

S&C POWER FUSES TYPES SMD-1A, SMD-2B, SMD-2C, SMD-3, AND SMD-50

**OUTDOOR TRANSMISSION
(34.5 KV THROUGH 138 KV)**



CONTENTS

| | |
|---|-----------|
| Application | 1 |
| Transformer Protection with SMD Power Fuses | 2 |
| Capacitor Bank Protection with SMD Power Fuses | 4 |
| Other Application Considerations | 5 |
| SMD Power Fuses Are Not Voltage Critical | 5 |
| SMD Fuse Units Permit Reduced Phase Spacing and Ground-Clearance Requirements | 5 |
| SMD Power Fuses Are Not Disruptive to Source-Side Loads | 5 |
| Construction and Operation | 6 |
| The Fusible Element | 6 |
| Nondamageable Construction | 6 |
| The SMD Fuse Unit | 8 |
| Principal Parts of an SMD Power Fuse | 8 |
| The Live Parts | 10 |
| Fault Interruption in SMD Fuse Units | 10 |
| Fuse Mountings | 13 |
| Vertical and Vertical-Offset Styles | 13 |
| Upright Styles | 15 |
| Right-Angle Style | 16 |
| Inverted Style | 17 |
| Fuse Handling | 18 |
| Opening and Closing SMD Power Fuses | 18 |
| Installing or Removing Fuse Units | 18 |
| Additional Handling Recommendations | 19 |
| Interrupting Ratings | 20 |
| Short-Circuit Interrupting Ratings | 20 |

S&C SMD® Power Fuses set the standard of excellence for transformer and capacitor-bank protection in utility and industrial substations. They offer fast, high-magnitude fault responses to ultimately save utilities money by reducing O&M expenses. Proving high quality and performance for the past 50 years, SMD Power Fuses are an obvious choice to help customers maintain reliable systems.

Application

S&C Type SMD-1A, SMD-2B, SMD-2C, SMD-3, and SMD-50 Power Fuses provide reliable and economical protection for transformers and capacitor banks in outdoor substations served at voltages of 34.5 kV through 138 kV. As with other S&C power fuses, SMD Power Fuses incorporate precision-engineered nondamageable silver or



nickel-chrome fusible elements. Consequently, the SMD Power Fuses' time-current characteristic (TCC) curves are precise and permanently accurate, ensuring not only dependable performance, but also the continued reliability of system coordination plans.

The precise TCC curves and nondamageability of these power fuses permit source-side protective devices to be set for faster operation than may be practical with other power fuses or power circuit breakers, thereby providing better system protection without compromising coordination.

SMD Power Fuses are offered with maximum continuous current ratings from 100 amperes to 300 amperes (depending on fuse type and voltage rating). They are available with the fault-interrupting ratings summarized in **Table 5 on page 21**, **Table 6 on page 22**, **Table 7 on page 23**, **Table 8 on page 23**, and **Table 9 on page 24**. Fuse units are available in a wide range of ampere ratings and in three speeds: S&C Standard, Slow, and Very Slow (SMD-50 Power Fuses are offered in the S&C Standard and Slow Speeds only), permitting coordination with protective relays, circuit reclosers, and other fuses. The broad selection of ampere ratings and speeds permits close fusing to achieve maximum protection and optimum coordination.

SMD Power Fuses are available in six mounting configurations designed to accommodate the space and bus configuration requirements of many different station layouts. Fuse mountings are illustrated in **Figure 11 on page 13**, **Figure 12 on page 13**, **Figure 13 on page 13**, **Figure 14 on page 15**, **Figure 15 on page 16**, and **Figure 16 on page 17**.

TRANSFORMER PROTECTION WITH SMD POWER FUSES

High-voltage power fuses provide a reliable and economical means to protect small to midsize load transformers installed in utility and industrial substations. The considerable economies inherent in power-fuse protection are possible because the fuse itself is much less costly than other types of protective equipment. There also is no need for auxiliary equipment, such as station batteries, motor-driven operators, and protective relays. See **Figure 1**.

FIGURE 1. Transformer protection using SMD Power Fuses.



Additional benefits of a compact fuse-protection package are low installation costs and a space-saving design that will fit on almost any structure. Moreover, unlike relay-actuated protective devices, such as circuit breakers and reclosers, power fuses require only minimal physical maintenance, such as periodic checks on the condition of the fuse-unit bore and occasional refinishing of fuse tubes exposed to severe weathering.

The transmission-voltage power fuse should be selected to provide both system and transformer protection. For system protection, the fuse should operate promptly in response to potentially damaging overcurrent conditions to minimize

short-circuit stresses on source-side conductors and equipment and also to limit the extent of service interruption to the smallest possible portion of the system.

For transformer protection, the primary-side fuse should operate promptly in response to a bus or cable fault located between the transformer and the nearest secondary-side overcurrent protective device. It also should provide backup protection for the transformer should the secondary-side overcurrent protective device either fail to operate because of a malfunction or operate too slowly because of incorrect ratings or settings. See **Figure 2**.

FIGURE 2. Transformer protection using three vertical, 180° opening-style SMD Power Fuses.



SMD Power Fuses provide full fault-spectrum protection for transformers. They will detect and interrupt all faults—large, medium, and small (even down to minimum melting current), regardless of whether:

- ◆ The fault is on the primary or secondary side
- ◆ There is line-to-line or line-to-ground voltage across the fuse
- ◆ The transformer is adjacent to the fuse or cable-connected to it from a remote location and regardless of transformer winding connections

SMD Power Fuses are capable of handling the full range of transient recovery voltages associated with these conditions. And they develop a positive internal gap of high dielectric strength after circuit interruption, thereby preventing destructive reignitions when exposed to full system voltage. The “dropout” action of these power fuses provides the additional benefit of visible air gap isolation for the transformer after fuse operation.

The close fusing necessary to provide superior protection for secondary-side faults is possible with SMD Power Fuses because they use silver or pretensioned nickel-chrome fusible elements that are not damaged by transient surges that may heat the element nearly to the severing point. They are available in a variety of speeds that provide TCC curves especially suited to protecting transformers for very-low-magnitude fault currents. They also

possess substantial peak-load capabilities and surge capacity more than adequate to withstand transformer magnetizing-inrush currents as well as severe hot- and cold-load pickup currents.

Close fusing with SMD Power Fuses, coupled with the exceptional low-current fault-interrupting performance, ensures maximum transformer protection for a broad range of secondary-side fault currents, thus minimizing the life-shortening thermal and mechanical stresses associated with prolonged transformer through-faults. In addition, the ability to fuse closer to the transformer full-load current facilitates coordination with source-side protective devices by permitting the use of lower ampere ratings or time-dial settings for faster response.

CAPACITOR BANK PROTECTION WITH SMD POWER FUSES

SMD Power Fuses are suitable for fusing of station capacitor banks, particularly where available fault currents are high. These power fuses have a substantial continuous peak-load capability that permits the use of smaller ampere ratings than may be possible with other makes of power fuses, without risking nuisance fuse operations caused by capacitor-bank inrush or outrush currents. Close fusing with SMD Power Fuses ensures rapid isolation of faulted capacitor banks, thereby protecting the system from unnecessary outages.

