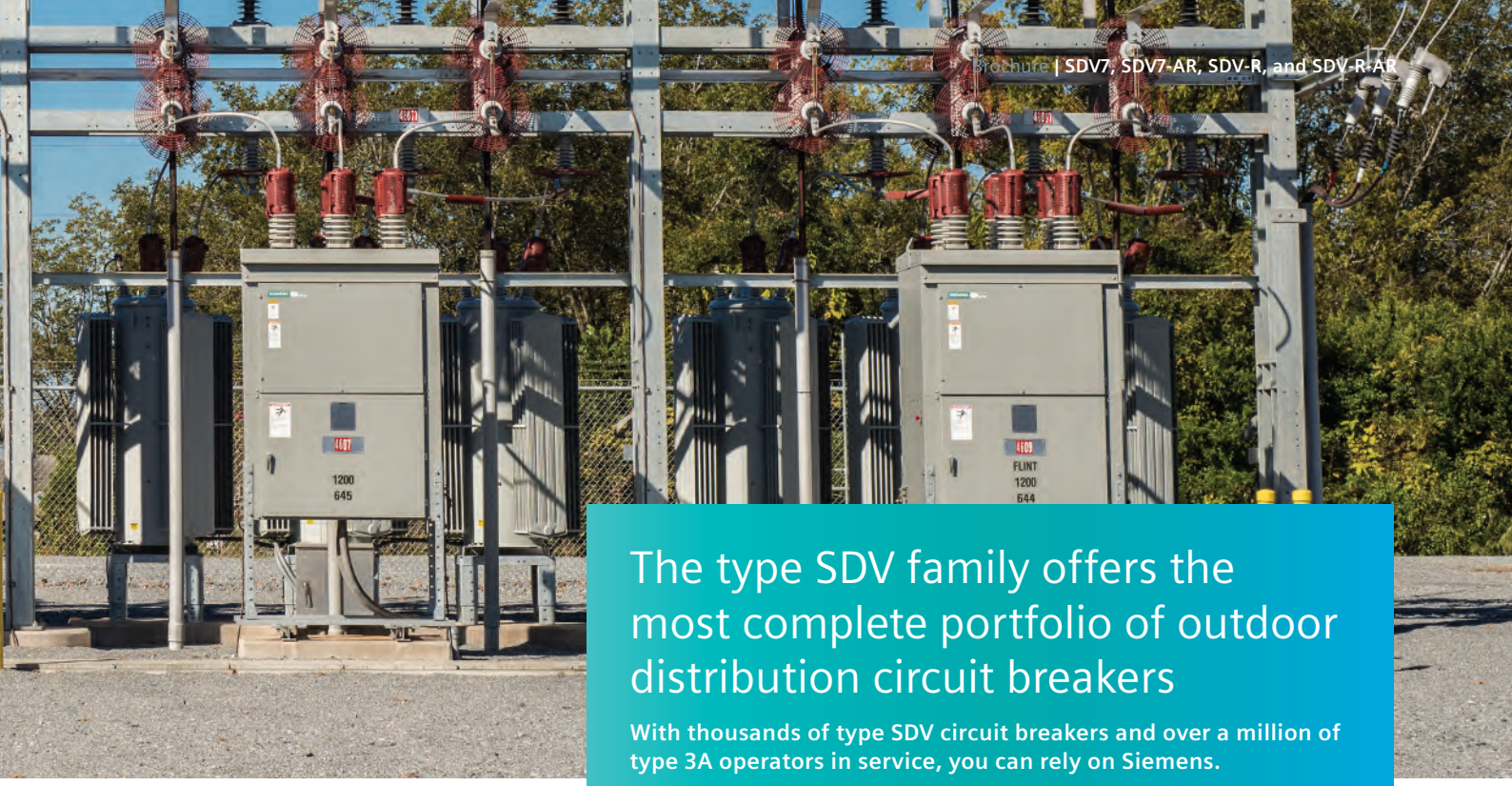
SDV

Outdoor distribution circuit breaker family

15.5 kV-38.0 kV

usa.siemens.com/sdv


1200
649
1200
641



The type SDV family offers the most complete portfolio of outdoor distribution circuit breakers

With thousands of type SDV circuit breakers and over a million of type 3A operators in service, you can rely on Siemens.

Siemens is the only medium-voltage, outdoor distribution circuit breaker OEM that can offer both stored-energy (spring) and magnetic-actuated drive mechanisms as well as both conventional and arc-resistant enclosures for typical distribution applications.

For renewable energy applications, Siemens has added the type SDV-R stored-energy drive circuit breaker that features an integral grounding switch, which is available in both conventional and arc-resistant enclosures.

Table of contents

Introduction

The types SDV7 and SDV-R family of distribution circuit breakers are the latest generation of the successful type SDV product line

Introduction
The Siemens SDV family of outdoor distribution circuit breakers have been operating reliably in a wide variety of applications since the early 1980s. The product line has been continually expanded to include higher ratings, reduced footprint, enhanced personnel safety features, and environmentally responsible options.

With an eye towards renewable energy applications, Siemens recently added the type SDV-R circuit breaker with an integral grounding switch as a complimentary offering to the highly successful SDV7 family of circuit breakers.

The type SDV-R integral fast-acting grounding switch is mechanically interlocked with the circuit breaker to limit transient voltage excursion to low levels, eliminating the need for grounding transformers.

Removing the grounding transformer not only reduces total installed cost and physical footprint, but also eliminates the risk of transformer oil spills. As such, **SDV-R offers wind power producers a welcome alternative to large grounding transformers with cable connections, which occupy significant real estate and pose the risk of oil leakage.**

The design of the type SDV7 features significant reduction in enclosure size; and, consequently, in the overall footprint. The type SDV7 product line encompasses the voltage groups 15.5 kV, 27.6 kV, and 38.0 kV. **Each group is specifically designed to optimize space and material for the voltage class while retaining common features across the entire product line.**

With an eye towards renewable energy applications, Siemens recently added the type SDV-R circuit breaker with an integral grounding switch as a complimentary offering to the highly successful SDV family of circuit breakers.

