S&C Type XS Fuse Cutouts

Outdoor Distribution 4.16 kV through 25 kV

Application

An Unexcelled Cutout

S&C Type XS Fuse Cutouts, when fused with S&C Positrol® Fuse Links—provide *full-fault-spectrum* protection to overhead distribution systems rated 4.16 kV through 25 kV★, whether applied to overhead transformers, capacitors, cables, or lines. "Full-fault-spectrum protection" means that Type XS Cutouts interrupt all faults . . . from the lowest current that will melt the fuse link to the maximum rated interrupting current—whether the fault is on a transformer primary or secondary—with line-to-line or line-to-ground voltage across the cutout—regardless of transformer winding connections—and with the capability of handling the full range of transient-recovery-voltage severity associated with these conditions.

S&C Positrol Fuse Links possess melting time-current characteristics that are accurate not only initially but also on a sustained basis; this permanent accuracy is achieved principally through the design and construction of the fusible element. The silver or nickel-chrome elements in S&C Positrol Fuse Links are drawn through precision dies to very accurate diameters, assuring initial accuracy. And Positrol Fuse Links feature solderless construction—elements are swaged to their terminals to produce a permanent connection that is unaffected by vibration, corrosion, or aging.

All S&C Type XS Cutouts employ single venting—*down and away only*—an especially important feature where exhaust must be kept out of other phases in overbuilt circuits. Their nonexpendable fuse-tube cap construction, moreover, eliminates the extra expense of fuse-tube cap replacement.

Type XS Cutouts have been expressly designed for superior mechanical performance. Fusing is simple, even with gloved hands. Type XS Cutout fuse tubes are readily inserted in the cutout hinge and easily closed, without any need for careful steering or manipulation on the part of operating personnel—even from extreme angles and under adverse conditions of light and weather. And Type XS Cutouts can be opened and fuse tubes removed with equal ease.

. . . Becomes a Low-Cost Load-Switching Device

With the attachment of Loadbuster®, S&C's portable loadbreak tool, Type XS Cutouts convert to a sectionalizing device for no-external-arc live switching of transformers, capacitors, lines, or cables.

Loadbuster switching helps keep service interruptions to a minimum. There's no need for complex switching procedures involving opening and reclosing of line and feeder breakers to permit dead switching. There's no need for one or more line crews to travel and retravel miles of system. Loadbuster makes every cutout a sectionalizing point. Live switching can be done at the point that minimizes the length of planned outages and at the point where the fewest customers will be involved. As a bonus, Loadbuster will switch hook-equipped disconnects and power fuses too, adding even greater live-switching versatility.

Unlike switching with expensive loadbreak cutouts, there is no guesswork or uncertainty associated with switching Type XS Cutouts with Loadbuster. There is no dependence upon correct sequencing of the interrupting blade with the main blade, or upon spring assistance to snap open the auxiliary blade after years of inactivity . . . characteristics of loadbreak cutouts which are impossible to check prior to each attempted operation.

★ Also applicable on 26.4-kV through 34.5-kV systems for protection of single-phase-to-neutral circuits (lines or transformers) only, and grounded-wye connected capacitor banks in solidly-grounded-neutral (multigrounded-neutral) systems.

