

# S&C Alduti-Rupter<sup>®</sup> Switches

Outdoor Distribution, 14.4 kV through 69 kV



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## Application

S&C Alduti-Rupter® Switches, rated 14.4 kV through 69 kV, 600 amperes or 1200 amperes continuous and live switching, provide *no-external-arc* circuit interruption of overhead distribution feeders and outdoor distribution substations. These time-proven-reliable switches are specially designed for live-switching duties including:

- **Line switching**—load splitting (parallel or loop switching), load dropping . . . and associated charging currents;
- **Transformer switching**—load currents . . . and associated magnetizing currents; and
- **Cable switching**—load splitting (parallel or loop switching), load dropping . . . and associated charging currents.

Alduti-Rupter Switches are available in seven rugged three-pole group-operated styles that can be tailored to suit any configuration and mount on any structure. An unparalleled selection of standard mounting arrangements simplifies application engineering and ordering, reducing lead time and cost, and facilitating stocking. For installations where simultaneous three-phase switching isn't needed, single-pole switches are available too.

Vertical-Break and Double-Break Styles feature heavy-duty designs that are ideal for distribution substations or feeders. Side-Break Heavy-Duty, Side-Break Standard-Duty, and Single-Pole Styles are also excellent choices for feeder applications.

Side-Break Integer, Vertical-Break Integer, and Double-Break Integer Styles are pre-engineered and preassembled, with necessary phase-to-phase and phase-to-ground electrical clearances built-in, for the ultimate in installation simplicity. The interphase drive is factory-adjusted to ensure proper operation. These switches are the most cost-effective choice for old or new line configurations. Vertical-Break Integer and Double-Break Integer Styles, further, can be furnished with S&C Mounting Pedestals—perfect for substation applications.

For complete specifications on all Alduti-Rupter Switches—including ratings, dimensions, weights, and ordering information—refer to S&C Specification Bulletin 761-31. For details on standard mounting arrangements, refer to S&C Data Bulletin 761-80.

### **Distribution Feeder Applications**

Increasing load densities and expanding demand for electricity have resulted in greater load per mile of distribution line, and increased numbers of interconnections, lateral feeders, and branches. More and more sectionalizing devices are required to simplify switching procedures, reduce the size and duration of outages, and provide points for



**Insulated-base 34.5-kV Side-Break Integer Style Alduti-Rupter Switch.**

cold-load pickup. Ordinary disconnects aren't adequate for this duty . . . they have only limited switching capabilities. But with their *no-external-arc* interrupting performance and full 600- or 1200-ampere live-switching capabilities, Alduti-Rupter Switches are well suited to the task.

For most applications where simultaneous three-phase switching is required to avoid single-phasing issues (for example, where improper operation of ground relays would result), a Side-Break or Vertical-Break Alduti-Rupter Switch is ideal. Selection of a Side-Break Heavy-Duty, Side-Break Standard-Duty, or Side-Break Integer Style is primarily a matter of matching the switch to the economics of the application. Side-Break Standard-Duty and Integer Styles feature simplified interphase drive mechanisms, bearings, supports, and mounting arrangements appropriate for distribution feeders.

Cost savings are realized with Integer Styles through factory-assembly and elimination of individual switch bases. There's no do-it-yourself kit of individual switch poles and parts to be assembled in the field. Integer Style Switches have a one-piece steel or insulated base which supports the insulators of all three poles.

Vertical-Break Integer and Side-Break Integer Switches rated 25/34.5 kV and 34.5 kV further, have a one-time duty-cycle fault-closing rating when power-operated by an S&C Switch Operator (or fault-closing *capability* when manually operated). These switches are ideal where automated switching is required to improve the reliability of service.

With Integer Styles, the complete assembly—including operating mechanism and all mounting hardware—arrives at the job site in a single shipment. Stocking problems are minimized and there's no chance of misplacing components. Mounting the switch is easy, so operating personnel save time. Pole-mounted switches require only two through-bolts and one or two pole bands and lag screws for stable support . . . pedestal-mounted switches are secured with four bolts. Simple addition of the handle and the vertical pipe sections completes the installation. Integer Style Alduti-Rupter Switches are engineered to be trouble-free.

Single-pole S&C Alduti-Rupter Switches are an excellent choice where simultaneous three-phase switching isn't required. With their no-external-arc interrupting performance, they can be mounted inverted—and operated with a conventional hookstick. (The external arcing of ordinary disconnects demands upright positioning, making group operation mandatory.) You save the cost of a three-pole operating mechanism and its installation.

### ***Distribution Substation Applications***

The rate of load growth and the trend to higher distribution voltages have presented switching problems at distribution substations too.

On the secondary side, there are more feeders, more heavily loaded lines, and longer lines. Alduti-Rupter Switches are up to the task. They can split load and drop lines or cables . . . even the entire load in an emergency. Their no-external-arc interrupting performance is especially important in substations, where close phase spacings rule out use of arc-producing disconnects.

On the primary side, Alduti-Rupter Switches meet all requirements for transformer switching—load dropping, parallel switching, and magnetizing current switching. Here again, their no-external-arc interrupting performance is an asset—permitting phase spacings of only 48 inches at 46 kV.