Ratings available					
Type	**Rating**	**Non-arc-resistant**	**Arc-resistant**	**Stored-energy operator**	**Magnetic-actuator operator**
SDV7	15.5 kV; 20 kA/25 kA; 1,200 A/2,000 A	Available	Available	Available	Available
SDV7	15.5 kV; 31.5 kA/40 kA; 1,200 A/2,000 A/3,000 A	Available	Available	Available	Future
SDV7	27.6 kV; 20 kA/25 kA; 1,200 A/2,000 A	Available	Available	Available	Available
SDV7	38.0 kV; 20 kA/25 kA; 1,200 A/2,000 A	Available	Available	Available	Future
SDV7	38.0 kV; 31.5 kA/40 kA; 1,200 A/2,000 A/2,500 A	Available	Available	Available	Future
SDV-R	38.0 kV; 20 kA/25 kA/31.5 kA/40 KA; 1,200 A/2,000 A	Available	Available	Available	Future

SDV7-AR

SDV7

SDV-R-AR

SDV-R

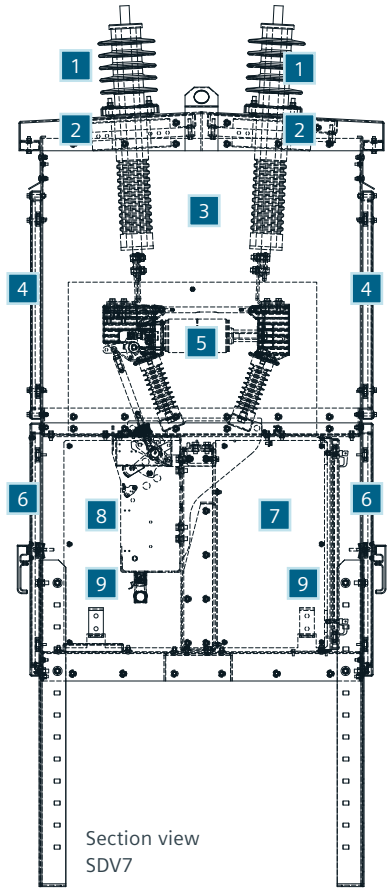
The heart of the SDV7-SE and SDV-R circuit breakers is the 3AH35-SE operator that is derived from the highly reliable type 3A family of operators, that has over 45 years of design heritage in a variety of Siemens products globally.

A significant feature enhancement to the SDV product line was the introduction of the type 3AH35-MA magnetically-actuated operator used in the SDV7-MA circuit breakers. It is adapted to the basic high-voltage support structure of the type 3AH35-SE stored-energy operator to maintain product commonality.

The type 3AH35-MA magnetic actuator operator employs long-life, rare-earth permanent magnets to provide the closing force needed for the worst-case closing and latching duty, in combination with the basic kinematic structure used with the entire type SDV7 family for opening operations. The magnetic actuator employs an electronic controller to provide power to close the circuit breaker, as well as to supply the energy to open the circuit breaker.

To enhance operator safety, an option for arc-resistant construction in both the SDV7 and SDV-R product lines is available. **The SDV family is the only family of outdoor distribution circuit breakers to offer an enclosure construction that has been tested for internal arcing in accordance with IEEE C37.20.7, for accessibility type 2B.** The rated internal arcing short-circuit current is equal to the rated short-circuit current for a duration of 0.5 seconds. The arc-resistant design shares the same footprint dimensions as the non-arc-resistant design, for ease in application.

With thousands of type SDV circuit breakers and over a million type 3A operators in service, you can rely on Siemens products to meet your distribution system demands.



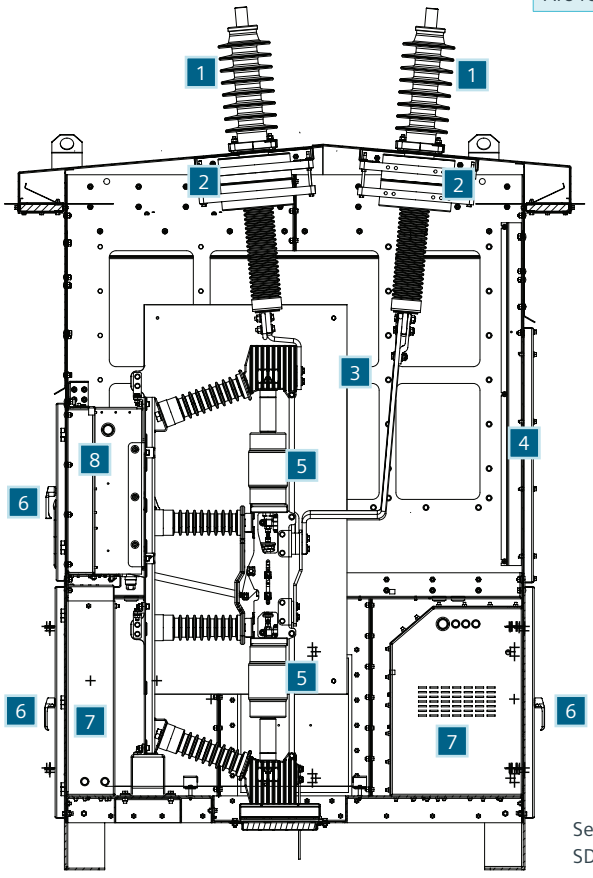
Section view
SDV7

1. Bushings
2. Current transformers
3. High-voltage compartment
4. Access door (bolted)
5. Vacuum interrupters
6. Access door (latched)
7. Relay and contol compartment
8. Operator compartment
9. Ground pads (opposite corners)

Relay and control
compartment side

Operator
compartment side

Enclosure type	Stored-energy operator	Magnetic-actuator operator
Non-arc-resistant	SDV7-SE, SDV-R	SDV7-MA
Arc-resistant	SDV7-SE-AR, SDV-R-AR	SDV7-MA-AR



Section view
SDV-R

Vacuum interrupters

The heart of the medium-voltage circuit breaker is the time-proven Siemens vacuum interrupter. Siemens vacuum interrupters use chrome-copper contact material, which keeps the chopping current to five amperes or less and thereby keeps overvoltages to a minimum.

The contact configuration employs axial-magnetic field geometry to maintain the arc in diffuse mode and minimize contact erosion, and provide a capability of up to 100 full-rated fault interruptions (depending on rating) before replacement is necessary.

