important safety feature on our puffer breaker designs. A temperature compensated pressure switch safeguards against operation under low pressure conditions.

Large doors, sealed with rubber gaskets, offer easy access for inspection and maintenance. To prevent condensation, heater elements (125 watts) offer continuous inside/outside temperature differential.

Included in the control cabinet are the necessary auxiliary switches, cutoff switch, latch check switch, alarm switch and operation counter. The control relays and three control knife switches (one each for the control, heater and motor) are mounted on a control panel. Terminal blocks on the side and top of the housing are available for control and transformer wiring.

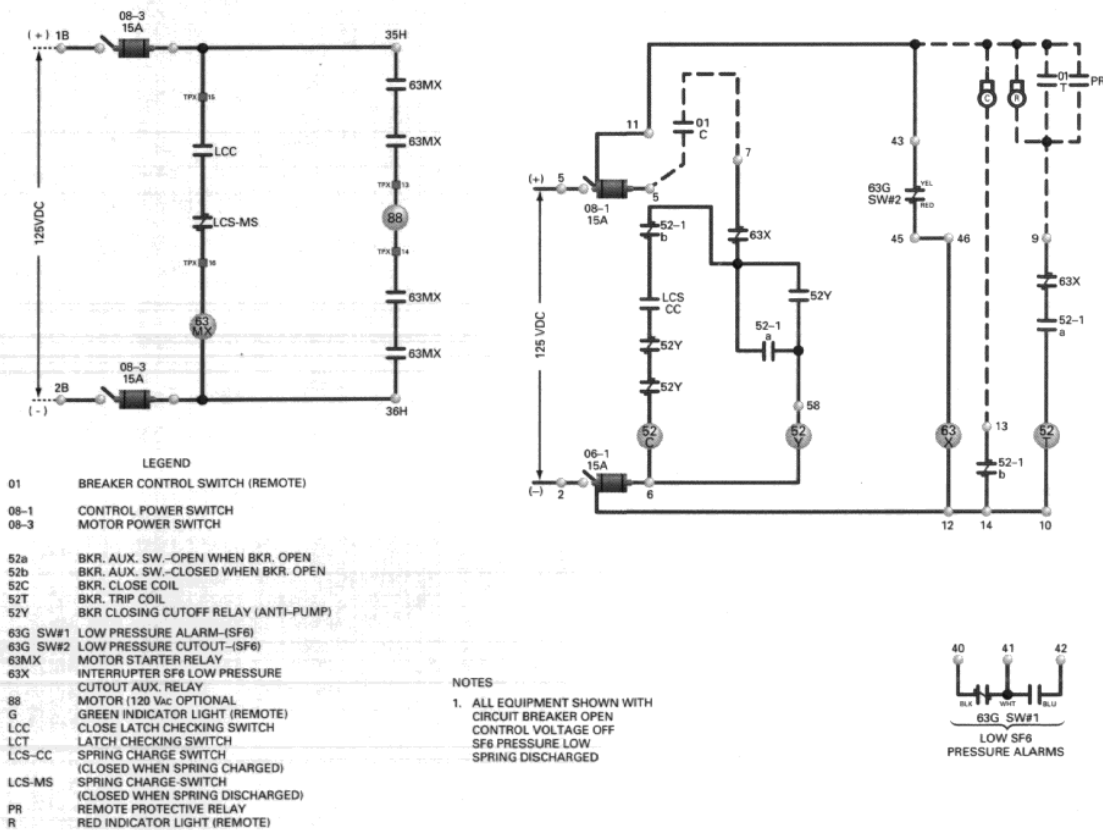
Current transformer terminal blocks are mounted on the left outside of the housing while the control terminal blocks are mounted on the back wall.



Control Power Requirements

Rated Voltage	48 VDC	125 VDC	250 VDC	115 VAC	230 VAC
Trip Coil Current (amps)	12.6	4.3	2.6	4.3	2.6
Close Coil Current (amps)	12.6	4.3	2.6	4.3	2.6

WIRING DIAGRAM



As shown in Fig. 1, the closing spring is discharged and the breaker is in the open position. Before a closure can be initiated, Spring A must be charged. This is accomplished by a motor (1) with a ratchet arm (2), which imparts motion to a wheel (3) within the mechanism. The wheel turns (CCW) until Spring A is charged.

Fig. 2 shows the mechanism with Spring A charged and the breaker in the open position. The close latch (4) supports the closing spring's stored energy. To close the breaker, the close release latch (5) is rotated, releasing the close latch and allowing Spring A to discharge.

As illustrated in Fig. 3, when Spring A discharges, the breaker changes to the closed position, and the opening Spring B (not shown) is charged. The mechanism is now ready to open. The spring charging motor now starts and recharges the closing Spring A as shown in Fig. 4.

The opening Spring B pressure is supported by the trip latch (6). To open the mechanism, the open release latch (7) is rotated. This releases the trip latch and allows the opening Spring B (not shown) to discharge.

When the opening Spring B discharges, the breaker opens and is in the position shown in Fig. 2.