Performance

Voltage and Interrupting Ratings

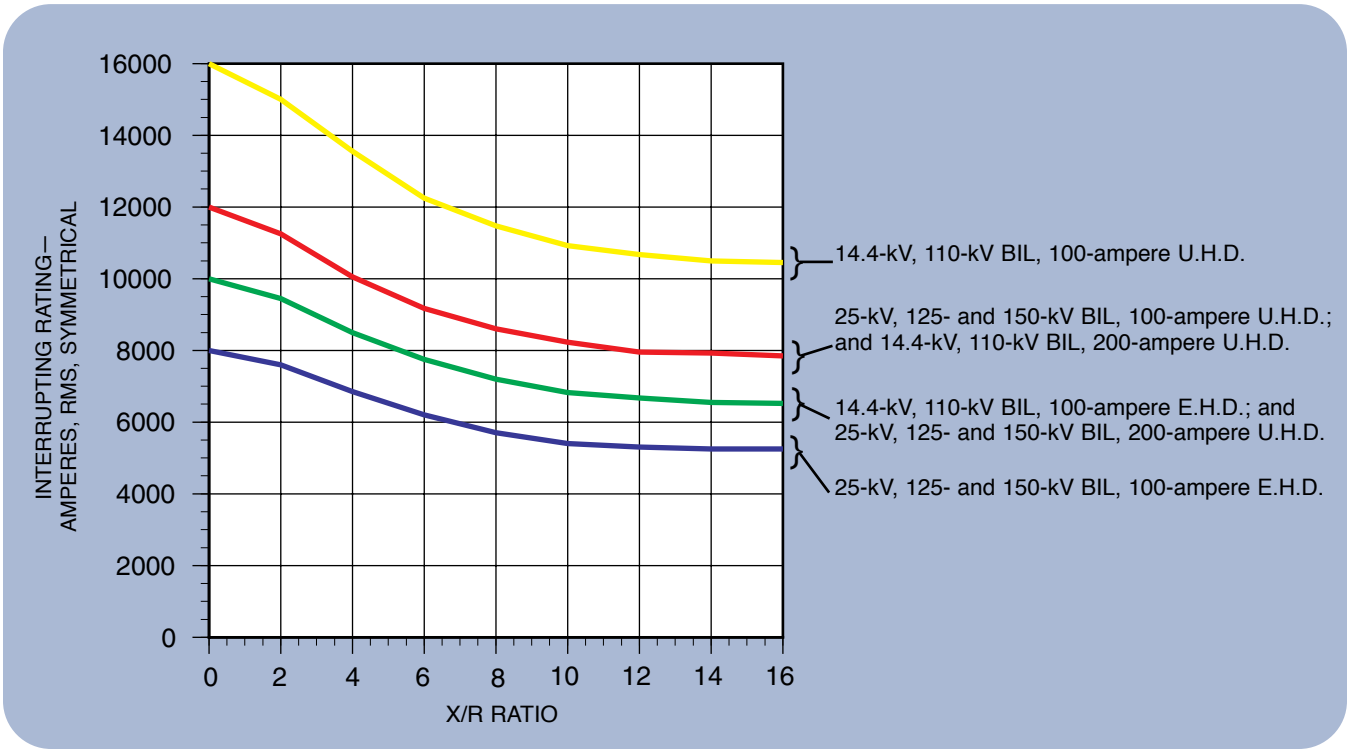
S&C Type XS Fuse Cutouts are assigned single-value nominal voltage ratings (not "dual," "slant," or "system voltage class" ratings) and can be applied, without restriction, on all three-phase systems having system maximum operating voltage (line-to-line) less than or equal to the cutout maximum voltage. Recognizing that under certain fault conditions cutouts can be exposed to voltage in excess of system line-to-neutral voltage—fault conditions which the cutouts *should* clear with no reliance on backup devices—S&C has tested Type XS Cutouts at *full system line-to-line voltage* across a wide spectrum of available fault currents, using transient recovery voltages realistically representative of those the cutout will see in actual service.

In contrast, most manufacturers of dual-voltage-rated cutouts restrict three-phase application of these cutouts to grounded-wye systems *only*. But even in such restricted applications the cutouts can still be exposed to voltage in excess of system line-to-neutral voltage under certain fault conditions, as noted above—and as recognized in the standards. In such instances the cutouts may not clear, thereby requiring a backup device to operate.

Type XS Cutout interrupting ratings have been substantiated by testing performed in accordance with IEEE C37.41-2000.

Shown on page 4 are asymmetrical and symmetrical interrupting ratings for both three-phase and single-phase applications of Type XS Cutouts. The symmetrical ratings for the overhead—pole-top style cutouts are based on an X/R ratio of either 8 or 12, depending on cutout voltage rating and interrupting current rating (as specified by IEEE C37.41-2000)—realistic maximum ratios for locations where cutouts are normally applied on a typical distribution feeder. Higher symmetrical interrupting ratings apply, of course, at locations where the X/R ratio is lower. The curves in the chart below indicate the symmetrical ratings of Type XS Cutouts at other X/R ratios.