Vertical-Break and Vertical-Break Integer Switches are an excellent choice for distribution substation applications. These economical, highly reliable switches are available in a wide variety of mounting configurations, including low-profile pedestal mounting. Vertical-Break Integer models rated 25/34.5 kV and 34.5 kV have a one-time duty-cycle fault-closing rating when power-operated by an S&C Switch Operator (or fault-closing *capability* when manually operated).

Double-Break Switches, which utilize two interrupters per phase, are offered at voltages of 34.5 kV through 69 kV. Double-Break Integer Switches are also offered at 46 kV, and have a two-time duty-cycle fault-closing rating when power-operated by an S&C Switch Operator (or fault-closing *capability* when manually operated).

With their no-external-arc interrupting performance, Alduti-Rupter Switches can be furnished in upright, vertical, and inverted mounting configurations, permitting extremely compact substation designs . . . an increasingly important consideration with the dwindling availability of space in urban applications.

### ***Full-Load Switching—for Vastly Simplified Switching Practices***

Alduti-Rupter Switches perform interrupting duties positively, with no external arc—and also provide foolproof isolation of a visible air gap. They offer the utmost flexibility in distribution-system switching practices. Here are a few examples:

- **Lines may be extended and additional load accommodated** (within the rating of the switch) without affecting switching ability.
- **Interlocking isn't required**, for example, in transformer applications, between the primary switch and the secondary breaker.
- **A loaded circuit can be dropped inadvertently** (through error or misunderstanding) with no hazard to the operator or to the system.
- **In an emergency, Alduti-Rupter Switches can drop the entire connected load** without complicated breaker-and-switch sequencing. There's no need to drop individual loads as a preliminary operation.

### ***Power Operation***

Because Alduti-Rupter Switches can switch loaded or unloaded lines, transformers, and cables, they're ideally suited for remote supervisory control or fully automatic operation when equipped with an S&C Switch Operator.

Type AS-1A Switch Operators provide power operation of switches with rotating-type operating mechanisms, and have operating times not exceeding 0.75 second maximum. Type AS-10 Switch Operators provide power operation of switches with reciprocating-type operating mechanisms, and have operating times not exceeding 1.2 seconds maximum. Advanced, microprocessor-based M Series® Switch Operators provide power operation of switches with rotating- or reciprocating-type operating mechanisms, and have an operating time not exceeding 0.5 second maximum.



The high operating speed of these switch operators provides sufficient moving-contact velocity in the interrupters to ensure full interrupting capability and long operating life. High operating speed also provides adequate closing velocity, permitting the assignment of the following duty-cycle fault-closing ratings:

- 25/34.5-kV and 34.5-kV Side-Break Integer: 15,000 amperes, RMS, asymmetrical, one-time duty-cycle.
- 25/34.5-kV and 34.5-kV, 600-ampere Vertical-Break Integer: 20,000 amperes, RMS, asymmetrical, one-time duty-cycle.
- 25/34.5-kV and 34.5-kV, 1200-ampere Vertical-Break Integer: 30,000 amperes, RMS, asymmetrical, one-time duty-cycle.
- 46-kV Double-Break Integer: 18,000 amperes, RMS, asymmetrical, one-time duty-cycle, when driven by a Type AS-1A or Type AS-10 Switch Operator; 16,000 amperes, RMS, asymmetrical, one-time duty-cycle, when driven by an M Series Switch Operator.

For more information on Type AS-1A and Type AS-10 Switch Operators, see Descriptive Bulletin 769-30 and Specification Bulletin 769-31. For more information on M Series Switch Operators, see S&C Descriptive Bulletin 1051-30 and Specification Bulletin 1051-31.

### Recommended Phase Spacings

The no-external-arc interrupting performance of Alduti-Rupter Switches allows significantly smaller phase spacings than horn-gap switches. This table shows recommended Alduti-Rupter Switch phase spacings on feeders and in substations, compared to industry-standard phase spacings.



46-kV Double-Break Integer Style Alduti-Rupter Switch with M Series Switch Operator.

Alduti-Rupter Switches			Minimum Phase Spacing, Inches, Per ANSI C37.32-2002		
Style	Rating, kV, Nom.	Recommended Phase Spacing, Inches	Horn-Gap Switches	Side-Break (Horizontal-Break) Disconnects	Vertical-Break Disconnects and Bus Supports
Single-Pole or Three-Pole Vertical-Break	14.4	24	36	30	24
	25	30	48	36	30
	25/34.5	25	48	36	30
	34.5	36	60	48	36
Three-Pole Side-Break Heavy-Duty or Standard-Duty	14.4	32	36	30	24
	25	39	48	36	30
	34.5	47	60	48	36
Three-Pole Double-Break	34.5	36	60	48	36
	46	48	72	60	48
	69	72	84	72	60

## Construction and Operation

### Direct Drive of Interrupter Contact

Alduti-Rupter Switches don't rely on moving probes, "mousetrap" actuating schemes, or internal latches for tripping. Operation is simple and straightforward.