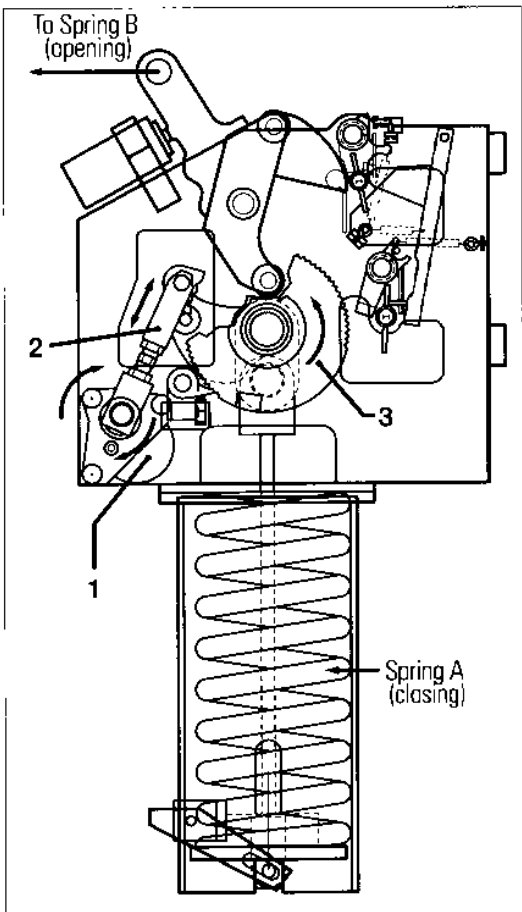


Fig. 1 Spring discharged breaker open

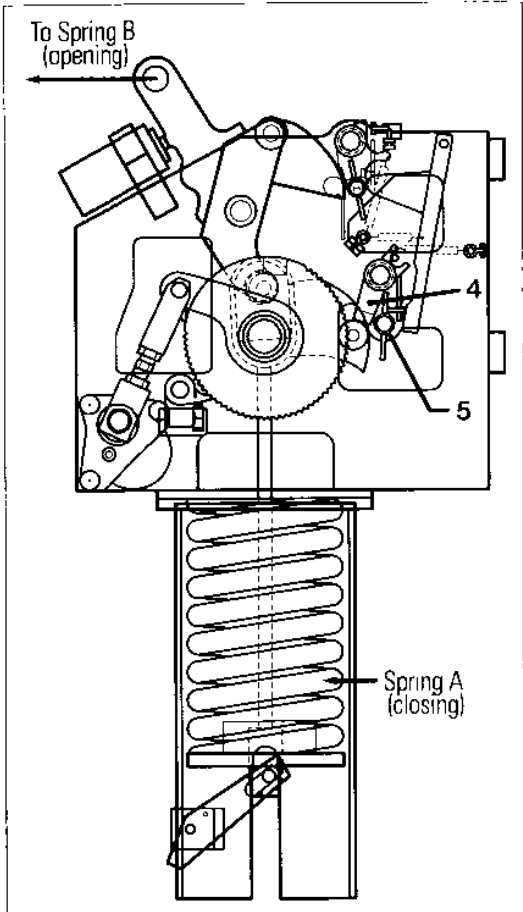


Fig. 2 Spring charged breaker open

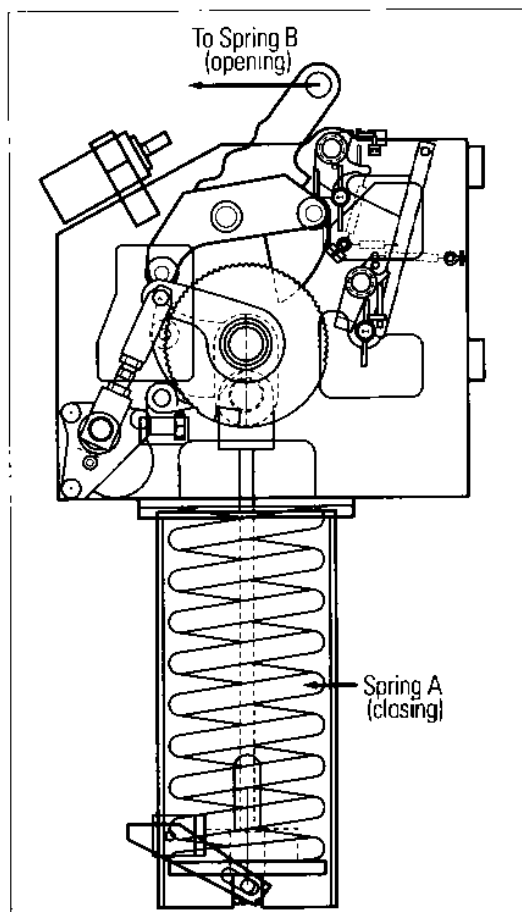


Fig. 3 Spring discharged breaker closed

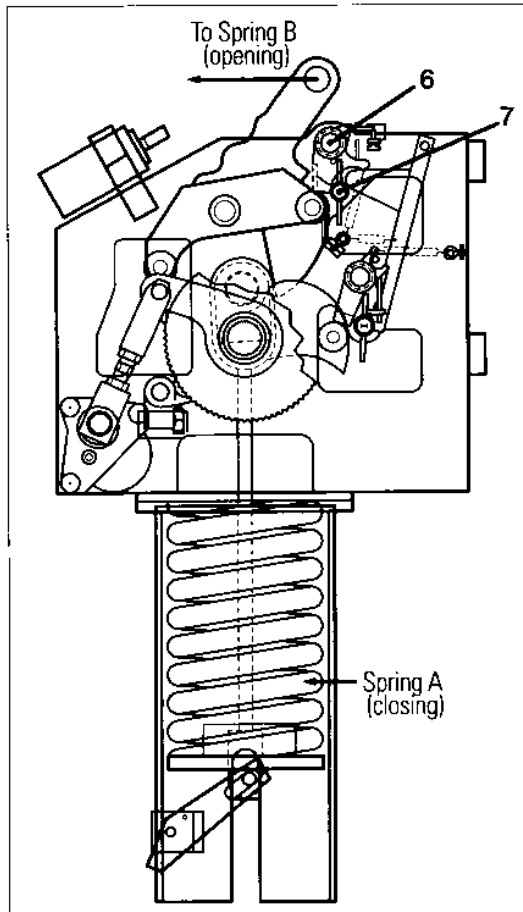
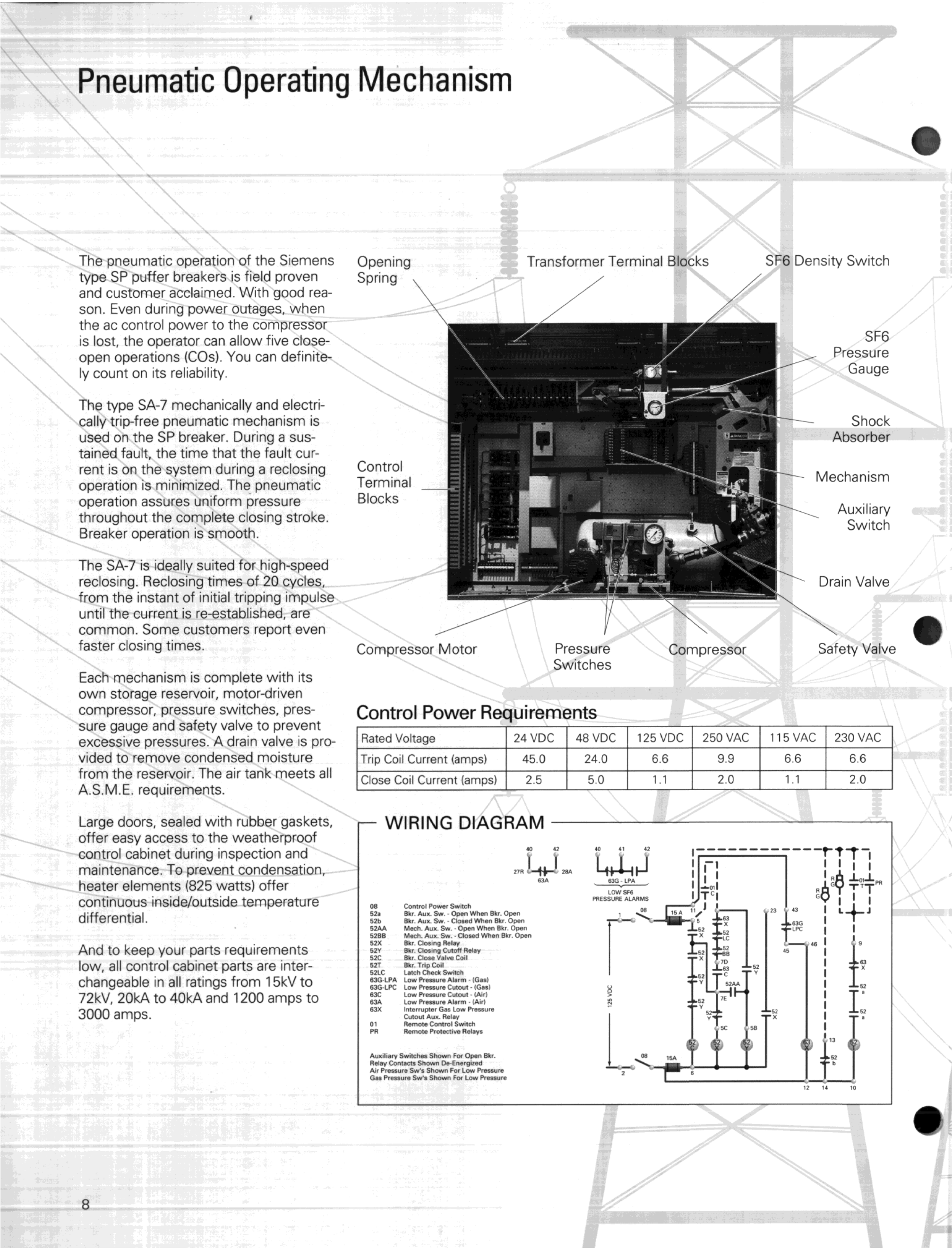


Fig. 4 Spring charged breaker closed



Pneumatic Operating Mechanism

The pneumatic operation of the Siemens type SP puffer breakers is field proven and customer acclaimed. With good reason. Even during power outages, when the ac control power to the compressor is lost, the operator can allow five close-open operations (COs). You can definitely count on its reliability.