Other Application Considerations

SMD POWER FUSES ARE NOT VOLTAGE CRITICAL

SMD Power Fuses are not “voltage critical,” so they may be applied at any system voltage equal to or less than the rated voltage of the fuse. Moreover, these fuses operate without producing overvoltages that can cause spurious operation of surge arresters or contribute to failure of transformer insulation.

SMD FUSE UNITS PERMIT REDUCED PHASE SPACING AND GROUND-CLEARANCE REQUIREMENTS

The exhaust of SMD Power Fuses is nonconducting, unlike the highly ionized blast associated with operation of expulsion-type fuses that use fiber-lined fuse tubes. Consequently, standard electrical clearances can be used to ground and between adjacent phases, a definite plus for many station applications where space may be at a premium.

Without stretched-out phase spacings, structures can be smaller, simpler, and less expensive. (For recommended mounting clearances, refer to the appropriate S&C Information Bulletin.) Moreover, because of the selection of mounting configurations, a wide variety of station layouts can be accommodated using SMD Power Fuses.

SMD POWER FUSES ARE NOT DISRUPTIVE TO SOURCE-SIDE LOADS

SMD Power Fuses provide prompt, reliable operation without disrupting service to source-side loads. Other protection alternatives involving transfer-trip relaying, automatic grounding switches, or sacrificial switches result in extensive interruption of service to other loads in the event of a fault at the transformer. Moreover, grounding-switch and sacrificial-switching schemes result in severe bolted-fault stress to the system and source transformers, plus undue fault testing of line-terminal circuit breakers for all faults, even transformer secondary-side faults.

For additional detailed application recommendations and technical information on SMD Power Fuses, including minimum melting and total clearing time-current characteristics, preloading and ambient temperature adjustment factors, and loading capabilities, consult the nearest S&C Sales Office.

Construction and Operation

THE FUSIBLE ELEMENT

SMD Power Fuses possess the performance characteristics and quality that make them especially suitable for fault protection on 34.5-kV through 138-kV transmission and subtransmission systems. The fuses are available in a wide variety of ampere ratings and TCC curves, permitting close fusing to achieve maximum protection and optimum coordination for both the source-side system and downstream equipment.

The initial and sustained accuracy of their melting TCC curves ensures that these fuses can be depended on to operate exactly when they should and—equally important—not to operate when they shouldn't. This permanent accuracy is achieved principally in the design and construction of the fusible element.

NONDAMAGEABLE CONSTRUCTION

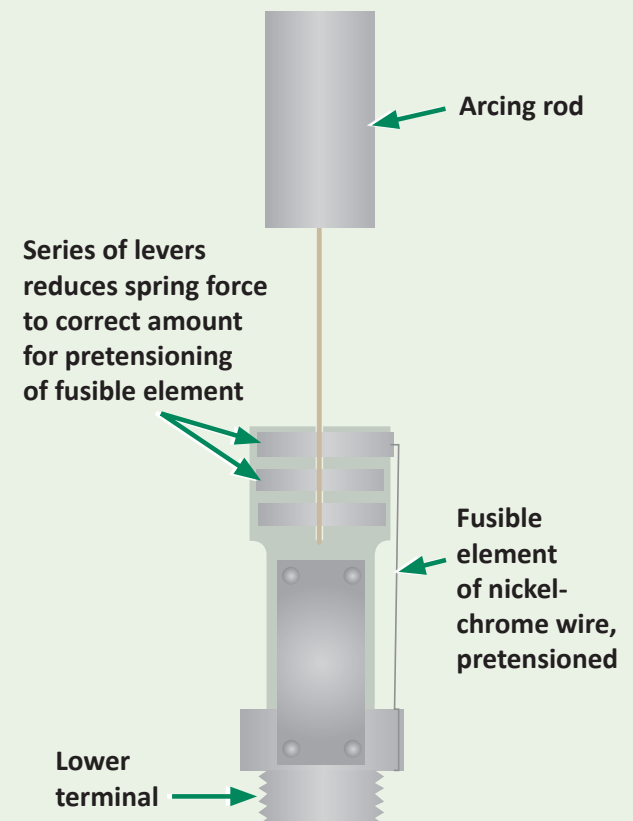
SMD Power Fuses have silver or pretensioned nickel-chrome current-responsive elements with these characteristics:

- ◆ They are drawn through precision dies to very accurate diameters.
- ◆ They are of solderless construction, brazed into their terminals.
- ◆ Their melting TCC curves are precise, with only 10% total tolerance in melting current compared to the 20% tolerance of many fuses (20% and 40% respectively in terms of time).
- ◆ Their design and construction features ensure they will conform to their TCC curves not only initially but on a sustained basis.

- ◆ They are corrosion-resistant and nondamageable. Neither age, vibration, nor surges that heat the element nearly to the severing point will affect the characteristics of SMD Power Fuses.

The nondamageability of SMD Power Fuses, made possible by the construction features illustrated in **Figure 3**, **Figure 4 on page 7**, and **Figure 5 on page 7** provide these advantages:

FIGURE 3. Nondamageable low-current, nickel-chrome fusible element for SMD Fuse Units rated 1 and 3E amperes. In these ratings, the nickel-chrome wire is too fine to withstand the full force of the spring. An assembly of levers in effect multiplies the tensile strength of the wire to permit the desired pretensioning without jeopardizing the security of the fusible element.



Construction and Operation (continued)

1. **Superior transformer protection.** SMD Power Fuses enable fusing close to the transformer full-load current, thus providing protection against a broad range of secondary-side faults.
2. **Higher levels of service continuity.** “Sneakouts” (unnecessary fuse operations) are eliminated.
3. **Close coordination with other overcurrent protective devices.** This is attainable because

of the initial and sustained precision of the fusible elements and because no “safety zones” or “setback allowances” must be applied to the published TCC curves to protect the element against damage.

4. **Operating economies.** There is no need to replace unblown companion fuses on suspicion of damage following a fuse operation.

FIGURE 4. Nondamageable nickel-chrome fusible element for SMD Fuse Units rated 5E and 7E amperes. When called upon to operate, the pretensioned nickel-chrome wire weakens abruptly and separates before its cross-section changes.