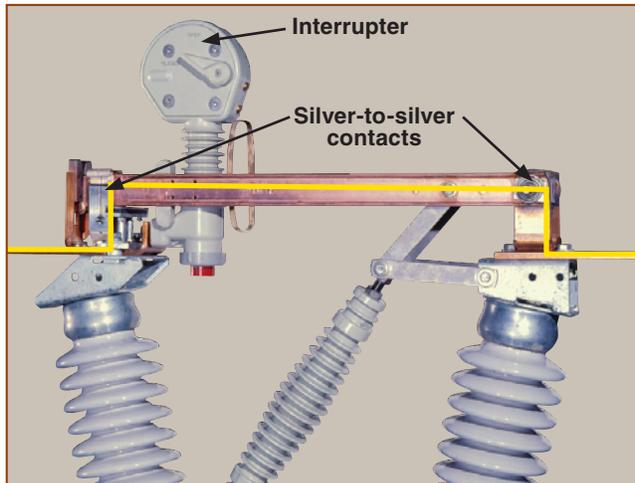
Each interrupter is direct-powered by the opening or closing movement of its blade . . . It can't get out of sequence. There's no reliance on springs for contact separation; springs are used only for positive open-closed detents.

High-speed motion of the interrupter contact is provided by a speed-multiplying straight-line linkage within the interrupter. For every position of the blade, there's a predetermined position of the interrupter contact, such that the external gap between the line and load sides of the switch always exceeds the gap within the interrupter at the time of circuit interruption.

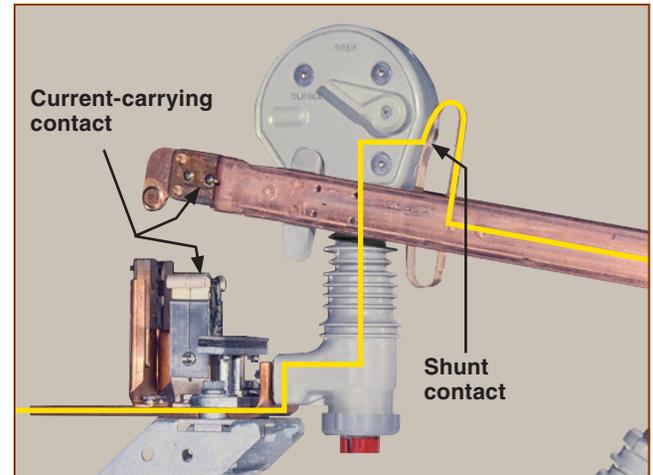
Coordination of the interrupter's dynamic internal dielectric strength with its generous external leakage distance and striking distances—plus programmed blade position—eliminates any chance of flashover.

### Interrupter Sequence of Operation

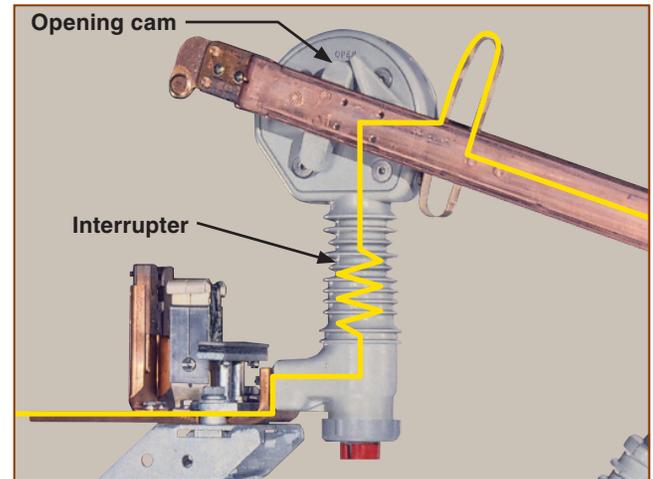
With the switch blade in the fully closed position, the interrupter contact is isolated from the circuit. The current path is solely through the copper switch blade and the silver-to-silver contacts.



As the switch blade opens, current is transferred to the interrupter by positive wiping action of the spring-tempered, phosphor-bronze shunt contact—before the current-carrying contact parts. There's no external arcing.