Symmetrical Interrupting Ratings at Various X/R Ratios



60-Hertz Short-Circuit Interrupting Ratings①— Per IEEE C37.41-2000

OVERHEAD–POLE-TOP STYLES—Three-Phase and Single-Phase Applications

Continuous Current Rating, Amperes ⇨	100							200		
Style ⇨	Extra-Heavy-Duty②			Ultra-Heavy-Duty③				Ultra-Heavy-Duty③		
Voltage Rating, kV, Nom. ⇨	14.4	25	25	14.4	25	25	25	14.4	25	25
kV, Max ⇨	15	27	27	15	27	27	27	15	27	27
kV, BIL ⇨	110	125	150	110	125	150	150	110	125	150
Leakage Distance to Ground, Minimum, Inches (mm) ⇨	8½ (216)	11 (279)	17 (432)	8½ (216)	11 (279)	17 (432)◆	26 (660)■	8½ (216)	11 (279)	17 (432)
Catalog Number with Porcelain Insulator ⇨	89021R10	89022R10	89042R10	89031R10	89032R10	89052R10	89053R10▼	89071R11	89072R11	89092R11
System Voltage, kV ⇩	Short-Circuit Interrupting Rating, Amperes RMS, Asymmetrical④ and Symmetrical⑤									
4.16 thru 14.4	**10 000** 7 100	**8 000** 5 300	**8 000** 5 300	**16 000** 10 600	**12 000** 8 000	**12 000** 8 000		**12 000** 8 000		
16.5 thru 24.9		**8 000** 5 300	**8 000** 5 300		**12 000** 8 000	**12 000** 8 000			**10 000** 7 100	**10 000** 7 100
26.4● thru 34.5●			**8 000** 5 300			**12 000** 8 000				
26.4◐ thru 34.5◐							**12 000** 8 000			

① Consult the nearest S&C Sales Office for 50-hertz ratings.

② Uses nonremovable or removable buttonhead fuse links.

③ Uses removable buttonhead fuse links only.

④ Asymmetrical rating is shown first, in bold-face type.

Asymmetrical rating is based on total available short-circuit current of the circuit including the dc component, in accordance with IEEE standards.

⑤ Symmetrical rating is shown second, in light-face type.

Symmetrical rating is based on available symmetrical short-circuit current at locations where X/R ratio is equal to 8 (for Cutout Catalog Numbers 89021R10, 89071R11, 89072R11, and 89092R11) or 12 (for all other overhead—pole-top style cutouts). IEEE C37.41-2000 specifies these X/R ratios, as applicable, depending on cutout voltage rating and interrupting current rating.

◆ Approximate fuse-tube length, top of fuse-tube cap to bottom of fuse tube: 14⊠⊠ inches (375 mm).

■ Approximate fuse-tube length, top of fuse-tube cap to bottom of fuse tube: 18⊠⊠ inches (464 mm).

▼ Meets 170-kV BIL rating requirement of IEC Publication 282-2.

● Applicable for protection of single-phase-to-neutral circuits (lines or transformers) only, and grounded-wye connected capacitor banks in solidly-grounded-neutral (multigrounded-neutral) systems—where the leakage distance to ground meets user's requirements.

◐ Applicable for protection of single-phase-to-neutral circuits (lines or transformers) only, and grounded-wye connected capacitor banks in solidly-grounded-neutral (multigrounded-neutral) systems.

Switching Ratings

S&C Type XS Cutouts are designed for use with Loadbuster, S&C's portable loadbreak tool, which has an interrupting rating of 600 amperes nominal, 900 amperes maximum design. When used with Loadbuster, Type XS Cutouts are suitable for the following single-pole live-switching duties on single-phase or three-phase circuits of overhead distribution systems through 25 kV◐:

- **Transformer switching**—transformer load currents up to and including the emergency peak-load capability of the fuse link, as well as transformer magnetizing currents associated with the applicable loads.
- **Line switching**—load splitting (parallel or loop switching) and load dropping of currents up to and including the emergency peak-load capability of the fuse link or the continuous-current rating of the disconnect blade; also line dropping (charging currents typical for distribution systems of these voltage ratings).
- **Cable switching**—load splitting (parallel or loop switching) and load dropping of currents up to and including the emergency peak-load capability of the fuse link or the continuous-current rating of the disconnect blade; also cable dropping (charging currents typical for distribution systems of these voltage ratings).
- **Capacitor-bank switching**—switching of single capacitor banks as follows:

System Voltage, kV	Maximum Capacitor Bank Rating, kVAC, Three-Phase		
	Solidly or Effectively Grounded System		Ungrounded System
	Single① Banks, Grounded-Wye Connected	Single① Banks, Ungrounded-Wye Connected	Single① Banks, Grounded- or Ungrounded-Wye Connected
4.16 and 4.8	600	600	600
6.9 and 7.2	1050	1050	1050
8.32	1200	1200	1200
12 thru 14.4	1800	1800	1800
16	2400	2400	2400
20.8 thru 23.9	3000	◧	◧
24.9	3600	◧	◧

① Loadbusters must not be used for switching parallel ("back-to-back") capacitor banks.