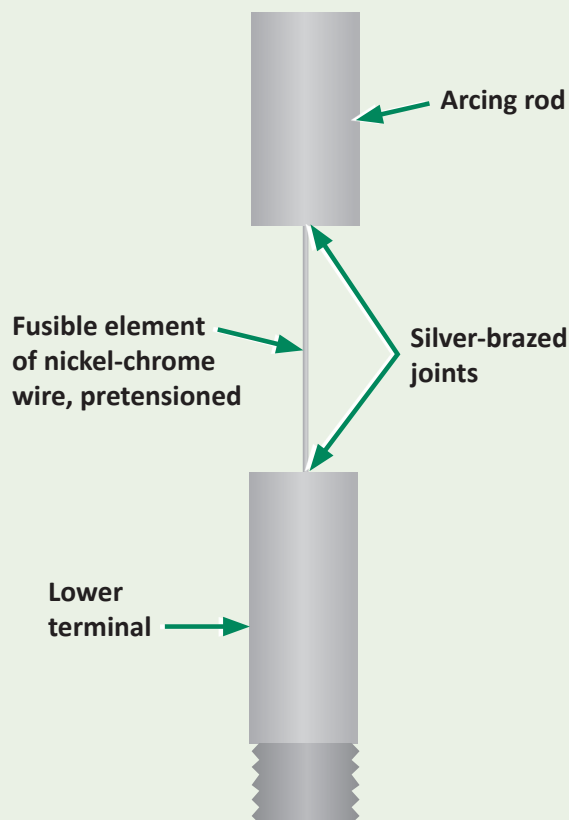
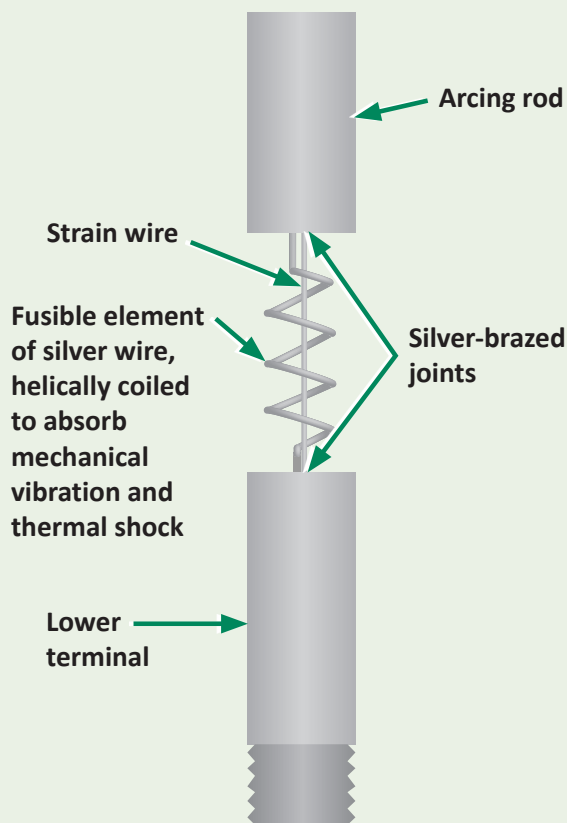


FIGURE 5. Nondamageable silver fusible element for SMD Fuse Units rated 10E amperes and larger. These ratings use the silver fusible element, strain-wire construction, which is not damaged by overloads or transient faults approaching the minimum melting current.



Construction and Operation (continued)

THE SMD FUSE UNIT

An SMD Fuse Unit consists principally of a fusible element, a spring-driven arcing rod, and a solid-material arc-extinguishing medium contained within a filament-wound glass-epoxy tube.

The fusible element is connected at one end through a current-transfer bridge and copper conducting tube to the fuse-unit lower ferrule. The other end of the fusible element is swaged and silver-brazed to the silver-clad copper arcing rod that extends upward through the solid-material medium.

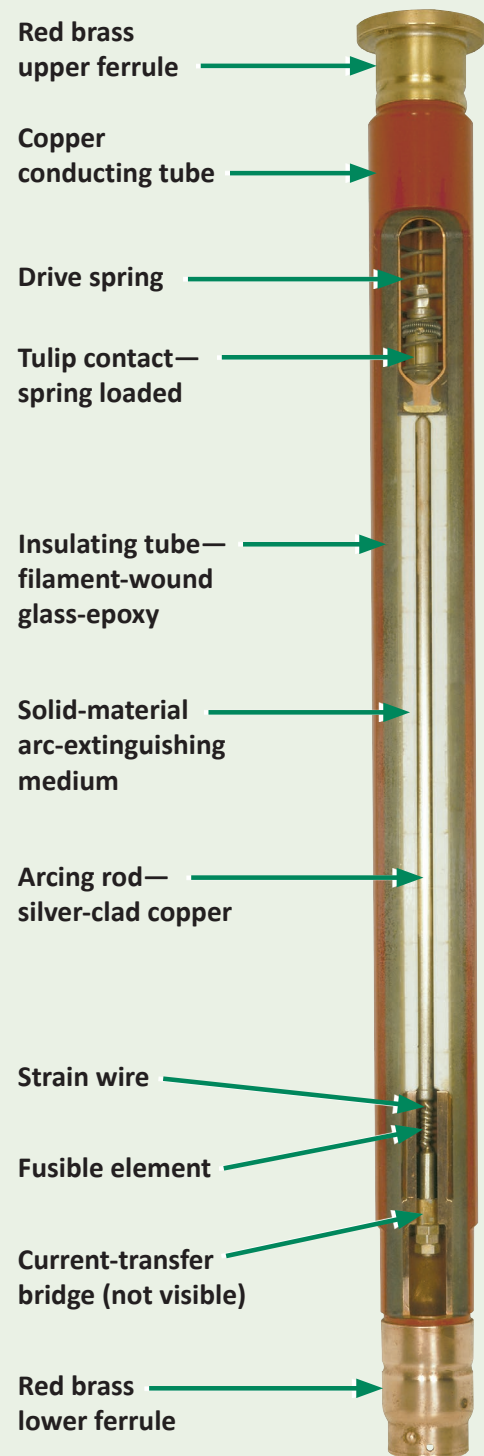
A spring-loaded tulip contact near the upper end of the fuse provides electrical continuity between the arcing rod and the fuse-unit upper ferrule, thereby completing the load-current path through the fuse.

A stainless steel drive spring provides the stored energy to drive the arcing rod upward through the arc-extinguishing medium during a fuse operation and also to trip the latch mechanism on the fuse upper live parts so the fuse unit can automatically “drop” to the Open position. See **Figure 6**.

PRINCIPAL PARTS OF AN SMD POWER FUSE

An SMD Power Fuse consists of a mounting and the replaceable fuse unit. The mounting includes a galvanized steel base (except SMD-2B Power Fuses rated 115 kV and 138 kV, which include an aluminum base, as illustrated on page 13), insulators, upper and lower contact assemblies, and fuse unit end-fittings.

FIGURE 6. Details of a typical SMD Power Fuse Unit.