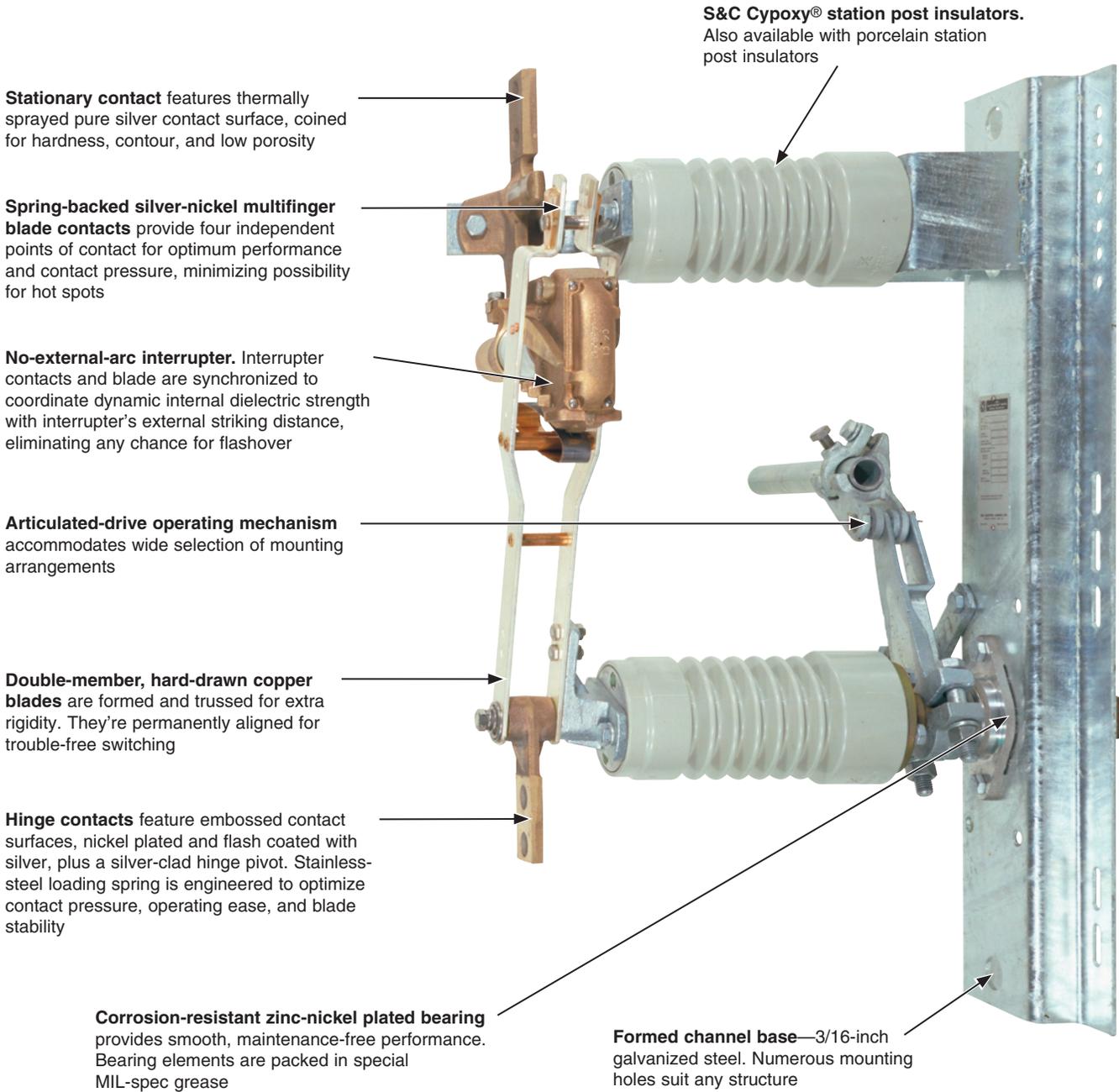


As the switch blade continues to open, the opening cam on the switch blade direct-drives the interrupter contact open. Circuit interruption occurs internally, using the deionizing gases generated by thermal action of the arc on S&C's special trailer and liner material formulations. There's no external arc or flame. Exhaust is quietly vented through a labyrinthine muffler. No interrupter maintenance is required.