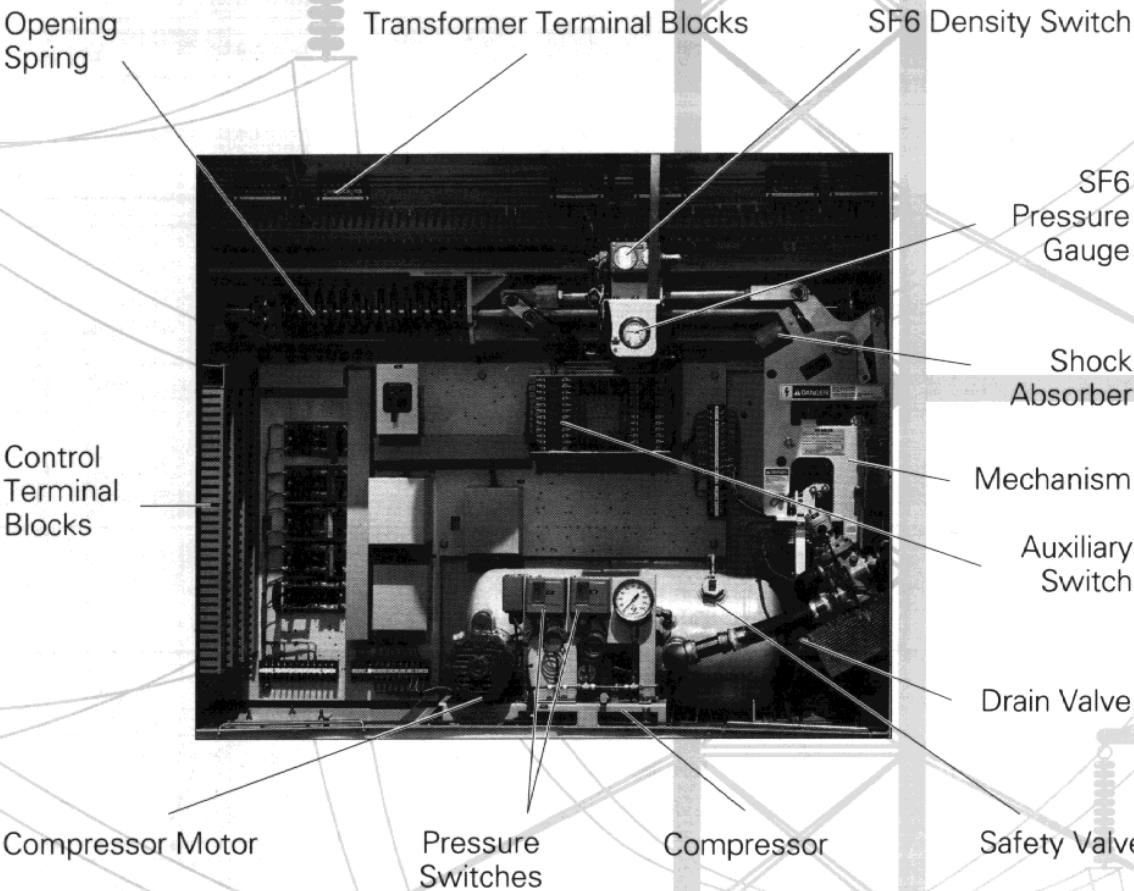
The type SA-7 mechanically and electrically trip-free pneumatic mechanism is used on the SP breaker. During a sustained fault, the time that the fault current is on the system during a reclosing operation is minimized. The pneumatic operation assures uniform pressure throughout the complete closing stroke. Breaker operation is smooth.

The SA-7 is ideally suited for high-speed reclosing. Reclosing times of 20 cycles, from the instant of initial tripping impulse until the current is re-established, are common. Some customers report even faster closing times.

Each mechanism is complete with its own storage reservoir, motor-driven compressor, pressure switches, pressure gauge and safety valve to prevent excessive pressures. A drain valve is provided to remove condensed moisture from the reservoir. The air tank meets all A.S.M.E. requirements.

Large doors, sealed with rubber gaskets, offer easy access to the weatherproof control cabinet during inspection and maintenance. To prevent condensation, heater elements (825 watts) offer continuous inside/outside temperature differential.

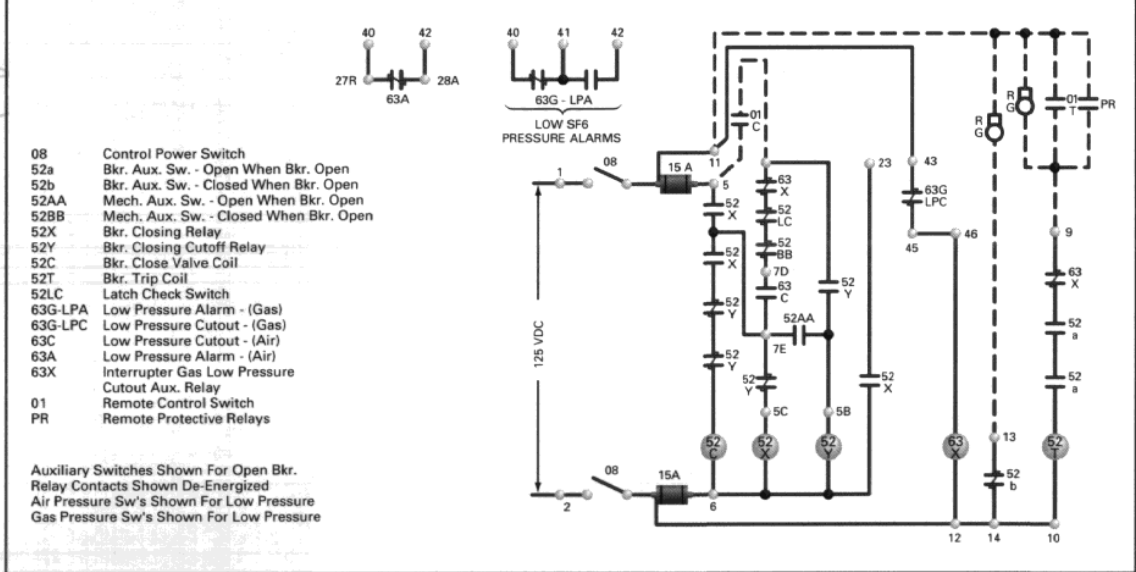
And to keep your parts requirements low, all control cabinet parts are interchangeable in all ratings from 15kV to 72kV, 20kA to 40kA and 1200 amps to 3000 amps.