An easily visible indicator is provided to directly determine the wear of the contacts.

Low-maintenance requirements

The vacuum interrupter is a sealed unit so the only maintenance typically required on the interrupter is to remove contaminants and check the vacuum integrity mechanically. The vacuum interrupters can be disconnected from the operating mechanism quickly, without tools, to check vacuum integrity. Other maintenance requirements on the circuit breaker include lubrication of moving parts and cleaning of insulation, at recommended intervals of five years (or ten years with the inclusion of an optional heater monitoring circuit) or 10,000 operations.

Simple current path

The type SDV current-path configurations are extremely simple. For SDV7, the vacuum interrupters are located so that the connections between bushings and vacuum interrupters are short and direct. For SDV-R, additional vacuum interrupters are introduced for the grounding switch function and arranged for ease of connecting to the station ground. The current path uses a flexible shunt connection between the vacuum interrupter moving contact and the bushing terminal, rather than using sliding contacts or other moving elements in the current circuit.

The type SDV distribution circuit breaker enclosure includes bolted, hinged doors on the front and rear of the high-voltage compartment, as well as hinged, latched doors for the operator compartment as well as the relay and control compartments. Access to internal components, whether high voltage or low voltage, is very convenient.

Enclosures

The configuration of the circuit breakers is very compact, resulting in a small footprint enclosure, allowing the SDV circuit breakers to fit into many existing installations.

The enclosures are robustly constructed, with the adjustable legs located at the corners of the enclosure rather than recessed under the enclosure. This affords them the ability to achieve the high-loading seismic qualification and resist up to 150 mph wind loads. The enclosures have a corrosion-resistant, powder-paint finish and are design-test proven to protect the internal current path and control elements from such harsh environmental conditions as wind-driven rain or dust, ice and snow accumulations, and outside temperatures as low as -50 °C (-58 °F).

All exterior hardware, hinges, and latches are stainless steel and the bushings are porcelain dry-type with extended creep distances for long life.

Stainless-steel ground pads welded on diagonally opposite corners of the enclosure are standard on all SDV circuit breakers. This is a better arrangement than designs that incorporate the ground pads into removable legs. On SDV-R circuit breakers, these pads are isolated from the grounding pad connection for the grounding switch to further enhance operator safety.

The types SDV7-AR and SDV-R-AR family enclosures offer arc-resistant construction. The arc-resistant enclosure has been tested for conditions of internal arcing in accordance with IEEE C37.20.7, for accessibility type 2B. The arc-resistant design shares the same footprint dimensions as the non-arc-resistant design, for ease in application.

Siemens is the only OEM that can offer both stored-energy (spring) and magnetic-actuated drive mechanisms.

Type 3AH35-SE

Stored-energy operator

Type 3AH35-SE stored-energy operator removed from enclosure

Type 3AH35-SE stored-energy operator
The type 3AH35-SE circuit breaker operator used in the types SDV7-SE and SDV-R circuit breakers is a durable and reliable stored-energy mechanism. This operator is designed to perform up to 10,000 operations before overhaul, and the basic operator in the 3A family has a mean time before failure (MTBF) of over 53,000 years.

The type 3A operator family has over 1,000,000 units in service worldwide in vacuum circuit breakers.

Improvements in the operator have been incorporated to enhance service life and simplify maintenance.

Newer lubricants and alternative bearing materials have been selected to reduce the chance for interaction between the lubricants and the metals to ensure long service life. Mounting provisions for devices, such as the opening latch, closing latch, and similar items, are designed for one-person removal and installation.

Reusable spring clips are used for pivot pins, avoiding the need for special removal tools or a supply of special purpose retainers during maintenance.

The spring-charging mechanism is a gear-drive design. Compared to a ratchet-and-pawl mechanism, the type 3AH35-SE operator is quieter and exhibits longer mechanical life.

The type 3AH35-SE stored-energy operator includes provisions for manual operation, such as during maintenance. The closing spring can be manually charged with a spring-charging crank. The spring-charging crank includes a coupling that automatically disengages if the spring-charging motor begins to operate.

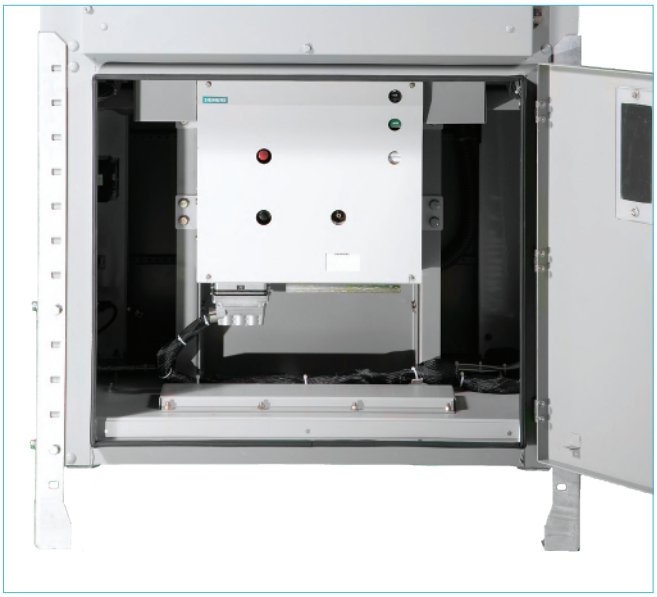
The operating mechanism also includes pushbuttons for manually closing or opening the circuit breaker. The buttons are recessed to avoid inadvertent operation.

The demonstrated total mechanical endurance of the operator is more than 60,000 operations with overhaul and vacuum interrupter replacement at 10,000 operation intervals.

The entire type SDV7-SE and SDV-R family, from 15.5 kV through 38.0 kV, uses the same basic type 3AH35-SE operating mechanism. The operators differ only in elements related to the voltage or interrupting rating of the circuit breaker.