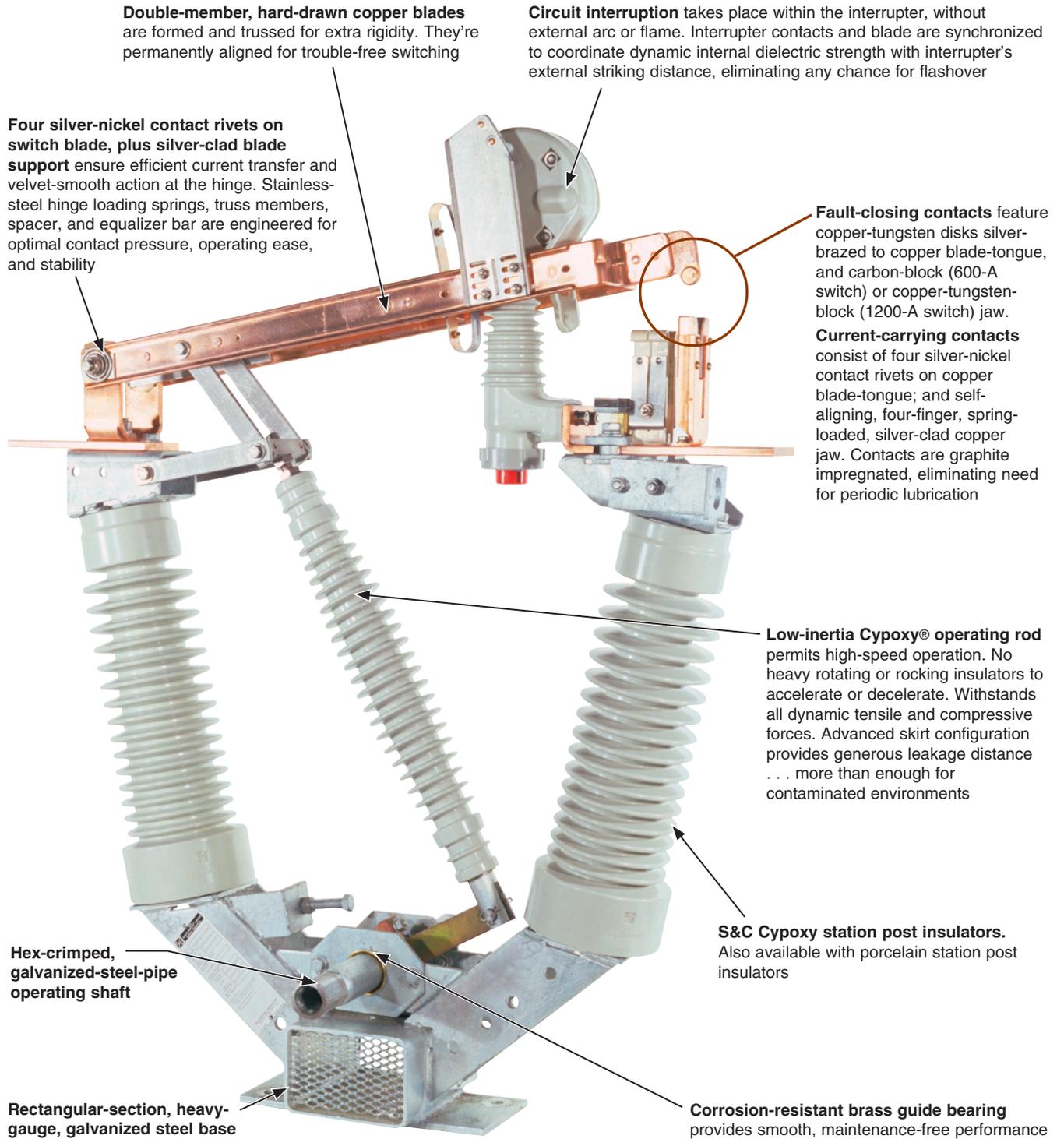


In the closing sequence (not shown), the closing cam on the switch blade direct-drives the interrupter contact closed, ready for the next programmed opening after engagement of the current-carrying contact. There are no arcing horns, buggy whips, or interrupter-pickup probes on the blade to compromise dielectric coordination of the interrupter.