Construction and Operation (continued)

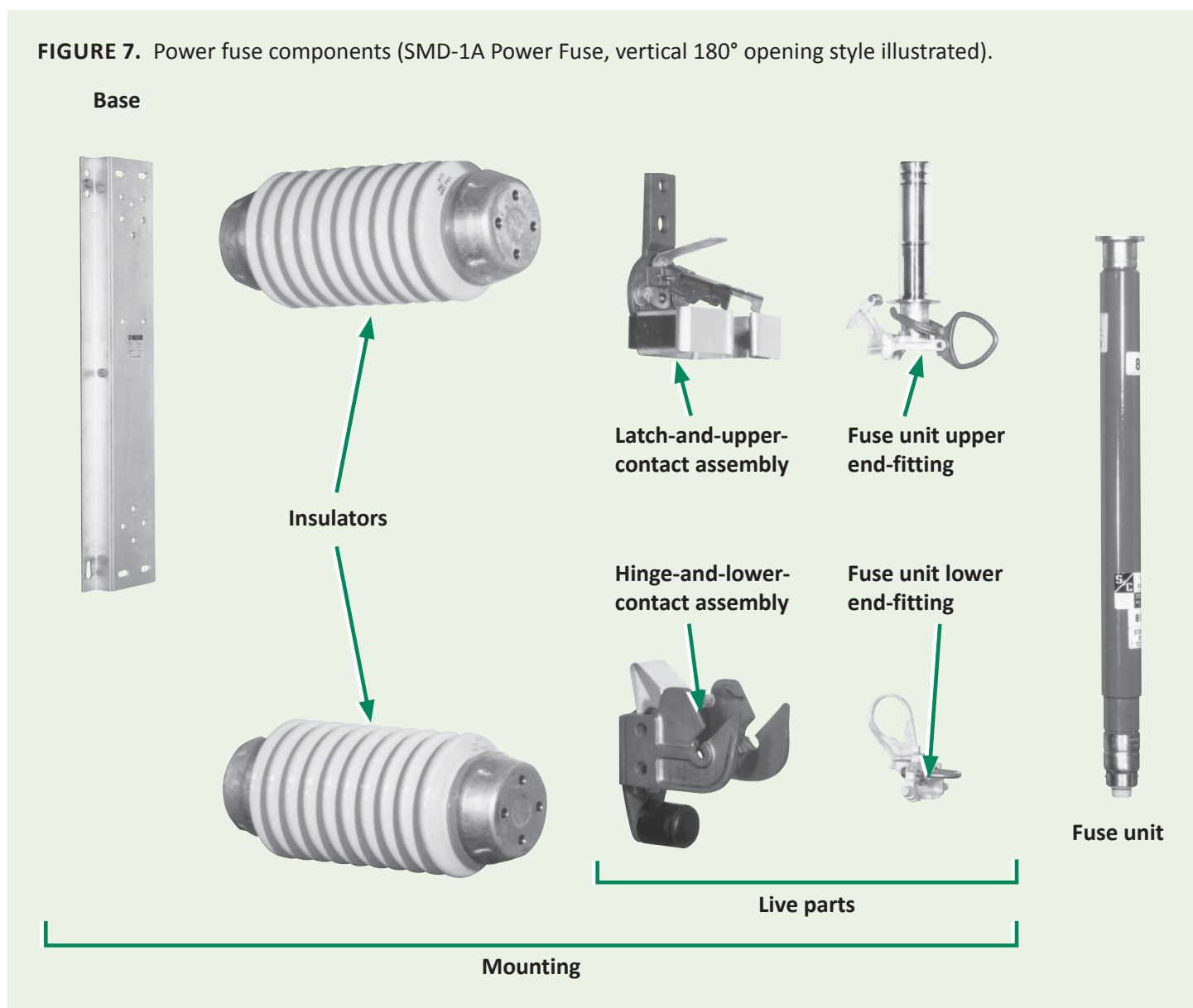
Upper and lower contact assemblies for SMD-1A, SMD-2B, SMD-2C, and SMD-3 Power Fuses include rugged bronze-alloy castings and silver-clad contacts. SMD-50 Power Fuse contact assemblies include aluminum-alloy castings and silver-clad contacts.

All styles of fuse unit end-fittings feature silver-clad contact surfaces as well. The fuse unit is furnished separately. Live parts consisting of upper and lower contact assemblies and fuse unit

end-fittings are available separately with all SMD Transmission Power Fuses for the convenience of purchasers wanting to make their own mountings. Fuse unit end-fittings are also sold as separate items to assist users in keeping their spare fuse units ready for quick replacement in case of an emergency.

Figure 7 shows the principal parts of a typical SMD Power Fuse, including fuse unit and fuse unit end-fittings.

FIGURE 7. Power fuse components (SMD-1A Power Fuse, vertical 180° opening style illustrated).



THE LIVE PARTS

Silver-Clad Contacts

Superb current transfer between the SMD Fuse Unit and the upper and lower fuse-mounting contacts is ensured by the wiping action of the silver-clad contact surfaces. As the fuse unit is closed into the upper contact assembly, silver-clad contact fingers first engage and “wipe” across the silver-clad contact surfaces of the fuse unit upper end-fitting. Then, during latching, a high-pressure, low-resistance contact is established by compressive flexing of the contact fingers.

The lower contacts feature silver-clad surfaces and compressive loading for built-in wiping action and efficient current transfer between the lower contact assembly and the fuse unit lower end-fitting.

Articulated Latch

The spring-biased articulated latching mechanism of Type SMD Power Fuses is designed to compensate for variations in insulator spacing or contact alignment that may result from possible slight distortion of a fuse base bolted to an irregular structure. The automatic leveling action provided by the mechanism ensures positive latching even if the insulators have moved from the position of nominal contact alignment.

Latching is accomplished by the roller in the spring-biased “floating” latch assembly riding over

and dropping in behind the nose projection on the upper end-fitting. Because of the “floating” action of the latch assembly, the fuse cannot be dropped out by vibration or shock that may jar the insulator stacks. While normally preventing any accidental opening, the roller-type latch releases without resistance when deliberately tripped for dropout action.

Icing does not interfere with dropout action. As described in **Figure 9 on page 11** at the right on page 11, the force of the drive spring propels the release tube upward, breaking any accumulation of ice and actuating the latch-release mechanism.

FAULT INTERRUPTION IN SMD FUSE UNITS

Fast, positive fault interruption (as shown in the sequence of the illustrations in **Figure 8 on page 11**, **Figure 9 on page 11**, and **Figure 10 on page 12**) is achieved in SMD Fuse Units by both of the following means:

- ◆ High-speed elongation of the arc in the solid-material-lined bore by rapid movement of the spring-driven arcing rod
- ◆ The efficient deionizing action of the gases generated through thermal reaction of the solid material caused by the heat of the confined arc

The resultant high rate of dielectric recovery more than matches the transient recovery voltage severity of any circuit where SMD Power Fuses are applied.

FIGURE 8. Overcurrent melts the fusible element and then transfers to the strain wire, which volatilizes instantly.