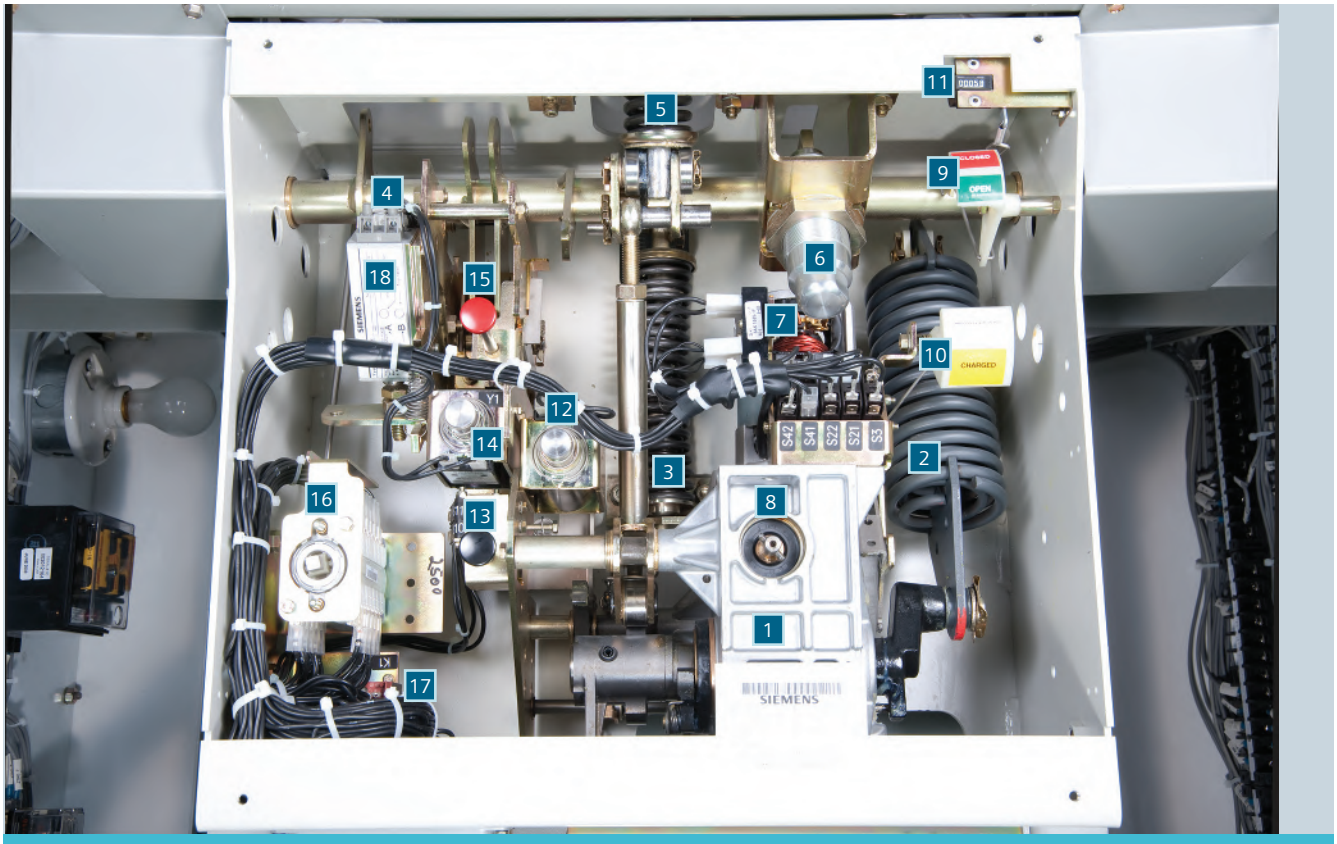
The components that differ according to rating include: the length of the main rotating shaft, contact pressure springs, closing spring, opening spring and pushrods, as well as the high-voltage elements, such as the vacuum interrupter, standoff insulators, and similar items.

The SDV-R operators also feature a second vacuum interrupter in each phase to perform the fast-acting grounding function, revised kinematics to mechanically interlock the circuit switching function and the grounding functions, and the orientation of the vacuum interrupters with respect to the operator housing to promote a compact design solution.



Type 3AH35-SE operator compartment in SDV7

Type 3AH35-SE operator in SDV-R



1. Spring charging gearbox
2. Closing spring
3. Opening spring
4. Main rotating shaft
5. Contact pressure spring
6. Opening operation shock absorber
7. Spring charging motor
8. Manual spring charging access port
9. OPEN-CLOSE indicator
10. CHARGED-DISCHARGED indicator
11. Mechanical operation counter
12. Spring release (close) coil
13. Manual close pushbutton
14. Trip coil
15. Manual open (trip) pushbutton
16. Auxiliary switch
17. Anti-pump relay
18. Undervoltage trip device (optional)

Siemens is the only OEM that can offer both stored-energy (spring) and magnetic-actuated drive mechanisms.

Type 3AH35-MA

Magnetic-actuator operator

Type 3AH35-MA magnetic-actuator operator removed from enclosure

Type 3AH35-MA magnetic-actuator operator
The type SDV7-MA distribution circuit breaker is available with a magnetic-actuator operator. The basic configuration of the circuit breaker is the same as for the stored-energy version, including the high-voltage elements and the vacuum interrupters, with only the operating mechanism replaced.

The type 3AH35-MA magnetic-actuator operator employs rare-earth magnets (neodymium-iron-boron) to maintain a stable CLOSED position, in combination with an electromagnetic coil structure to change from the OPEN position to the CLOSED position. The magnetic actuator uses a single coil design, providing a stable OPEN and a stable CLOSED position without supplemental energy input. The electronic controller provides a substantial current to the electromagnetic coil for closing operation, so that the electromagnetic force adds to the magnetic force provided by the rare-earth magnets.

For opening, only a modest electromagnetic force is needed, in the reverse direction, to offset the magnetic force provided by the rare-earth magnets. In effect, the electromagnetic force cancels the magnetic force during opening operations.

The force for opening primarily is provided by the contact pressure springs on each phase (not shown) with an assist from the opening spring. The opening spring is the same as used on the stored-energy version, and its primary function is to provide the force to oppose the force of atmospheric pressure on the vacuum interrupter bellows, which would otherwise cause the contacts of the open circuit breaker to close.

The field diagrams of the magnetic actuator illustrate the combined magnetic and electromagnetic field conditions in the various circuit breaker positions.