Control Power Requirements

Rated Voltage	24 VDC	48 VDC	125 VDC	250 VAC	115 VAC	230 VAC
Trip Coil Current (amps)	45.0	24.0	6.6	9.9	6.6	6.6
Close Coil Current (amps)	2.5	5.0	1.1	2.0	1.1	2.0

WIRING DIAGRAM

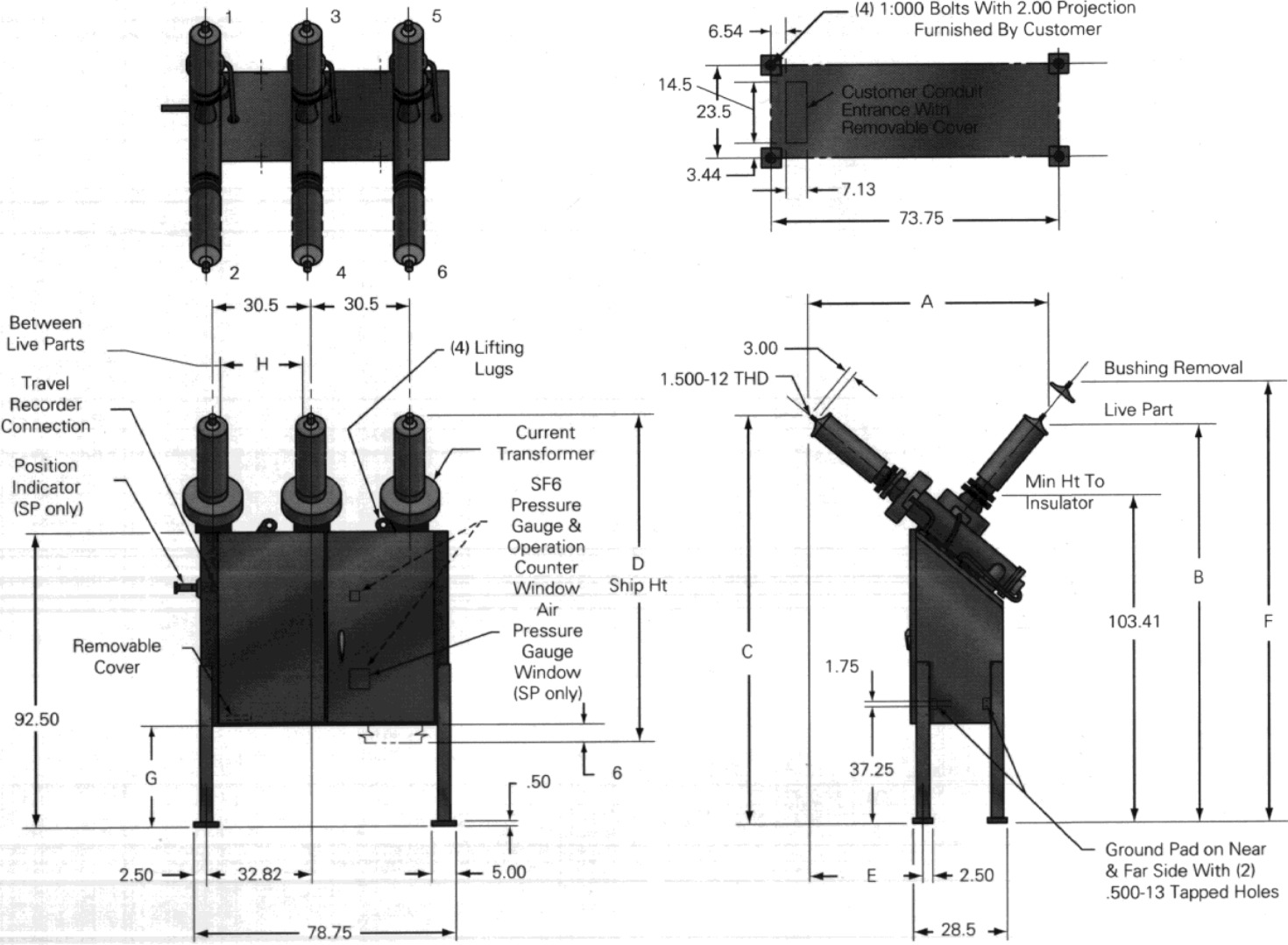


Dimensions

Type		Dimensions (inches)									Weight (lbs)	
Voltage	Cont. Current	A	B	C	D	E	F	G	H	Creep	Breaker	SF ₆
SP/SPS-15.5	1200/2000	63.2	119.1	123.7	97.00	29.1	136.4	33.5	27.0	50.0	3185	15
SP/SPS-15.5	1200/2000	73.9	124.9	128.6	102.0	35.0	142.2	33.5	27.0	73.0	3250	15
SP/SPS-15.5	2500/3000	83.8	119.1	133.0	107.0	39.7	147.5	33.5	23.5	50.0	3285	15
SP/SPS-25.8	1200/2000	63.2	119.1	123.7	97.0	29.1	136.4	33.5	27.0	50.0	3185	15
SP/SPS-25.8	1200/2500	73.9	124.9	128.6	102.0	35.0	142.2	33.5	27.0	73.0	3250	15
SP/SPS-25.8	2500/3000	83.8	119.1	133.0	107.0	39.7	147.5	33.5	23.5	50.0	3285	15
SP/SPS-38	1200/2000	63.2	119.1	123.7	97.0	29.1	136.4	33.5	27.0	50.0	3185	15
SP/SPS-38	1200/2000	73.9	124.9	128.6	102.0	35.0	142.2	33.5	27.0	73.0	3250	15
SP/SPS-38	2500/3000	83.8	119.1	133.0	107.0	39.7	147.5	33.5	23.5	50.0	3285	15
SP/SPS-48.3	1200/2000	63.2	119.1	123.7	97.0	29.1	136.4	33.5	27.0	50.0	3185	15