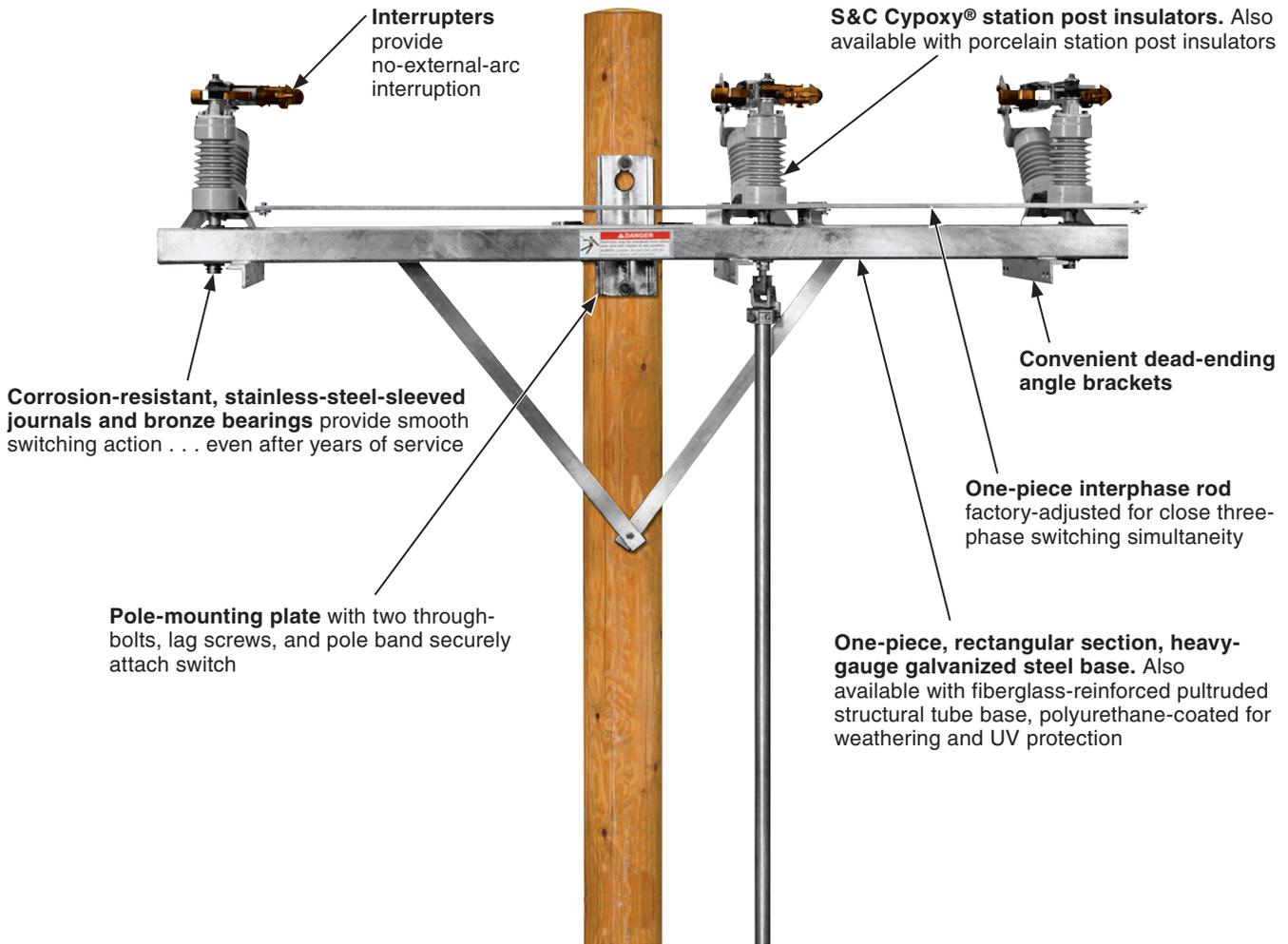
## Typical Construction



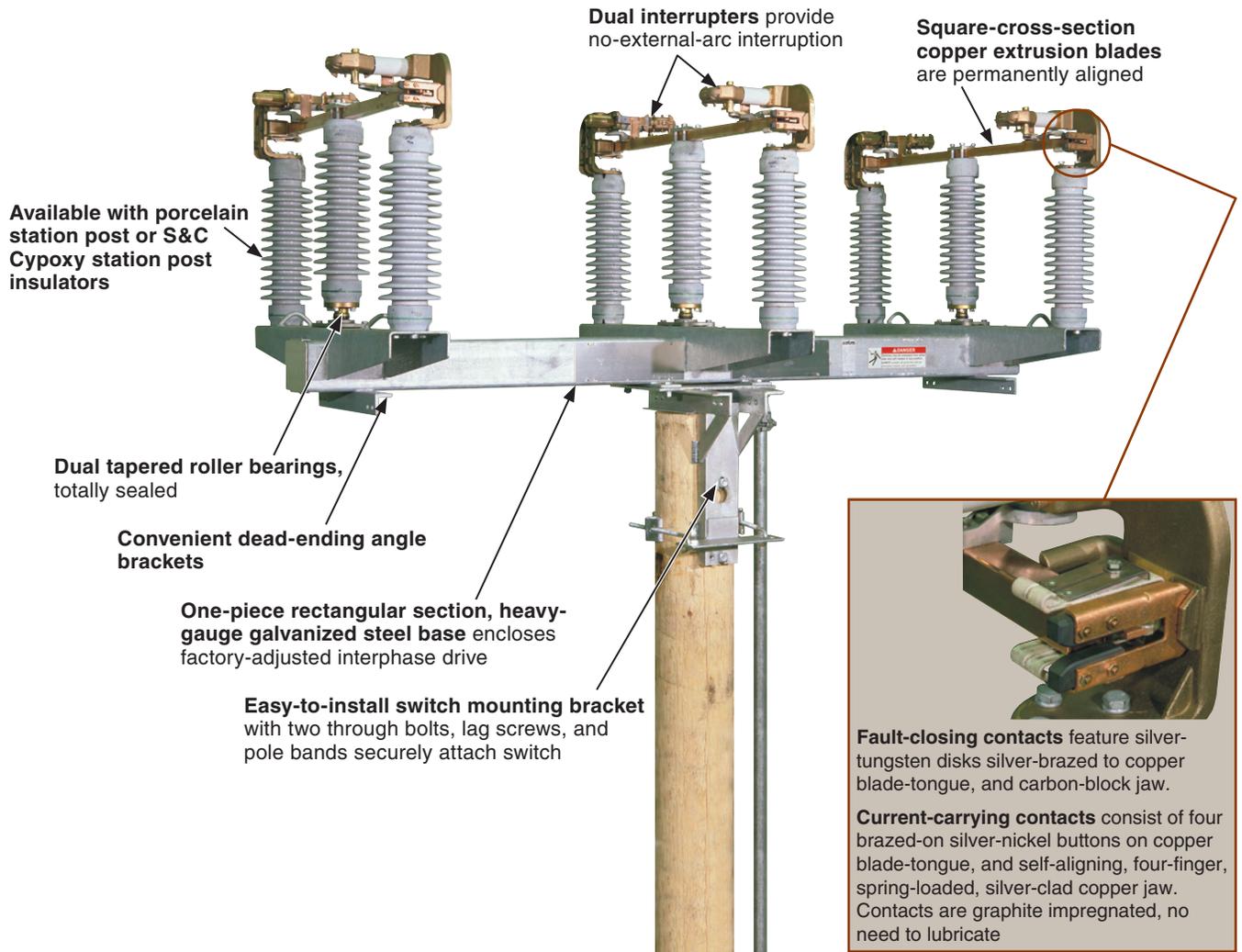
One pole-unit of 14.4-kV Three-Pole Side-Break Heavy-Duty Style Alduti-Rupter Switch, 600 amperes continuous.



One pole-unit of 34.5-kV Three-Pole Vertical-Break Style Alduti-Rupter Switch, 1200 amperes continuous.



14.4-kV Three-Pole Side-Break Integer Style Alduti-Rupter Switch, 1200 amperes continuous.



46-kV Double-Break Integer Style Alduti-Rupter Switch, 600 amperes continuous.