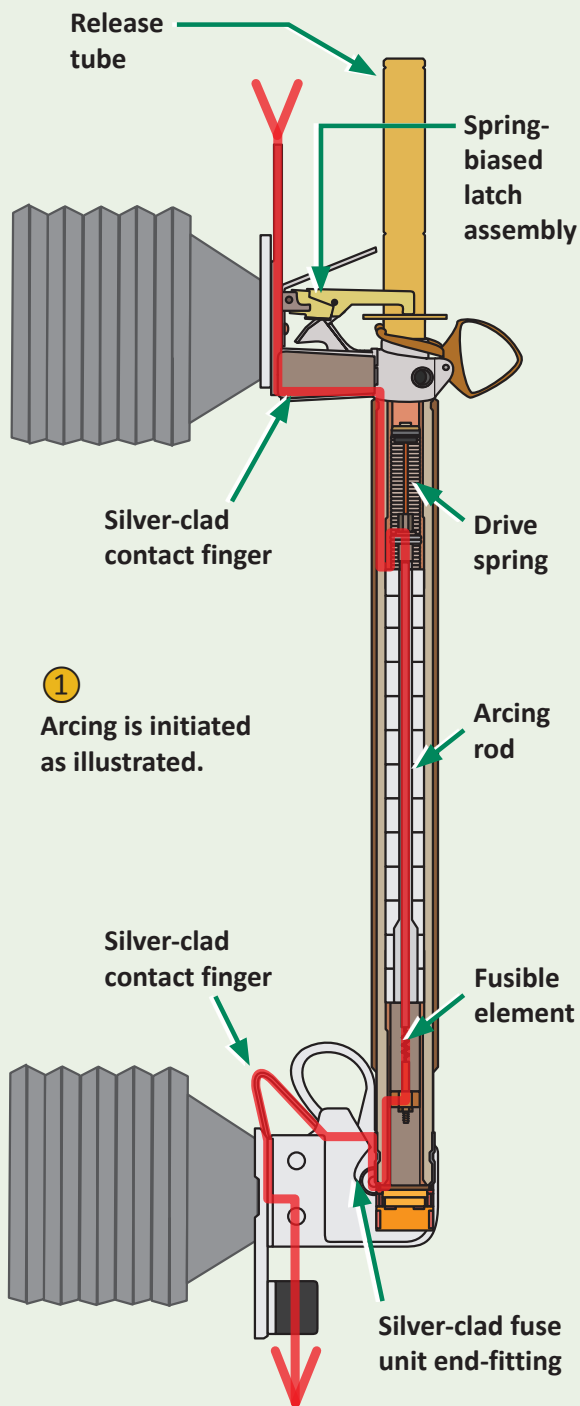
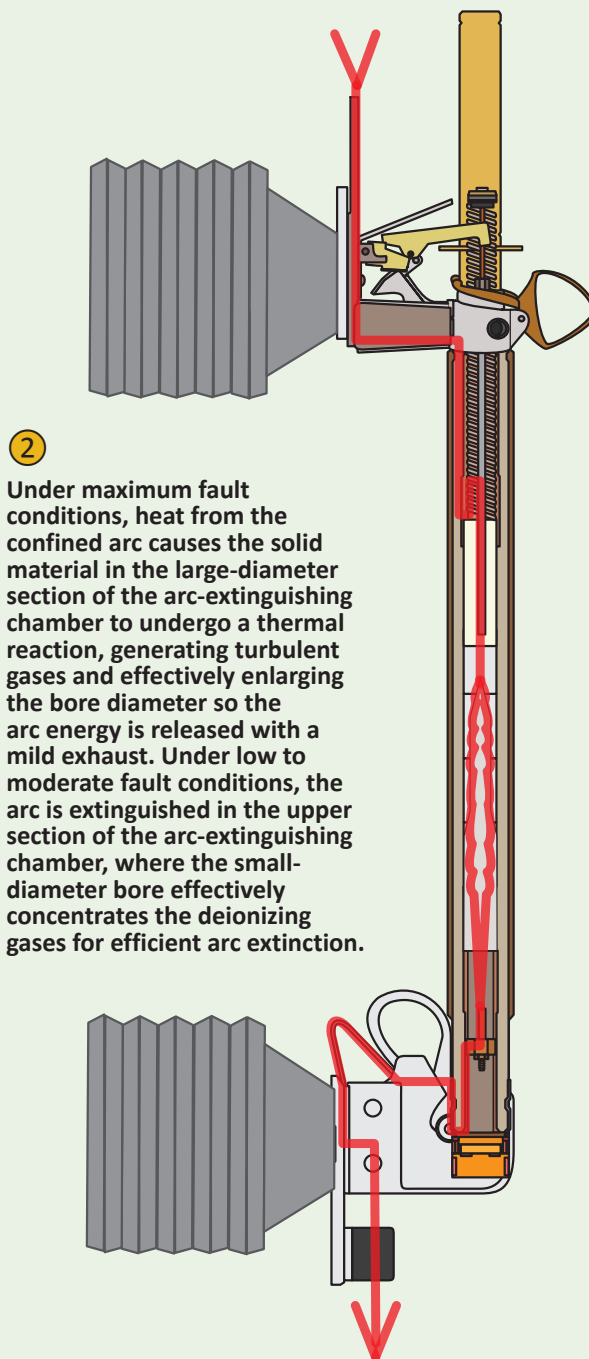


FIGURE 9. Released force of the drive spring thrusts the arcing rod upward, causing rapid elongation of the arc in the solid-material lined bore of the fuse unit.

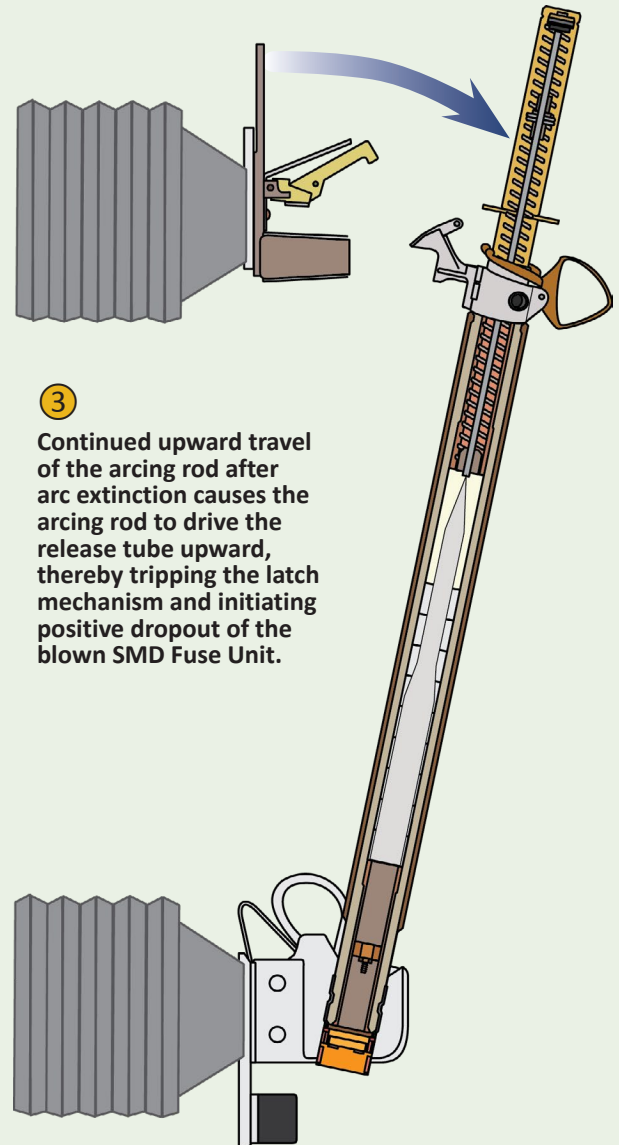


Construction and Operation (continued)

Positive Dropout Action

When the fuse unit is blown, the force of the drive spring causes the arcing rod to drive the release tube upward and disengage the latch on the upper-contact assembly. After the latch is fully disengaged, the compression-loaded contact fingers thrust the fuse unit outward, permitting it to swing to the fully Open position. Tripping of the latch and the start of the dropout action during fault interruption are illustrated to the right.