SP/SPS-48.3	1200/2000	73.9	124.9	128.6	102.0	35.0	142.2	33.5	27.0	73.0	3250	15
SP/SPS-48.3	2500/3000	83.8	119.1	133.0	107.0	39.7	147.5	33.5	23.5	50.0	3285	15
SP/SPS-72.5	1200/2000	63.2	126.6	131.2	97.0	29.1	143.9	41.0	27.0	50.0	3185/3455*	15
SP/SPS-72.5	1200/2000	73.9	124.9	128.6	102.0	35.0	142.2	33.5	27.0	73.0	3250/3520*	15
SP/SPS-72.5	2500/3000	83.8	126.6	140.5	107.0	39.7	154.9	41.0	23.5	50.0	3285/3555*	15
SP/SPS-72.5	2500/3000	94.3	124.9	137.9	112.0	46.1	153.3	33.5	23.5	73.0	3350/3620*	15

Dimensions only for reference,
not for construction purposes.

*Includes capacitor for 40kA.
Breaker weights include 6 CTs. Add 120 lbs. for each additional CT.



Controls and Relays

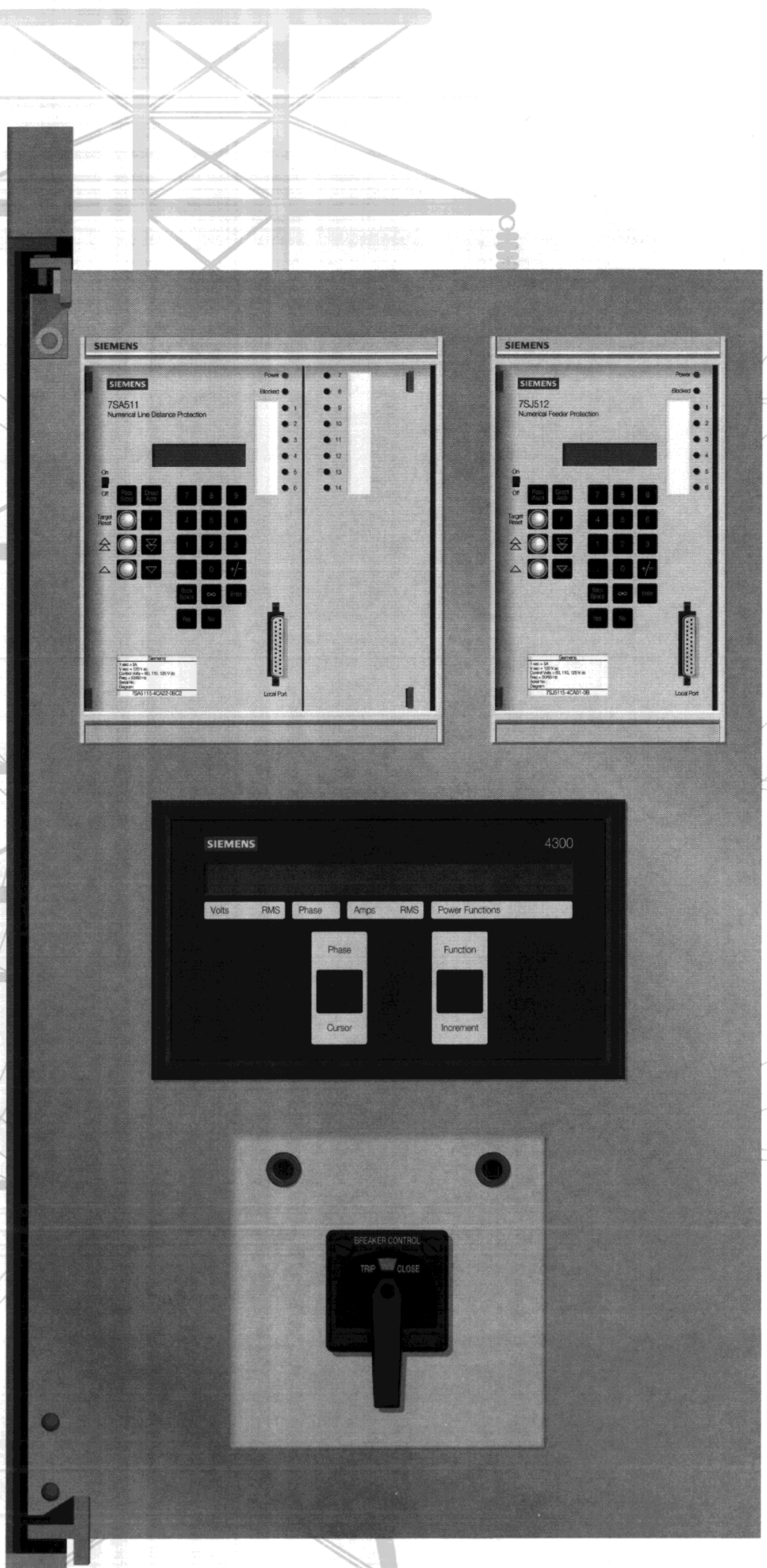
A unique optional relay panel in the operating mechanism cabinet allows for the local mounting of critical protective relays and controls. This feature couples convenience with immediacy. This panel has been used to accommodate a vast array of different relays and meters, and we have produced hundreds of schemes that are available to meet your needs. Our engineers have years of experience in designing these relay and control systems.