Magnetic-actuator electronic controller
The operation of the magnetic actuator is controlled by an electronic module. The electronic module receives power from a 24 Vdc power supply, stores energy in capacitors on several printed circuit boards, and provides a variety of functions, including:

- Closing, upon remote (or relay) command or from local pushbutton
- Opening, upon remote (or relay) command or from local pushbutton
- Capacitor control, including charging, monitoring, and periodic condition checking.

The electronic controller allows for circuit breaker reclosing according to the standard reclosing duty sequence in IEEE C37.04, O – 0.3 s – CO – 15 s – CO. The capacitors used to power circuit breaker opening and closing actions recharge following operations as follows:

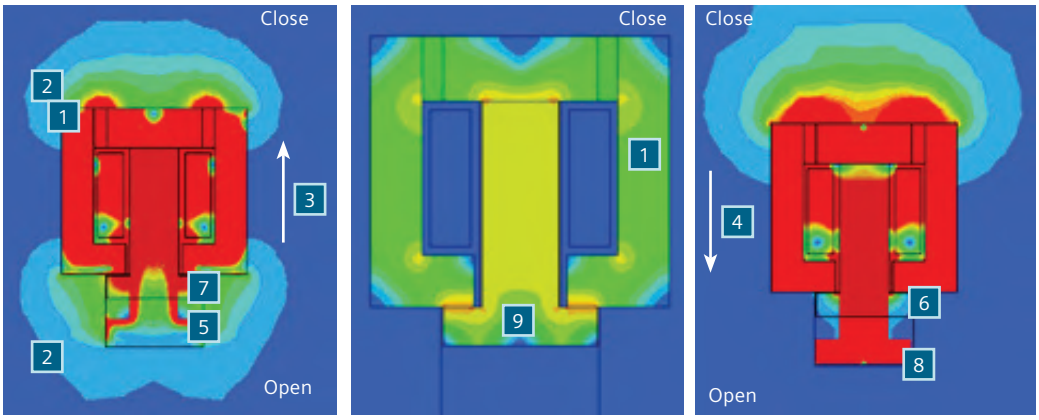
- After a C operation ≈ 10 s
- After an O operation ≈ 2-5 s
- After a CO operation ≈ 12-15 s.

When first energized, the capacitors require approximately 35 s to obtain full charge.

The electronic controller is designed for harsh environments and long life. The estimated life of the electronic controller is approximately 20 years with an ambient environment outside the circuit breaker enclosure of -50 °C (-58 °F) or less.

The capacitors used have a life expectancy of 45 years with an ambient environment at the capacitors of 70 °C (158 °F) (3% of total hours), 50 °C (122 °F) (40% of total hours), with the remaining 57% of total hours in an ambient of 40 °C (104 °F) or less. In an environment less harsh than this, the expected life is well in excess of 45 years.

Electromagnetic and magnetic fields condition in various circuit breaker positions



Fields during closing - electromagnetic and magnetic fields additive

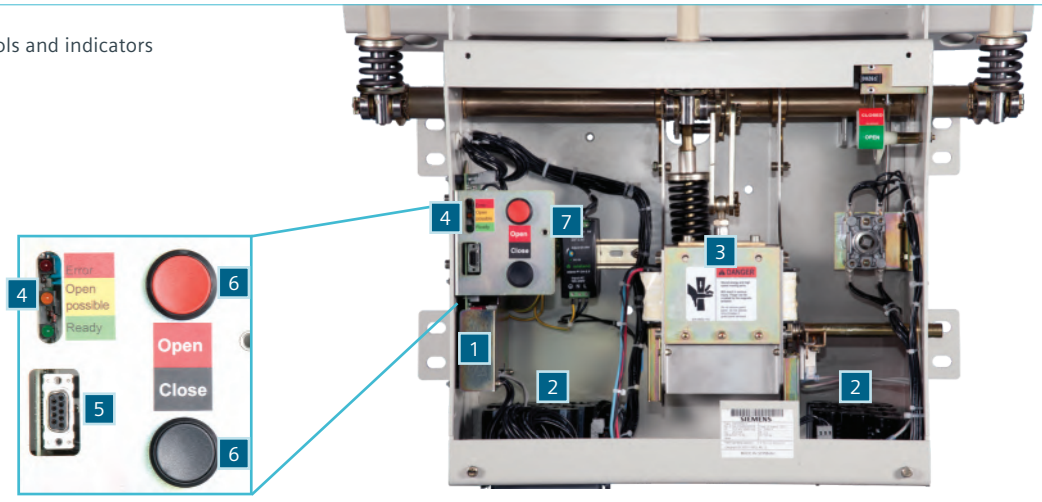
Fields while circuit breaker closed - magnetic field maintains CLOSED position

Fields during opening - electromagnetic field opposes (cancels) magnetic field

1. Magnetic field from rare-earth magnets
2. Electromagnetic field due to current coil
3. Direction of armature movement during closing
4. Direction of armature movement during opening
5. Armature at start (in OPEN position)
6. Armature at start (in CLOSED position)
7. Armature at end (in CLOSED position)
8. Armature at end (in OPEN position)
9. Armature in CLOSED position

Operator elements, controls and indicators

1. Electronic controller
2. Capacitor board
3. Magnetic actuator
4. LED
5. RS-232 PC interface
6. Local pushbuttons (black-close, red-open)
7. Green LED (power supply behind front cover)

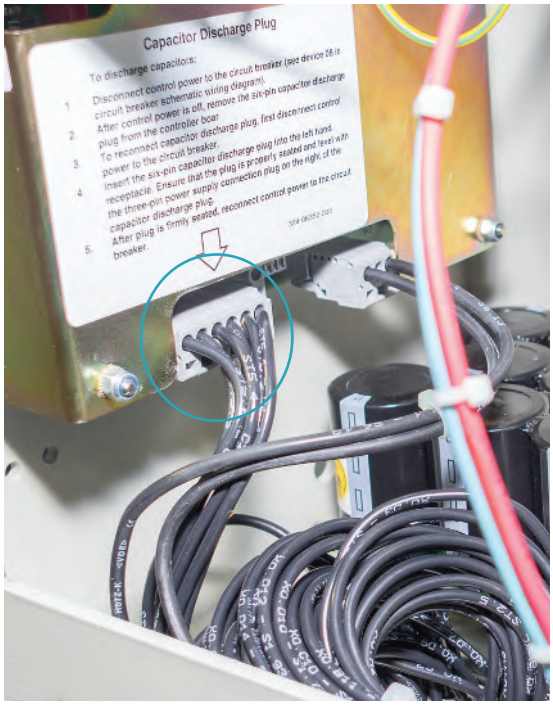


The capacitor boards are generously sized, with energy storage above the level needed to operate the circuit breaker. In fact, the system can open and close the circuit breaker if as much as 20% of the capacitors are disabled.