FIGURE 10. Tripping of the latch and the start of the dropout action during a fault interruption.



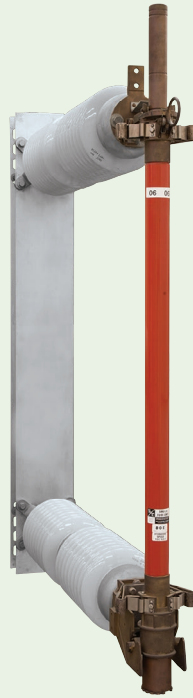
VERTICAL AND VERTICAL-OFFSET STYLES

FIGURE 11. Vertical 180° opening style¹ (34.5-kV SMD-1A Power Fuse illustrated).



1 Complete mounting shown; live parts can be furnished separately.

FIGURE 12. Vertical 45° opening style¹ (115-kV SMD-2B Power Fuse illustrated).



1 Complete mounting shown; live parts can be furnished separately.

FIGURE 13. Vertical-offset style¹ (69-kV SMD-2C Power Fuse illustrated).



1 Complete mounting shown; live parts can be furnished separately.

Fuse Mountings (continued)

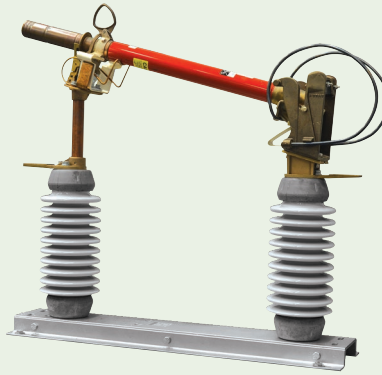
TABLE 1. Ratings for Available Fuse Types for 180- and 45-Degree Vertical- and Vertical-Offset Style Mounting

| Fuse Type | Rating, Nominal (kV) | Rating, Max (kV) | Rating, BIL (Amperes RMS) | Rating, Max (Amperes, RMS) | Rating, Interrupting (Sym) (Amperes, RMS) |
|--------------------|----------------------|------------------|---------------------------|----------------------------|---|
| SMD-50 | 34.5 | 38 | 200 | 100E | 6700 |
| SMD-50 | 46 | 48.3 | 250 | 100E | 5000 |
| SMD-50 | 69 | 72.5 | 350 | 100E | 3350 |
| SMD-1A | 34.5 | 38 | 200 | 200E | 17500 |
| SMD-1A | 46 | 48.3 | 250 | 200E | 13100 |
| SMD-1A | 69 | 72.5 | 350 | 200E | 8750 |
| SMD-2C | 34.5 | 38 | 200 | 300E | 33500 |
| SMD-2C | 46 | 48.3 | 250 | 300E | 31500 |
| SMD-2B | 69 | 72.5 | 350 | 300E | 17500 |
| SMD-2B | 115 | 121 | 550 | 250E | 10500 |
| SMD-2B | 138 | 145 | 650 | 250E | 8750 |
| SMD-2B | 138 | 145 | 750 | 250E | 8750 |
| SMD-3 ¹ | 69 | 72.5 | 350 | 300E | 25000 |

¹ SMD-3 Mountings are not available in vertical-offset style.

UPRIGHT STYLES

FIGURE 14. Upright style¹ (34.5-kV SMD-1A Power Fuse illustrated).



¹ Complete mounting shown; live parts can be furnished separately.

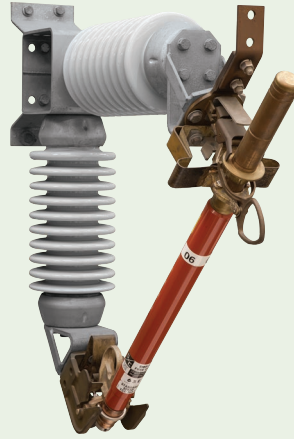
TABLE 2. Ratings for Available Fuse Types for Upright-Style Mounting

| Fuse Types | Rating, Nominal (kV) | Rating, Max (kV) | Rating, BIL (Amperes RMS) | Rating, Max (Amperes, RMS) | Rating, Interrupting (Sym) (Amperes, RMS) |
|------------|----------------------|------------------|---------------------------|----------------------------|---|
| SMD-1A | 34.5 | 38 | 200 | 200E | 17500 |
| SMD-1A | 46 | 48.3 | 250 | 200E | 13100 |
| SMD-1A | 69 | 72.5 | 350 | 200E | 8750 |
| SMD-2C | 34.5 | 38 | 200 | 300E | 33500 |
| SMD-2C | 46 | 48.3 | 250 | 300E | 31500 |
| SMD-2B | 69 | 72.5 | 350 | 300E | 17500 |
| SMD-2B | 115 | 121 | 550 | 250E | 10500 |
| SMD-2B | 138 | 145 | 650 | 250E | 8750 |
| SMD-2B | 138 | 145 | 750 | 250E | 8750 |
| SMD-3 | 69 | 72.5 | 350 | 300E | 25000 |

Fuse Mountings (continued)

RIGHT-ANGLE STYLE

FIGURE 15. Right-angle style¹ (34.5-kV SMD-1A Power Fuse illustrated).



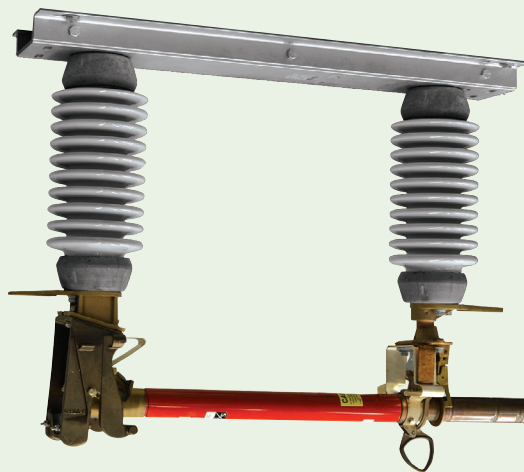
¹ Complete mounting shown; live parts can be furnished separately.