◧ Loadbusters must not be used for switching ungrounded-wye connected banks—or grounded-wye connected banks on ungrounded systems—where maximum system operating voltage exceeds 18 kV (for Loadbuster, Catalog Number 5300R3) or 29 kV (for Loadbuster, Catalog Number 5400R3).

In single-pole switching of ungrounded-primary three-phase transformers or banks (or single-phase transformers connected line-to-line), circuit connections or parameters may, in some cases, produce excessive overvoltages. In particular, for the following applications above 22 kV, single-pole switching by any means—including Loadbuster—should be performed only under the conditions stated in italics:

- Switching unloaded or lightly loaded delta-connected or ungrounded-primary wye-wye connected three-phase transformers or banks (or line-to-line connected single-phase transformers) rated 150 kVA or less three-phase, or 50 kVA or less single-phase—or of any kVA rating when combined with unloaded cables or lines—where maximum system operating voltage exceeds 22 kV. *Single-pole switching should be performed only if each phase is carrying 5% load or more, or if the transformer or bank is temporarily grounded at the primary neutral during switching.*
- Switching loaded or unloaded ungrounded-primary wye-delta connected three-phase transformers or banks—alone or combined with unloaded cables or lines—where maximum system operating voltage exceeds 22 kV. *Single-pole switching should be performed only if each phase is carrying 5% load or more and if the lighting-load phase is always switched open first (or switched closed last); or if the transformer or bank is temporarily grounded at the primary neutral during switching.*

◐ Also, 26.4-kV through 34.5-kV systems on single-phase-to-neutral circuits (lines or transformer protection) only, and grounded-wye connected capacitor banks in solidly-grounded-neutral (multigrounded-neutral) systems.

Construction

Ruggedness

The mechanical construction of the Type XS Cutout is rugged and strong: it is designed to withstand the interruption forces of heavy fault currents and the typically forceful closing-in by operating personnel.

The upper contact and the hinge are attached to husky steel supports and the mounting bracket is attached to a strong mounting insert.

On cutouts with porcelain insulators, the supports and mounting insert are permanently anchored into cavities in the insulator with inorganic cement, which does not deteriorate with age or absorb moisture. The cement won't shrink, so the supports and insert won't loosen. It won't swell either, thus eliminating stress on the cavities. The cement actually retains a slight resiliency to partially absorb the shock of the interruption forces.

On cutouts with polymer insulators, the supports and mounting insert are molded into a high-strength fiberglass-reinforced polyester core, over which is molded the composite-polymer silicone insulation. The core has a thicker diameter near the top, center, and bottom for enhanced torsional rigidity.

No steel bands are needed around the top, bottom, and center of the insulator. Such bands produce mechanical stress concentrations at these three points; their thin insulation coatings are subject to damage due to mishandling on installation and to deterioration with time and weather; and there is an eventual loss of birdproofing and a lessening of the leakage distance.

Superb Current Transfer

The fuse tube is held at the upper contact by a self-aligning spring-loaded detent-type latch. The detent features silver-clad embossed surfaces for built-in wiping action—resulting in minimum electrical resistance between the upper contact and the silver-clad fuse-tube cap.

The silver-clad lower contacts also feature embossed surfaces for built-in wiping action, and are backed up by prestressed stainless-steel loading springs for efficient current transfer between the contacts and the silver-clad fuse-tube trunnion.

These specially designed high-pressure upper and lower contacts, featuring built-in wiping action, ensure superb current transfer—even after the contacts have been exposed to the atmosphere for an extended period of time.