You can choose from standard relay and meter packages or one of the new, state-of-the-art relay combinations from Siemens. The complete line of numerical protection relays from Siemens can give you all of the relaying protection you need in a small space. Each of these relays has multiple functions and accepts standardized voltage and current signal levels, making them compatible with your standard relay applications.

For example, our 7SJ512 numerical Feeder Protection relay facilitates distribution automation by combining overcurrent, with optional reclosing and directional elements, into an integrated package with configurable logic. This, combined with waveform capture, target history, interrupting duty recording, display of measured and calculated system quantities, self diagnostics and communication abilities provide comprehensive protection, data acquisition and predictive maintenance functions for present and future requirements.

To cover your power metering needs, Siemens offers two power meters, the 4700 and the 4300. Both measure phase and line voltages, phase currents, average voltage and current, kilowatts, power factor and more in one compact, digital unit. The 4700 performs event logging functions. And both the 4300 and the 4700 can be integrated into an electrical data communications system for remote monitoring.

For further information on the relaying and metering options for the SP and SPS breakers, contact your Siemens representative.



Ratings and Specifications

Identification	Ratings								Related Capabilities		
Type	Nominal kV Class	Voltage		Insulation		Current — Amperes		Interrupting Time (Cycles)	Current Values — Amperes		
		Rated Max kV	Rated Voltage Range Factor			Rated Continuous at 60 Cycles	Rated Short Circuit Current at Rated Max. kV		Maximum Symmet- rical Interrupting Capability	3-Sec. Short Time Current Carrying Capability	Closing and Latching Capability
				Low Freq. (kV, rms)	Impulse (kV, Crest)						
SP/SPS-15.5-31.5	14.4	15.5	1.0	50	110	1200/3000	31,500	3	31,500	31,500	50,000
SP/SPS-15.5-40	14.4	15.5	1.0	50	110	1200/3000	40,000	3	40,000	40,000	64,000
SP/SPS-25.8-20	23.0	25.8	1.0	60	150	1200/3000	20,000	3	20,000	20,000	32,000
SP/SPS-25.8-31.5	23.0	25.8	1.0	60	150	1200/3000	31,500	3	31,500	31,500	50,000
SP/SPS-25.8-40	23.0	25.8	1.0	60	150	1200/3000	40,000	3	40,000	40,000	64,000
SP/SPS-38-20	34.5	38.0	1.0	80	200	1200/3000	20,000	3	20,000	20,000	32,000
SP/SPS-38-31.5	34.5	38.0	1.0	80	200	1200/3000	31,500	3	31,500	31,500	50,000
SP/SPS-38-40	34.5	38.0	1.0	80	200	1200/3000	40,000	3	40,000	40,000	64,000
SP/SPS-48.3-20	46.0	48.3	1.0	105	250	1200/3000	20,000	3	20,000	20,000	32,000
SP/SPS-48.3-31.5	46.0	48.3	1.0	105	250	1200/3000	31,500	3	31,500	31,500	50,000
SP/SPS-48.3-40	46.0	48.3	1.0	105	250	1200/3000	40,000	3	40,000	40,000	64,000
SP/SPS-72.5-20	69.0	72.5	1.0	160	350	1200/3000	20,000	3	20,000	20,000	32,000
SP/SPS-72.5-31.5	69.0	72.5	1.0	160	350	1200/3000	31,500	3	31,500	31,500	50,000
SP/SPS-72.5-40	69.0	72.5	1.0	160	350	1200/3000	40,000	3	40,000	40,000	64,000