TABLE 3. Ratings for Available Fuse Types for Right-Angle Style Mounting

| Fuse Types | Rating, Nominal (kV) | Rating, Max (kV) | Rating, BIL (Amperes RMS) | Rating, Max (Amperes, RMS) | Rating, Interrupting (Sym) (Amperes, RMS) |
|------------|----------------------|------------------|---------------------------|----------------------------|---|
| SMD-50 | 34.5 | 38 | 200 | 100E | 6700 |
| SMD-50 | 46 | 48.3 | 250 | 100E | 5000 |
| SMD-50 | 69 | 72.5 | 350 | 100E | 3350 |
| SMD-1A | 34.5 | 38 | 200 | 200E | 17500 |
| SMD-1A | 46 | 48.3 | 250 | 200E | 13100 |
| SMD-1A | 69 | 72.5 | 350 | 200E | 8750 |
| SMD-2C | 34.5 | 38 | 200 | 200E | 33 500 |
| SMD-2C | 46 | 48.3 | 250 | 250E | 31500 |
| SMD-2B | 69 | 72.5 | 350 | 350E | 17500 |
| SMD-3 | 69 | 72.5 | 350 | 350E | 25000 |

INVERTED STYLE

FIGURE 16. Inverted style¹ (34.5-kV SMD-1A Power Fuse illustrated).



¹ Complete mounting shown; live parts can be furnished separately.

TABLE 4. Ratings for Available Fuse Types for Inverted-Style Mounting

| Fuse Types | Rating, Nominal (kV) | Rating, Max (kV) | Rating, BIL (Amperes RMS) | Rating, Max (Amperes, RMS) | Rating, Interrupting (Sym) (Amperes, RMS) |
|------------|----------------------|------------------|---------------------------|----------------------------|---|
| SMD-1A | 34.5 | 38 | 200 | 200E | 17500 |
| SMD-1A | 46 | 48.3 | 250 | 200E | 13100 |
| SMD-1A | 69 | 72.5 | 350 | 200E | 8750 |
| SMD-2C | 34.5 | 38 | 200 | 300E | 33500 |
| SMD-2C | 46 | 48.3 | 250 | 300E | 31 500 |
| SMD-2B | 69 | 72.5 | 350 | 300E | 17500 |
| SMD-2B | 115 | 121 | 550 | 250E | 10500 |
| SMD-2B | 138 | 145 | 650 | 250E | 8750 |
| SMD-2B | 138 | 145 | 750 | 250E | 8750 |
| SMD-3 | 69 | 72.5 | 350 | 300E | 25000 |

Fuse Handling

OPENING AND CLOSING SMD POWER FUSES

SMD Power Fuses rated 34.5 kV through 69 kV in the vertical, vertical-offset, right-angle, and inverted styles are easily opened (or closed) using a universal pole equipped with the appropriate S&C Handling Tool; i.e., the S&C Distribution Prong for SMD-50 Power Fuses or the S&C Station Prong for SMD-1A, SMD-2B, SMD-2C, and SMD-3 Power Fuses. See **Figure 17**.



FIGURE 17. Opening (or closing) SMD Power Fuses rated 34.5 kV through 69 kV.

During a closing operation, the fuse unit is restrained from tilting in the hinge by trunnions and cams on the fuse unit lower end-fitting; it is self-guiding so the fuse can be closed from nearly any angle. Note: SMD-1A, SMD-2B, SMD-2C,

SMD-3, and SMD-50 Power Fuses must not be opened under load. However, SMD-50 Power Fuses are equipped with arcing horns that permit switching transformer magnetizing current only. Moreover, SMD-50 Power Fuses in the vertical-offset and right-angle styles are suitable for live closing operations because the fuse's mild exhaust is vented in a direction away from the operator should the fuse close into a faulted circuit.

INSTALLING OR REMOVING FUSE UNITS

Fuse units for SMD-50 Power Fuses may be installed in (or removed from) a mounting using the S&C Distribution Prong. See **Figure 18 on page 19** and **Figure 19 on page 19**.

Fuse units for SMD-1A Power Fuses rated 34.5 kV through 69 kV in all styles except the upright style may be installed or removed using a universal pole equipped with the S&C Small Round Socket. A similar handling tool, the S&C Large Round Socket, may be used with SMD-2B, SMD-2C, and SMD-3 Power Fuses rated 34.5 kV through 69 kV (in all styles except the upright style).

Both the small and the large round sockets are slightly oversized so the operator can engage the release tube on the fuse unit easily. When removing the fuse unit from the mounting, the operator should be positioned directly beneath the hinge. Then, a simple lifting motion is all that is required to remove the fuse unit.

Because the fuse unit is securely seated in the socket, it effectively becomes part of the pole; there's no cantilever loading to contend with, and

the fuse unit can't jiggle or fall out. The fuse unit should be lowered to ground level by planting the base of the universal pole firmly on the ground against a fence or other fixed object and carefully "walking" the pole down until the fuse unit can be grasped and removed from the socket by hand.

Although SMD-1A, SMD-2B, SMD-2C, and SMD-3 Power Fuses rated 34.5 kV through 69 kV can be installed and removed using a universal pole equipped with the S&C Station Prong, S&C recommends using the appropriate round socket to provide complete, positive control. Moreover, S&C Round Sockets include a straight prong that may be used for fuse opening and closing operations, thereby eliminating any need for a separate S&C Station Prong.

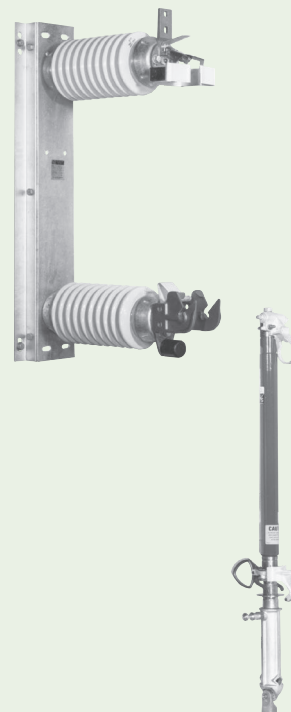
ADDITIONAL HANDLING RECOMMENDATIONS

Fuse units for SMD Transmission Power Fuses in the upright style (in all voltage ratings) must be installed and removed by hand. Power fuses rated 115 kV and 138 kV are generally serviced by hand as well; however, SMD-1A, SMD-2B, SMD-2C, and SMD-3 Power Fuses in the vertical 180° opening and inverted styles—in all available voltage ratings—may be serviced using the S&C Fuse Hoist whenever fuse mountings are equipped with the optional fuse-hoist hook (catalog number suffix "-H"). Contact the nearest S&C Sales Office for details.

FIGURE 18. Installing (or removing) SMD-50 Fuse Unit using an S&C Distribution Prong.



FIGURE 19. Installing (or removing) SMD-1A, SMD-2B, SMD-2C, or SMD-3 Fuse Unit using an S&C Round Socket.



Interrupting Ratings

SHORT-CIRCUIT INTERRUPTING RATINGS

The ratings shown in **Table 5 on page 21**, **Table 6 on page 22**, **Table 7 on page 23**, **Table 8 on page 23**, and **Table 9 on page 24** are the maximum interrupting ratings of the fuses based upon full line-to-line voltage across a single fuse. Obviously, this is only one criterion of fuse performance. These fuses have also been rigorously tested through the full spectrum of fault currents, from the lowest to the highest fault—not only primary faults but also secondary-side faults as seen from the primary side of the transformer—and under all realistic conditions of circuitry.