Superior Mechanical Performance Features

- **Simple fuse-link installation**—even with gloved hands. The carefully proportioned flipper can be readily held in place while the large, easy-to-grasp cable clamping bolt is being tightened.
- **Easy fuse-tube insertion (and removal).** Careful steering or manipulation is not required to hang the tube in the cutout, or to remove it. The fuse-tube lower ferrule can be hookstick-engaged either by its large, accessible lifting ring or its equally accessible hookstick keyhole. Both offer secure control of the fuse tube under all conditions. Wide, conspicuous "ears" on the hinge engage the fuse-tube lower ferrule, making tube insertion simple.
- **Superb alignment when closing**—from any angle and under adverse conditions of light and weather. Again, careful steering or manipulation of the fuse tube is not required. In the first stage of closing, when the tube is slowly pivoted up to an angle less than 90 degrees from the closed position, the fuse tube is restrained from tilting left or right by broad guiding surfaces at the hinge. When the tube is slammed into the upper contact, it is further controlled by the Loadbuster attachment hooks. At the end of the closing stroke, the fuse-tube cap wipes in and seats squarely in the detent-type latch which, unlike so-called "positive" latches, won't release due to rebounding.
- **No fuse-link breakage.** During closing, the top of the fuse tube may be subjected to very high impact forces—which can break the fuse link in some cutouts. But the high reduction ratio of the Type XS Cutout flipper lever system allows this impact to be absorbed before it reaches the fuse link. This arrangement does not impair the split-second flip-out of the fuse link when severed by fault current. (Flip-out is caused by the spring-loaded flipper and does not rely on force of the exhaust or collapse of the toggle joint.)
- **Completely reliable dropout action**—regardless of fault-current level. To ensure dropout of the fuse tube after circuit interruption—even after long periods of inactivity—the Type XS Cutout utilizes a high-speed spring-loaded flipper which rapidly withdraws the severed fuse-link cable. The upper-contact springs also contribute to toggle collapse by pushing the fuse tube down and out into the open position.
- **Smooth Loadbuster operation.** The Type XS Cutout and Loadbuster were literally "made for each other," not only electrically but mechanically as well. And the Type XS Cutout's Loadbuster attachment hooks keep the tool positively anchored until the time of tripping, yet allow for easy removal of Loadbuster should the operating personnel—for any reason—decide not to open the cutout after having attached Loadbuster.

Parallel-groove connector—tin-plated cast red brass. For ease of conductor connection, accommodates two conductors of unlike size in a single connector (lower connector can be placed in either the vertical or horizontal configuration). Other styles of connectors are also available

One-piece channel—heavy galvanized steel (which is also used for inserts, hangers, and structural bolts and nuts)

Upper contacts—silver-to-silver; stainless-steel spring provides high contact pressure

Rugged attachment hooks—for Loadbuster—guide tube during closing

Lower contacts (not visible)—silver-to-silver; provide dual current path, independent of hinge pivot. Stainless-steel backup springs prevent arcing when tube rises in hinge during recoil

Fuse tube—features MultiWind™-liner that's virtually impervious to water ingress. Special UV-resistant finish assures long life. Models also available with disconnect blade

Toggle joint—assures reliable dropout after operation

Trunnion—high-strength cast bronze, silver plated. Surfaces around trunnion bear on broad hinge surfaces to keep tube in alignment during closing

Sturdy ferrules—cast red brass. Pinned to top and bottom of tube for permanent alignment. Either the large, accessible lifting ring or the key-hole (not visible in photo) may be engaged with a hookstick for secure control of fuse tube during fuse-tube installation or removal

Trunnion pocket—secures tube in hinge during closing

Flipper—gives high-speed terminal separation, quick cable flip-out, and (in conjunction with the toggle joint) reduces transmission of forces to fuse link during closing

Catalog Number 89021R10-D. Extra-Heavy-Duty Overhead—Pole-Top Style, rated 14.4 kV nominal, 15 kV maximum, 110 kV BIL, 100 amperes continuous, 10,000 amperes interrupting, RMS, asymmetrical kV maximum, 110 kV BIL, 100 amperes continuous, 10,000 amperes interrupting, RMS, asymmetrical (12,000 amperes single shot), 8□□ inches (216 mm) minimum leakage distance to ground.

Catalog Number Suffix "-D" provides for the inclusion of parallel-groove connectors each accommodating No. 6 solid (13.3 mm^2) through No. 2 stranded (44.4 mm^2) copper or aluminum in one groove; No. 2 solid (33.6 mm^2) through 250 kc mil (168 mm^2) stranded copper or aluminum, or 4/0 ACSR (161 mm^2) in the other groove.

With Loadbuster, S&C's Portable Loadbreak Tool

Loadbuster is first attached to a universal pole at least six feet long. It is then positioned across the front of the Type XS Cutout, with the Loadbuster anchor hung on the attachment hook on the far side of the cutout. The pull-ring of the fuse tube or disconnect blade is engaged with Loadbuster's pull-ring hook and held fast with Loadbuster's pull-ring latch. As the universal pole is pulled downward with a firm, steady stroke, and as Loadbuster is extended to its maximum length, the cutout is opened and the current is diverted through Loadbuster—at the same time Loadbuster's internal operating spring is charged.