Supplementary Specifications Voltage

DESCRIPTION	UNIT	SP/SPS 15.5	SP/SPS 25.8	SP/SPS 38	SP/SPS 48.3	SP/SPS 72.5
Lightning Impulse Withstand Voltage						
Chopped Wave 2µs	kV	142	194	258	322	452
Chopped Wave 3µs	kV	126	172	230	288	402
Rated Normal Current (10 ³)	A	12/20/30	12/20/30	12/20/30	12/20/30	12/20/30
Normal Frequency	Hz	60	60	60	60	60
Optional Frequency	Hz	50	50	50	50	50
Rated Permissible Tripping Delay (Y)	s	2	2	2	2	2
Auxiliary Voltage	Vac	115/230				
Operating Mechanism	—	Spring ("OCO")/Pneumatic (5 "CO")				
Pneumatic Pressure	psig	190 (NA Spring Mech.)				
Air Compressor Motor	hp	0.75 (NA Spring Mech.)				
Trip Coils		Single (standard) - Dual (optional)				
Trip and Close Coil Rating	Vdc	48/125/250				
Breaks Per Phase	—	1				
Contact Gap	in	4.5				
Phase Spacing	in	30.5				
Seismic Withstand Standard	g	0.3 Dynamic				
Optional	g	0.5 Dynamic				
Rated Voltage Range Factor	(k)	1.0				
RIV at 1000 kHz	µV	<<500				

Current*

DESCRIPTION	UNIT	20kA	31.5kA	40kA
Rated Short Circuit Current	kA	20	31.5	40
Rating Making Current	kA	20	31.5	40
Closing and Latching Capability rms peak	kA kA	32 54	50 85	64 108
Capacitance Switching				
General Purpose	A		100	
Overhead Line	A		250	
Isolated Current				
Definite Purpose	A		100	
Overhead Line	A		630	
Isolated Current				
Asymmetrical Int. Capability Ratio (S)	—		1.2	
Normal Operating Temperature Range				
Standard	°C		-30°C to 40°C	
Special	°C		-40°C/-50°C to 40°C	
Closing Time (total)	ms		100	
Rated Reclosing Time	Cycles		20	
Rated Duty Cycle	—	OCO-15S-CO (No derating)		
External Creep				
Standard	in	50.5	50.5	50.5
Special	in	73	73	73
External Strike To Ground				
Standard	in	19	19	19
Special	in	29	29	29
Qty. SF ₆	lbs		15	
SF ₆ Pressure	psig	75 @ 70° F/20° C		

Getting The Best Breaker For Your Needs

In considering any circuit breaker, today's utilities must be concerned not only with initial price and installation, but also with the ongoing costs of ownership. The Siemens SP and SPS win in every category. Their relatively low price tag, simple installation, and easy maintenance will continue to pay dividends decades into the future.

In addition, both standard-type breakers can be used for a number of special requirements, such as:

- Switching capacitors, cables and reactors
- Environmentally restricted sites requiring oil sumps
- System stability problems requiring three-cycle interrupting
- Reclosing duty without de-rating interrupting capability

- High contamination zones that require extra creep and low contamination weather sheds
- High altitude application up to 10,000 feet without de-rating

How To Order

When ordering a Type SP or Type SPS breaker, specify the following:

1. Breaker type and rating
2. Trip voltage: refer to pages 6, 8
3. Close voltage: refer to pages 6, 8
4. Motor voltage: 115, 230 Vac (SP) 120 Vac/125 Vdc, 240 Vac/250 Vdc (SPS)
5. Heater voltage: 115, 230 Vac
6. BCTs: type, ratio, number, location
7. Terminals: specify in detail if desired
8. Relays: specify in detail if desired
9. Include customer specifications covering special equipment, accessories, tests, etc.

Basic Breaker

The standard basic breaker includes:

1. Three-pole SF6-filled outdoor power circuit breaker with three SF6 interrupters.
2. Set of four structural steel legs.
3. Light gray standard color.
4. Six light gray SF6 filled bushings.
5. Six relaying accuracy bushing current transformers.
6. Trip-free spring or pneumatic operating mechanism.
7. Instrumentation to monitor SF6 gas pressure and provide low pressure alarm.
8. Eleven stage auxiliary switch; eight stages for customer use.
9. Trip coil and close coil.
10. Cabinet heater to prevent condensation.
11. Necessary terminal blocks and wiring.
12. Operations counter.
13. Fused knife switches (3).
14. Grounding pads (2).
15. Mechanical position indicator.
16. Provision for travel recorder attachment.

17. Fifteen pounds of SF6 gas.
18. Set of special hand tools required for installing SP breakers provided for each station.

Optional Modifications

1. Extra BCTs.
2. Metering accuracy BCTs.
3. Extra creepage bushings.
4. Capacitor trip.
5. Relays for reclosing or non-reclosing breaker application.
6. External pull to trip handle.
7. Cabinet light and convenience outlet.
8. Special heaters and cabinet insulation for operation down to -50°C.
9. One or two additional 11-pole auxiliary switches.
10. Dual trip coils.
11. 50 Hertz operation.

Siemens Energy & Automation

Technology that serves the customer.

The information contained herein is general in nature and is not intended for specific construction, installation or application purposes. Siemens Energy & Automation, Inc. reserves the right to make changes in specifications shown herein or add improvements at any time without notice or obligation.

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