The capacitors have reserve energy such that the circuit breaker can be electrically opened using the pushbuttons on the operator for at least 300 seconds after control power is lost.

The power supply for the electronics circuits accommodates a wide range of input voltages. The high-range power supply accepts any voltage in the range of 110 Vac to 240 Vac or 110 Vdc to 250 Vdc. The low-range power supply accepts voltage in the range of 28 Vdc to 56 Vdc.

Electrical close and open commands operate through binary inputs, with the high-range command input version requiring input of at least 68 Vac or 68 Vdc for operation, while the low-range command input version requires input of at least 17 Vac or 17 Vdc for operation.



Detail of electronic controller and pull to plug to discharge capacitors

Automatic monitoring
The electronic controller includes monitoring and self-test functions, among which are these:

- Failure to close on command (after 100 ms)
- Excessive coil current
- Capability of capacitors
- Initial charging of capacitors on energization
- Periodic charging test cycle to verify energy storage capacity (performed weekly)
- Power supply (24 Vdc) failure
- Overcharging of capacitors (excess voltage)
- Coil circuit integrity
- Interlock check (lockout).

The electronic controller also maintains a log, which includes details of the last 32 operations and results of capacitor capability tests.

Built-in fast-discharge circuit for capacitors
The controller system design includes built-in means to discharge the capacitors if maintenance is to be performed. There is no need for the user to provide jumper wires or loading resistors to discharge the capacitors – simply disconnect the plug between the electronic controller board and the capacitor boards, and the discharge circuit is automatically enabled, discharging the capacitors to a low level to enable maintenance. The NEC (NFPA 70) requires discharge to below 50 Vdc within five minutes, but the system incorporated in the type SDV7-MA magnetic-actuator design discharges to less than 5 Vdc in approximately 90 seconds.

When control power is initially energized, the controller executes a start-up routine, after which charging of the capacitors begins.

When control power is first applied, a green LED on the power supply (item 7 on page 9) is illuminated.

The controller includes LEDs to indicate the energy status of the capacitor bank.

From complete discharge, approximately 25 seconds after control power is applied, a yellow LED lights, and approximately 5 to 10 seconds later, the yellow LED goes off and a green LED illuminates. The LEDs indicate status as follows:

- Green LED on power supply illuminated (visible with operator cover removed) indicates control power is available
- Green LED (adjacent to pushbuttons) illuminated indicates the operator is ready and is capable of Open-Close-Open sequence
- Yellow LED (adjacent to pushbuttons) illuminated indicates the operator is capable of an Open operation
- Red LED (adjacent to pushbuttons) illuminated indicates error and the energy is not sufficient for operation.
- The controller includes output terminals corresponding to the LEDs so that status can be monitored from remote locations.

External manual trip handle

An external manual trip handle is provided as standard on the type SDV7-MA and type SDV7-MA-AR circuit breakers with magnetic-actuator operator. The external manual trip handle requires only a modest force to operate it, and once the circuit breaker is opened, the handle can be padlocked to provide a lockout function and prevent closing of the circuit breaker either by electrical means or by manual means.

External manual trip handle

Handle in normal position

Handle in lockout position

Interlock not blocked (cover removed for photo)

Interlock blocked (cover removed for photo)

Arc-resistant enclosure option

To help improve operator safety

Siemens is the only OEM that can offer both conventional and arc-resistant circuit breaker enclosures

Type SDV7-AR

Type SDV-R-AR

Arc-resistant enclosure option
The SDV family is available with an option for arc-resistant construction.

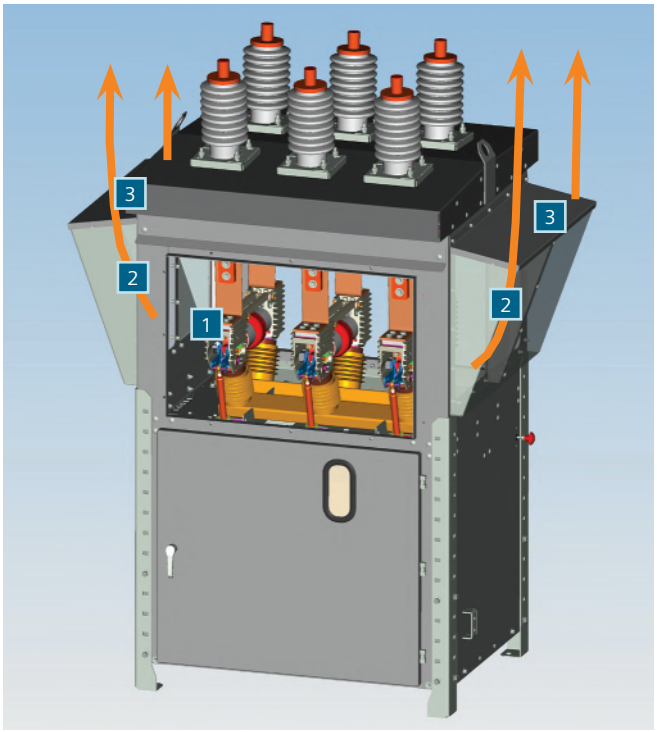
For arc-resistant capability, the basic type SDV7 enclosure is modified to include relief openings, along with exhaust channels on the sides of the enclosure to route the exhaust gases associated with an internal arcing event to the sides of the enclosure and thence to exhaust flaps located on the top of the side exhaust channels.

The modifications also include pressure-actuated flaps to close ventilation openings between the low-voltage compartments and the high-voltage compartment when an arcing event occurs.

The design has been successfully tested for resistance to internal arcing in accordance with IEEE C37.20.7 for accessibility type 2B. Accessibility type 2B means that a degree of protection is provided on all four sides of the enclosure, and this protection is provided even if low-voltage compartment doors are all open.