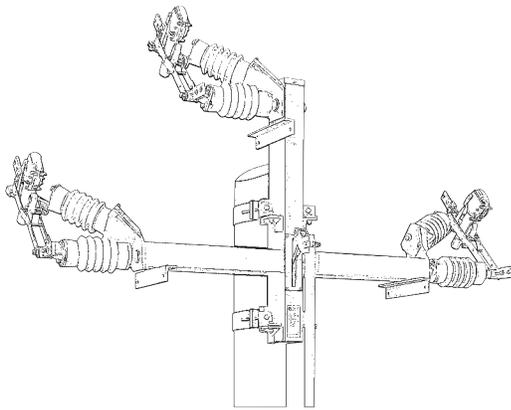
## Styles, Ratings, and Configurations

Style	50/60-Hz Ratings					Available Mounting Configurations
	kV			Amperes, RMS		
	Nom.	Max	BIL	Cont.	Mom., Asym	
<b>Three-Pole Group-Operated—Factory-Assembled and Adjusted</b>						
Side-Break Integer	14.4	17.0	110	1200	40 000	Vertical, Upright, Tiered Outboard, Triangular
	25	27	150	1200	40 000	
	25/34.5	38	150	600	40 000	
	34.5	38	200	600	40 000	
Vertical-Break Integer	14.4	17.0	200	2400★	40 000	Vertical, Upright, Tiered Outboard, Triangular, Pedestal, Pole-Top
	25/34.5	38	150	600	40 000	
	25/34.5	38	150	1200	40 000	
	34.5	38	200	600	40 000	
	34.5	38	200	1200	40 000	
Double-Break Integer	46	48.3	250	600	40 000	Vertical, Upright, Tiered Outboard, Pedestal, Pole-Top
<b>Three-Pole Group-Operated—Field-Assembled</b>						
Side-Break	14.4	17.0	110	600	40 000	Vertical, Upright, Triangular Upright
	25	27	150	600	40 000	
	34.5	38	200	600	40 000	
Vertical-Break	14.4	17.0	110	600	40 000	Vertical, Upright
	14.4	17.0	110	1200	61 000	
	14.4	17.0	200	2400★	40 000	
	25	27	150	600	40 000	
	25	27	150	1200	61 000	
	25/34.5	38	150	1200	40 000	
	34.5	38	200	600	40 000	
	34.5	38	200	1200	40 000	
Double-Break	34.5	38	200	600	40 000	Vertical, Upright, Triangular Upright, Tiered Upright, Tiered Outboard, Inverted
	46	48.3	250	600	40 000	
	69	72.5	350	1200▲	40 000	Upright, Tiered Upright
<b>Single-Pole</b>						
Single-Pole	14.4	17.0	110	600	40 000	Vertical, Inverted
	14.4	17.0	110	1200	61 000	
	25	27	150	600	40 000	
	25	27	150	1200	61 000	

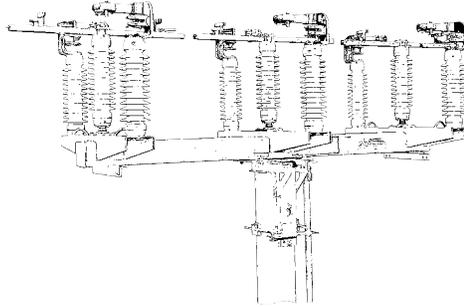
★ 1600 amperes, RMS, load interrupting. This model is specially designed for switching the secondary of single- or double-transformer substations.

▲ 600 amperes, RMS, load interrupting. This model is specifically designed for load splitting (parallel or loop switching).

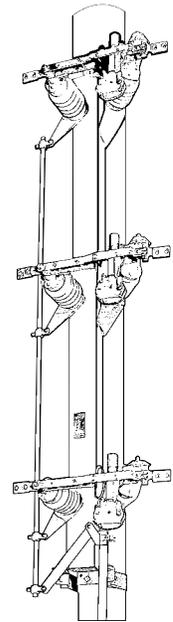




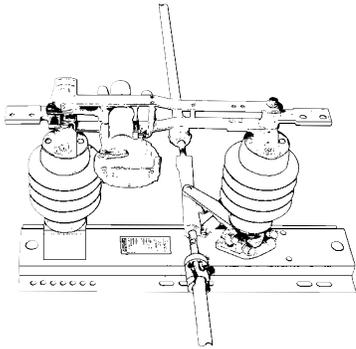
**Side-Break Integer Alduti-Rupter Switch,  
Triangular Mounting**



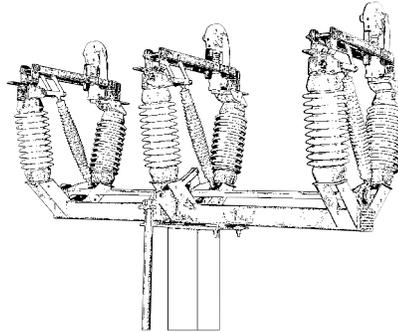
**Double-Break Integer Alduti-Rupter  
Switch, Pole-Top Mounting**



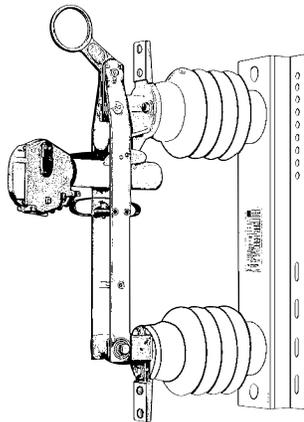
**Side-Break Integer  
Alduti-Rupter Switch,  
Tiered Outboard  
Mounting**