At a predetermined point in Loadbuster's opening stroke, its internal trigger trips, the charged operating spring is released, the internal contacts are separated, and the circuit is *positively* interrupted. The only sound is that of Loadbuster tripping.

Circuit interruption is independent of the speed at which the Loadbuster tool is operated. All that is required is a smooth operating stroke . . . without hesitation, without jerking . . . until the tool is

1. ATTACH: Reach across the front of the cutout and attach Loadbuster's anchor to the attachment hook on the far side of the cutout, and then engage its pull-ring with Loadbuster's pull-ring hook. Loadbuster's pull-ring latch prevents inadvertent disengagement of the cutout pull-ring and Loadbuster's pull-ring hook.

2. PULL: A firm, steady downward pull on Loadbuster—to its maximum extended length—opens the cutout in the normal manner as the current is diverted through Loadbuster. At a predetermined point in the opening stroke, Loadbuster trips, breaking the circuit positively.

3. REMOVE: Loadbuster is disengaged by first removing its anchor from the cutout attachment hook. Then, with the blade in the open position, Loadbuster is removed from the pull-ring with a simple "roll-off" motion.

extended to its maximum length. The resetting latch retains the tool in the open position for removal from the cutout—and until released to reset Loadbuster for its next operation.

And resetting Loadbuster is easy, too. Merely release the resetting latch and firmly close the extended tool to its fully telescoped position. It's that simple.

For detailed information on Loadbuster, S&C's portable loadbreak tool, see S&C Descriptive Bulletin 811-30.

Styles

Catalog Number 89021R10-D▲ Extra-Heavy-Duty Overhead—Pole-Top Style, rated 14.4 kV nominal, 15 kV maximum, 110 kV BIL, 100 amperes continuous, 10,000 amperes interrupting, RMS, asymmetrical, 8½ inches (216 mm) minimum leakage distance to ground.

Catalog Number 89072R11-D▲ Ultra-Heavy-Duty Overhead—Pole-Top Style, rated 25 kV nominal, 27 kV maximum, 125 kV BIL, 200 amperes continuous, 10,000 amperes interrupting, RMS, asymmetrical, 11 inches (279 mm) minimum leakage distance to ground.

▲ Catalog Number Suffix "-D" provides for the inclusion of parallel-groove connectors each accommodating No. 6 solid (13.3 mm^2) through No. 2 stranded (44.4 mm^2) copper or aluminum in one groove; No. 2 solid (33.6 mm^2) through 250 kc mil (168 mm^2) stranded copper or aluminum, or 4/0 ACSR (161 mm^2) in the other groove.

Catalog Number 89042R10-M★ Extra-Heavy-Duty Overhead—Pole-Top Style, rated 25 kV▼ nominal, 27 kV maximum, 150 kV BIL, 100 amperes continuous, 8,000 amperes interrupting, RMS, asymmetrical, 17 inches (432 mm) minimum leakage distance to ground.◆

Catalog Number 89253R10-D▲ Disconnect, Overhead—Pole-Top Style, rated 25 kV nominal, 27 kV maximum, 150 kV BIL, 300 amperes continuous, 26 inches (660 mm) minimum leakage distance to ground.

★ Catalog Number Suffix "-M" provides for the inclusion of eyebolt connectors each accommodating one conductor ranging in size from No. 8 solid (8.4 mm^2) through 250 kc mil (168 mm^2) stranded copper or aluminum, or 4/0 ACSR (161 mm^2).

▼ This cutout may also be applied on 26.4-kV through 34.5-kV systems for protection of single-phase-to-neutral circuits (lines or transformers) only, and grounded-wye connected capacitor banks in solidly-grounded-neutral (multigrounded-neutral) systems—where the cutout's 17-inch (432 mm) leakage distance to ground meets user's requirements.

◆ Approximate fuse-tube length, top of fuse-tube cap to bottom of fuse tube: 14¾ inches (375 mm).

▲ Catalog Number Suffix "-D" provides for the inclusion of parallel-groove connectors each accommodating No. 6 solid (13.3 mm^2) through No. 2 stranded (44.4 mm^2) copper or aluminum in one groove; No. 2 solid (33.6 mm^2) through 250 kc mil (168 mm^2) stranded copper or aluminum, or 4/0 ACSR (161 mm^2) in the other groove.