The rated arcing current is equal to the rated short-circuit current of the circuit breaker as shown and the rated arcing current duration is 0.5 s, in accordance with IEEE C37.20.7.

The basic enclosure dimensions and footprint are unchanged from the non-arc-resistant version, simplifying application. The exhaust channels add to the overall space occupied by the enclosure, as shown in the dimensional figures.



1. Relief opening
2. Exhaust channel
3. Exhaust flap on top of exhaust channel

Technical ratings

Each voltage group optimizes space and material while retaining common features across the entire line

Circuit breaker rating	Rated maximum voltage	Rated withstand voltages		Rated short-circuit and short-time current	Rated interrupting time[1]	Rated continuous current	Rated transient recovery voltage[2]		Rated permissible tripping delay time Y	Rated closing and latching current
		Lightning impulse (BIL)[3]	Power frequency				u_c TRV peak value	t_3 time to voltage u_c		
	kV	kV	kV	kA, rms	ms/cycles	A, rms	kV	µs	sec	kA, peak
SDV7 technical ratings in accordance with IEEE C37.04-1999 and C37.06-2000										
15.5-20	15.5	110/142	50	20	50/3	1,200, 2,000	29.2	32	2	52
15.5-25	15.5	110/142	50	25	50/3	1,200, 2,000	29.2	32	2	65
15.5-31.5	15.5	110/142	50	31.5	50/3	1,200, 2,000, 3,000	29.2	32	2	82
15.5-40	15.5	110/142	50	40	50/3	1,200, 2,000, 3,000	29.2	32	2	104
27.6-20	27.6	150/194	60	20	50/3	1,200, 2,000	52.1	45	2	52
27.6-25	27.6	150/194	60	25	50/3	1,200, 2,000	52.1	45	2	65
38.0-20	38.0	200/258	80	20	50/3	1,200, 2,000	71.7	59	2	52
38.0-25	38.0	200/258	80	25	50/3	1,200, 2,000	71.7	59	2	65
38.0-31.5	38.0	200/258	80	31.5	50/3	1,200, 2,000, 2,500	71.7	59	2	82
38.0-40	38.0	200/258	80	40	50/3	1,200, 2,000, 2,500	71.7	59	2	104
SDV-R technical ratings in accordance with IEEE C37.04-2018 and C37.20.4-2013										
38.0-20	38.0	200/258	80	20	50/3	1,200, 2,000	71.7	59	2	52
38.0-25	38.0	200/258	80	25	50/3	1,200, 2,000	71.7	59	2	65
38.0-31.5	38.0	200/258	80	31.5	50/3	1,200, 2,000	71.7	59	2	82
38.0-40	38.0	200/258	80	40	50/3	1,200, 2,000	71.7	59	2	104

Footnotes:

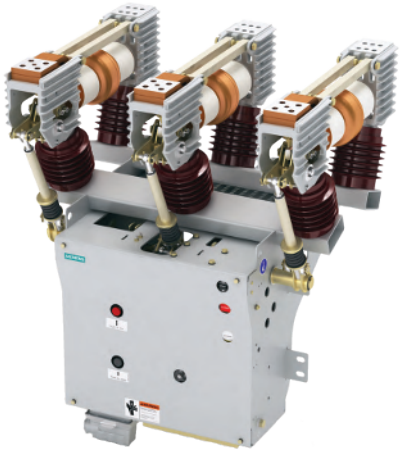
1. 50 ms interrupting time standard. 83 ms interrupting time optional with stored-energy operator only.
2. TRV values for SDV7 are in accordance with IEEE C37.06-2009 TRV peak value u_c roughly equal to historic E^2 value in IEEE C37.06-2000. Value t^3, time to voltage u_c is approximately 1/1.138 times T^2 value in IEEE C37.06-2000. TRV values for SDV-R are in accordance with IEEE C37.04-2018.
3. First value is full-wave impulse withstand. Second value is chopped-wave impulse withstand, applicable only with circuit breaker closed.
4. Rated internal arcing short-circuit current is equal to the rated short-circuit current for a duration of 0.5 s. Accessibility type 2B in accordance with IEEE C37.20.7.

Control data for stored-energy operator						
Nominal	Range		Close coil	Trip coil[1]	Spring charging motor	
	Close	Trip	A	A	Amperes run (avg.)	Charging seconds
48 Vdc[6]	36-56	28-56	11.4	30/11.4	8	10
125 Vdc	90-140	70-140	2.1	7.4/4.8	4	10
250 Vdc	180-280	140-280	2.1	9.6/4.2	2	10
120 Vac	104-127	104-127	2.0	---	6	10
240 Vac	208-254	208-254	2.0	---	3	10

Control data for magnetic-actuator operator					
	Input voltage range	Input power	Controller output		Capacitor voltage[2,3,4]
			Close	Open	
Electronic controller power supply	28-56 Vdc	80 W[5]	40-55 A	10-15 A	160 Vdc
	95-250 Vdc / 100-254 Vac	60 W / 60 VA[5]	40-55 A	10-15 A	160 Vdc
Binary inputs (close and open commands)	Low-range model	≥ 17 Vdc or 17 Vac		Recommended duration ≥ 100 ms	
	High-range model	≥ 69 Vdc or 53 Vac		Recommended duration ≥ 100 ms	

Footnotes:

1. First value is for standard 50 ms/three-cycle interrupting time. Second value is for optional 83 ms/five-cycle interrupting time (stored-energy operator only).
2. If controller power fails, capacitors retain sufficient charge to open circuit breaker within 300 seconds, with minimum open command duration 100 ms.
3. Capacitors discharge to 10 V or less within five minutes after disconnecting plug.
4. Capacitor charging time approximately 30-35 seconds from complete discharge, approximately 12 seconds after OPEN-CLOSE-OPEN sequence.
5. On initial energization, power demand is approximately 100 W, declining to approximately 20 W when capacitors are fully charged. When the circuit breaker operates (open or close), power demand again increases to approximately 100 W, declining to approximately 20 W when capacitors are fully charged.
6. Applicable to type SDV7 only; not applicable to type SDV-R.