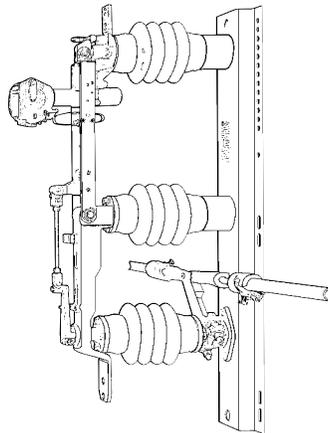
**Side-Break Alduti-Rupter Switch,  
Upright Mounting**



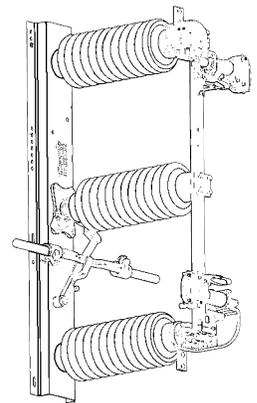
**Vertical-Break Integer Alduti-Rupter  
Switch, Pedestal Mounting**



**Single-Pole Alduti-Rupter Switch,  
Vertical Mounting**



**Vertical-Break Alduti-Rupter  
Switch, Vertical Mounting**



**Double-Break Alduti-Rupter  
Switch, Vertical Mounting**

## Choosing the Right Style and Mounting Configuration

To select the right style and mounting configuration Alduti-Rupter Switch for a particular application, ask yourself:

- **What's the application? And line configuration?** For cable risers and transformer tap-offs, the vertical mounting configuration is likely the best choice. For horizontal crossarm line construction, the upright mounting configuration is appropriate. For vertical (phase-over-phase) line construction, the tiered-outboard mounting configuration should be considered. For low-profile substation installations or service entrance applications, the pedestal mounting configuration is a great choice. And for installations with congested underbuilds, the pole-top mounting configuration should be considered . . . it often permits voltage upgrades without the need for pole extension or replacement.
- **How will the switch be mounted?** For mounting directly on or atop a pole or pedestal, a factory-assembled and adjusted Side-Break Integer or Vertical-Break Integer Switch is the most economical choice. For mounting on a crossarm(s) or structure, or if special phase spacing is required, a field-assembled-and-adjusted Side-Break or Vertical-Break Switch may be appropriate. And for substation applications, where heavy-duty construction is essential, a Vertical-Break, Vertical-Break Integer, Double-Break, or Double-Break Integer Switch is likely the right answer.

Steel-base Side-Break Integer, Vertical-Break Integer, and Double-Break Integer Switches offer a maximum dead-end loading of 8000 pounds per conductor where equal pull-off forces are applied to each side of the switch. Lower values apply to insulated-base Side-Break Integer Switches and instances where dead-end forces are applied on only one side of the switch.

All Alduti-Rupter Switches reflect S&C's high standards of design excellence, to provide years of trouble-free service. Full 40,000- or 61,000-ampere momentary ratings apply, with corresponding three-second ratings of 25,000 and 40,000 amperes, respectively. And impulse-withstand (BIL) ratings match those of station apparatus.

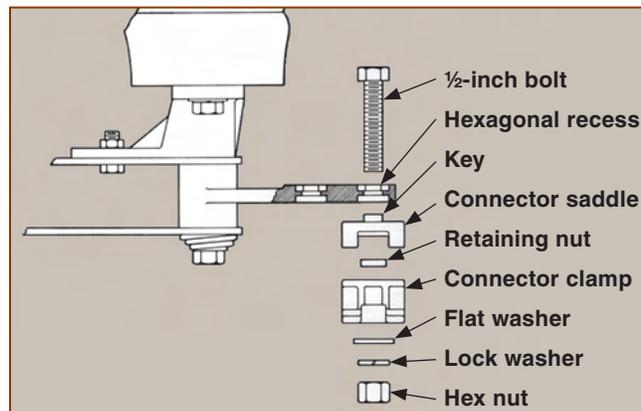
## Wide Range of Optional Features

Alduti-Rupter Switches can be furnished with a variety of optional features, including:

- **An insulator or fiberglass section in the operating rod.**
- **Heavy-duty operating rod.**
- **Key interlocks.**
- **Ice shields.**
- **Provisions for surge arresters.**
- **Dead-ending provisions.**
- **Extension-link assemblies.**
- **Current sensors.**

## Connectors Workable with Hot-Line Tools

Most Alduti-Rupter Switches▲ are designed for easy connector handling with hot-line tools. A hexagonal recess in the terminal pad prevents the connector attachment bolt from turning. The connector saddle is held against, and loosely keyed to, the terminal pad by the retaining nut. And the clamp is, in turn, keyed to the saddle. The connector can be easily loosened and tightened by means of the hex nut—without either connector member turning in place.



## Exhaustively Tested, Utility Proven

Every Alduti-Rupter Switch rating is based on full-scale testing: load splitting, load dropping, line and cable switching—all at maximum voltages and rated currents . . . and with test circuits tuned to duplicate the most severe transient recovery voltages likely to be encountered in service. Rated performance is assured for all live-switching duties. The validity of S&C's testing has been confirmed by nearly 60 years of reliable operation of S&C switches on utility systems worldwide.

▲ Exceptions: Vertical-Break, Vertical-Break Integer, and Side-Break Integer rated 25/34.5 kV and 34.5 kV.

## Descriptive Bulletin 761-30

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**S&C ELECTRIC COMPANY**

Excellence Through Innovation