In all S&C testing, special attention is given to establishing and controlling circuit parameters to duplicate conditions as severe as those encountered in the field. This involves testing at all degrees of asymmetry and matching the rate of rise of the transient recovery voltage of the test circuit to that found in actual field applications. This rate of rise depends, in turn, on carefully established laboratory test conditions to obtain realistic natural

frequencies and typical amplitudes of transient recovery voltage.

The short-circuit interrupting ratings listed in columns 3, 4, and 7 of these tables have been determined in accordance with the procedures described in the latest issue of ANSI Standard C37.41. Moreover, with respect to the requirement in this standard for testing with circuits having an X/R ratio of at least 15 (corresponding to an asymmetry factor of 1.55), S&C's tests were performed under the more severe condition of X/R = 20, corresponding to an asymmetry factor of 1.6.

Based upon the recognition there are many applications where the X/R ratio is less severe than the value of 15 specified by the standard, higher symmetrical interrupting ratings are listed in columns 5 and 6 for X/R = 10 and 5 respectively.

Interrupting Ratings (continued)

TABLE 5. SMD-1A Power Fuses—50/60-Hertz Short-Circuit Interrupting Ratings

| Voltage (kV, Nominal) | System (kV, Nominal) | Asymmetrical (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=20 (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=10 (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=5 (Amperes, RMS, Interrupting) | MVA, Interrupting, Three-Phase Symmetrical, Based on x/r=20 |
|-----------------------|----------------------|---|---|---|--|---|
| 34.5 | 23 | 28000 | 17500 | 19250 | 22400 | 700 |
| 34.5 | 27.6 | 28000 | 17500 | 19250 | 22400 | 840 |
| 34.5 | 34.5 | 28000 | 17500 | 19250 | 22400 | 1000 |
| 46 | 27.6 | 24000 | 15000 | Not Applicable | Not Applicable | Not Applicable |
| 46 | 34.5 | 24000 | 15000 | Not Applicable | Not Applicable | Not Applicable |
| 46 | 46 | 21000 | 13100 | 14500 | 16800 | 1000 |
| 69 | 34.5 | 16000 | 10000 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 46 | 16000 | 10000 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 69 | 14000 | 8750 | 9600 | 11200 | 1000 |
| 115 | 69 | 8000 | 5000 | Not Applicable | Not Applicable | Not Applicable |
| 115 | 115 | 8000 | 5000 | 5500 | 6400 | 1000 |
| 138 | 115 | 8000 | 5000 | 5500 | 6400 | 1000 |
| 138 | 138 | 6700 | 4200 | 4600 | 5400 | 1000 |

Interrupting Ratings (continued)

TABLE 6. SMD-2B Power Fuses—50/60-Hertz Short-Circuit Interrupting Ratings

| Voltage (kV, Nominal) | System (kV, Nominal) | Asymmetrical (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=20 (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=10 (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=5 (Amperes, RMS, Interrupting) | MVA, Interrupting, Three-Phase Symmetrical, Based on $x/r=20$ |
|-----------------------|----------------------|---|---|---|--|---|
| 69 | 23 | Not Applicable | 21900 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 276 | Not Applicable | 21900 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 34.5 | Not Applicable | 21900 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 46 | Not Applicable | 21900 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 69 | 28000 | 17500 | 17500 | 17500 | 2000 |
| 115 | 69 | 16800 | 10500 | Not Applicable | Not Applicable | Not Applicable |
| 115 | 115 | 16800 | 10500 | 10500 | 10500 | 2000 |
| 138 | 115 | 16800 | 10500 | Not Applicable | Not Applicable | Not Applicable |
| 138 | 138 | 14000 | 8750 | 8750 | 8750 | 2000 |

Interrupting Ratings (continued)

TABLE 7. SMD-2C Power Fuses—50/60-Hertz Short-Circuit Interrupting Ratings

| Voltage (kV, Nominal) | System (kV, Nominal) | Asymmetrical (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=20 (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=10 (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=5 (Amperes, RMS, Interrupting) | MVA, Interrupting, Three-Phase Symmetrical, Based on $x/r=20$ |
|-----------------------|----------------------|---|---|---|--|---|
| 34.5 | 23 | 53500 | 33500 | 36800 | 42800 | 1300 |
| 34.5 | 27.6 | 53500 | 33500 | 36800 | 42800 | 1600 |
| 34.5 | 34.5 | 53500 | 33500 | 36800 | 42800 | 2000 |
| 46 | 23 | 50500 | 31500 | Not Applicable | Not Applicable | Not Applicable |
| 46 | 27.6 | 50500 | 31500 | Not Applicable | Not Applicable | Not Applicable |
| 46 | 34.5 | 50500 | 31500 | Not Applicable | Not Applicable | Not Applicable |
| 46 | 46 | 50500 | 31500 | 34500 | 40200 | 2500 |
| 138 | 138 | 14000 | 8750 | 8750 | 8750 | 2000 |

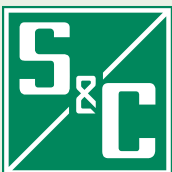
TABLE 8. SMD-3 Power Fuses—50/60-Hertz Short-Circuit Interrupting Ratings.

| Voltage (kV, Nominal) | System (kV, Nominal) | Asymmetrical (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=20 (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=10 (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=5 (Amperes, RMS, Interrupting) | MVA, Interrupting, Three-Phase Symmetrical, Based on $x/r=20$ |
|-----------------------|----------------------|---|---|---|--|---|
| 69 | 23 | Not Applicable | 25000 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 27.6 | Not Applicable | 25000 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 34.5 | Not Applicable | 25000 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 46 | Not Applicable | 25000 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 69 | 40000 | 25000 | 25000 | 25000 | 3000 |

Interrupting Ratings (continued)

TABLE 9. SMD-50 Power Fuses—50/60-Hertz Short-Circuit Interrupting Ratings

| Voltage (kV, Nominal) | System (kV, Nominal) | Asymmetrical (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=20 (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=10 (Amperes, RMS, Interrupting) | Symmetrical, Based on X/R=5 (Amperes, RMS, Interrupting) | MVA, Interrupting, Three-Phase Symmetrical, Based on x/r=20 |
|-----------------------|----------------------|---|---|---|--|---|
| 34.5 | 23 | 10600 | 6700 | 7300 | 8500 | 265 |
| 34.5 | 27.6 | 10600 | 6700 | 7300 | 8500 | 320 |
| 34.5 | 34.5 | 10600 | 6700 | 7300 | 8500 | 400 |
| 46 | 27.6 | 9600 | 6000 | Not Applicable | Not Applicable | Not Applicable |
| 46 | 34.5 | 9600 | 6000 | Not Applicable | Not Applicable | Not Applicable |
| 46 | 46 | 9600 | 5000 | 5500 | 6400 | 400 |
| 69 | 34.5 | 8000 | 4000 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 46 | 6400 | 4000 | Not Applicable | Not Applicable | Not Applicable |
| 69 | 69 | 5300 | 3350 | 3700 | 4300 | 400 |



CONTACT YOUR S&C SALES REPRESENTATIVE FOR MORE INFORMATION

sandc.com