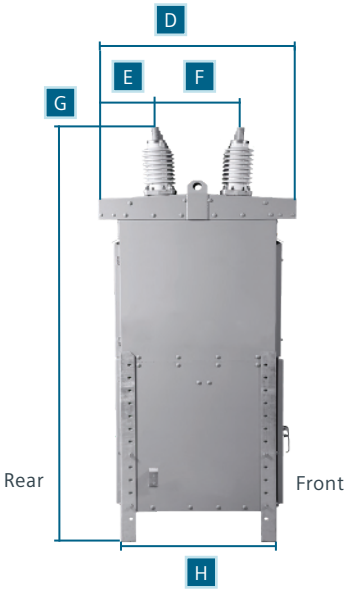
3AH35-SE

3AH35-MA

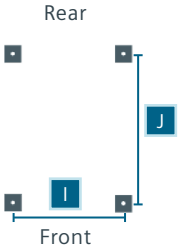
Dimensions

SDV7-AR

Front view



Side view



SDV-R-AR

Dimensions in inches (mm)

Type	Rating	A	B	C	D	E	F	G	H	I	J	K[5]
SDV7	15.5 kV, 1,200 A-2,000 A	10.7 (272)	13.0 (330)	47.1 (1,197)	44.5 (1.130)	12.4 (315)	19.8 (503)	**92.0-116.0 (2,337-2,945)**	36.1 (918)	**31.3 (794)**	**42.7 (1,084)**	10.3 (260)
SDV7	15.5 kV, 3,000 A	12.3 (312)	16.0 (406)	56.5 (1,435)	52.8 (1,340)	15.9 (403)	21.0 (534)	**96.0-120.0 (2,438-3,048)**	44.2 (1,123)	**39.4 (1,001)**	**52.0 (1,321)**	11.4 (290)
SDV7	27.6 kV, 1,200 A-2,000 A	12.3 (312)	16.0 (406)	56.5 (1,435)	49.8 (1,265)	14.4 (366)	21.2 (538)	**96.0-120.0 (2,438-3,048)**	44.2 (1,123)	**39.4 (1,001)**	**52.0 (1,321)**	11.4 (290)
SDV7	38.0 kV, 1,200 A, 2,000 A, 2,500 A	13.4 (340)	19.5 (495)	67.8 (1,723)	63.0 (1,600)	20.4 (518)	22.2 (563)	**120.5-144.5 (3,060-3,670)**	55.6 (1,413)	**50.9 (1,294)**	**63.1 (1,604)**	16.7 (424)
SDV-R	38.0 kV, 1,200 A, 2,000 A	14.6 (371)	19.5 (495)	68.2 (1,733)	82.2 (2,089)	20.7 (524)	28.5 (723)	**128.3-149.3 (3,259-3,792)**	68.5 (1,740)	**62.1 (1,578)**	**61.5 (1,561)**	15.6 (395)

Features and benefits

Standards
The type SDV circuit breakers meet the following standards:

- IEEE C37.04 ratings and requirements for ac high-voltage circuit breakers
- IEEE C37.09 test procedures for ac high-voltage circuit breakers
- IEEE C37.06 preferred ratings ac high-voltage circuit breakers.

Arc-resistance

- IEEE C37.20.7 Testing for internal arcing faults (for arc-resistant units).

Grounding switch

- IEEE C37.20.4 indoor ac switches (for SDV-R/SDV-R-AR units).

Maintenance interval
If applied under IEEE usual service conditions, maintenance is only needed at intervals of five years/10,000 operations. With the inclusion of an optional heater monitoring circuit, the maintenance interval can be extended to 10 years.

The SDV product line has been continually expanded to include higher ratings, reduced footprint, enhanced personnel safety features, and environmentally responsible options.

Standard features for all types include:

- Visual circuit breaker status window
- Operations counter
- Mechanical position indicator
- External manual trip means
- Generous relay and metering space
- Hinged panel for relays or devices
- Necessary terminal blocks and wiring
- Fused knife-switch control voltage disconnects
- Porcelain dry-type roof bushings
- Bolted cabinet construction
- Permanent lifting eyes
- Adjustable galvanized legs (4)
- Corrosion resistant powder paint finish (ANSI-61 light gray with white for interior panels of the low-voltage relay and control compartment)
- Stainless steel external ground pads (2)
- Stainless steel external hardware
- Cabinet heaters to prevent condensation
- Filtered ventilation
- IEEE rain- and dust-tested design
- Reduced footprint from previous models.

Standard features for the types SDV-R and SDV-R-AR only:

- Integral fast-acting grounding switch
- Isolated ground and grounding connection pads.

Seismic

When specified, the circuit breaker can be provided with the capability of maintaining structural integrity during and following a seismic disturbance, as appropriate for the specified UBC, IBC, or IEEE 693 levels.

Stored-energy operating mechanism type 3AH35-SE:

- Close and trip coil
- Options available:
  - Capacitor trip unit for alternating current (ac) tripping supply
  - Second trip coil
  - Undervoltage trip device
  - Additional auxiliary switch contacts
  - Circuit breaker control switch with indicating lights.

Magnetic-actuator operating mechanism type 3AH35-MA

- Pushbuttons for local close and open
- Options available:
  - Additional auxiliary switch contacts
  - Binary input voltage:
    - High range ≥ 68 Vdc or 68 Vac
    - Low range ≥ 17 Vdc or 17 Vac.
  - Electronic power supply:
    - 28-56 Vdc
    - 95-250 Vdc / 100-254 Vac.

Options available for all types include:

- Arc-resistant construction
- Terminal connectors for bushings
- Terminal connectors for ground
- Current transformers (up to two per bushing)
- Siemens protective relays
- Other protective relays
- Local/remote or toggle switches
- Additional heaters for -40 ˚C application (consult factory for -50 ˚C application)
- Heaters applied at ½ voltage
- Adjustable thermostat
- Seismic capability (IEEE 693 high level, UBC zones 1-4)
- Interior convenience outlet (GFCI)
- Interior light with switch
- Molded-case circuit breakers in lieu of fused knife switches
- Wire markers.

Published by Siemens Industry, Inc. 2020.

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Order No.: EMMS-T40004-03-4AUS
Printed in U.S.A.