Applications

A broad selection of time-current characteristic curves, plus high continuous current and fault-interrupting ratings, makes Fault Fiter Electronic Power Fuses the ideal selection for service-entrance protection, medium-voltage transformer protection, underground subloop protection, and backup protection for overdutied devices such as power circuit breakers. The fast response made possible by Fault Fiter provides a degree of protection superior to that provided by power circuit breakers and at continuous-current levels far exceeding those available with current-limiting fuses. Moreover, the special response characteristics available with Fault Fiter Electronic Power Fuses makes Fault Fiter the ideal selection for applications where traditional types of protective equipment have not been completely satisfactory.

Service-Entrance Protection and Coordination—In many applications, a main service-entrance protective device is required to provide a sectionalizing point between switchgear feeder fuses and the serving utility's upstream protective equipment. In the past, circuit breakers have often been used to address the upstream coordination requirements and to provide the continuous current capability to serve multiple downstream feeders with relatively large loads. In many applications, however, even circuit breakers have been unable to completely satisfy all coordination requirements. The Fault Fiter, equipped with an inverse-curve-type control module, can meet the coordination and high-continuous-current requirements of such applications at a cost far below that of circuit breakers and the associated relays.

Transformer Protection—Applications involving protection of medium-voltage power transformers in industrial, commercial, and institutional power systems are subject to difficult and often conflicting protection and coordination criteria. Ideally, the time-current characteristic curve of the primary-side protective device should intersect the transformer through-fault protection curve at the lowest possible current level, while still coordinating with secondary-side protective equipment. The Fault Fiter's compound and time-delayed compound-curve type TCCs—which combine high-speed response characteristics for high-current faults and inverse-type characteristics for lower-magnitude faults—are ideal for providing maximum protection for the transformer without compromising coordination with secondary-side devices.

Underground Subloop Protection—Pad-mounted transformers installed on underground-distribution systems usually incorporate "weak-link" fuses for protection against internal faults. As a result of the limited interrupting capability of such fuses, and because of concern for the momentary and fault-closing capabilities of the elbow connectors typically used on underground loops, transformers on systems with higher fault currents have sometimes been equipped with expensive internal backup current-limiting fuses. S&C Fault Fiters, equipped with the underground-subloop type control module installed in pad-mounted gear feeding the loop, provide an effective and economical alternative to backup current-limiting fuse protection for individual transformers, while accommodating the continuous current and the inrush currents associated with energizing the entire loop.

Overdutied Device Protection—Growth of modern power systems can cause available fault-current levels to increase beyond the capabilities of older equipment installed on the system. Fault Fiters equipped with an instantaneous-type control module can be selected to provide backup protection for overdutied devices in the event of a high-magnitude fault. The Fault Fiter will provide such protection and still allow the overdutied device to clear faults within its rating. With this solution, there is no need to replace overdutied devices at costs far in excess of the S&C Fault Fiter.

Application Qualifications

S&C Fault Fiter Electronic Power Fuses with instantaneous- or compound-curve-type control modules may not be applied in series with current-limiting fuses unless they are installed in conjunction with a separate relay-actuated three-phase load-interrupter switch, such as a switch-operator-driven S&C Mini-Rupter® with an S&C Type SPD Open-Phase Detector or S&C Type ZSD Overcurrent Relay. This will provide electrical isolation of the circuit in the event either the Fault Fiter or the series current-limiting fuse is left in a partially operated condition resulting from miscoordination and the attendant response of both fuses to the same system fault.

S&C Fault Fiter Electronic Power Fuses may sometimes be installed in proximity to source- or load-side capacitor banks. In such circumstances, minimum overhead-line or cable distances between the capacitor bank and Fault Fiter may be required to ensure proper response of Fault Fiter to system conditions. The mini-

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mum overhead-line and cable distances listed in Tables I, II, and III apply only to S&C Fault Fiter Electronic Power Fuses with instantaneous- or compound-curve-type control modules and applied in proximity to capacitor banks. S&C Fault Fiter Electronic Power Fuses with inverse- or time-delayed compound-curve-type control modules are not affected by nearby capacitor banks. The minimum overhead-line and cable distances listed in the tables, moreover, do not apply to Fault Fiters when nearby capacitor banks are located on the remote side of a transformer. In addition, inductance in the form of series reactors, which may typically be present in source-side substations, will minimize the effects of nearby capacitor banks, thereby reducing or eliminating the minimum distance requirement. For application assistance, refer to the nearest S&C Sales Office.

TABLE I—Minimum Distances to Source-Side Capacitor Banks①

S&C Fault Fiter Voltage Rating, kV, Nom.	Maximum Available Short-Circuit Current at Fault Fiter, Amperes, RMS Sym.②	Minimum Distance to Nearest Source-Side Capacitor Bank, Feet③	
		Overhead Line	Cable
4.16	10 000 20 000 30 000 40 000	450 750 850 1 350	1 600 2 700 3 000 4 700
13.8	10 000 20 000 30 000 40 000	1 200 2 000 2 400 3 700	4 200 7 000 8 400 13 000
25	10 000 20 000 30 000 40 000	2 000 3 400 4 100 6 200	7 000 12 000 14 500 21 700

① Distance restrictions do not apply to Fault Fiters with inverse- or time-delayed compound-curve-type control modules—nor do they apply to capacitor banks located on the remote side of a transformer.

② The short-circuit-current value selected should reflect anticipated system growth.

③ Shorter distances may apply in the case of certain circuit configurations. Refer to the nearest S&C Sales Office for information.

TABLE II—Minimum Distances to Load-Side Capacitor Banks—Single Banks①

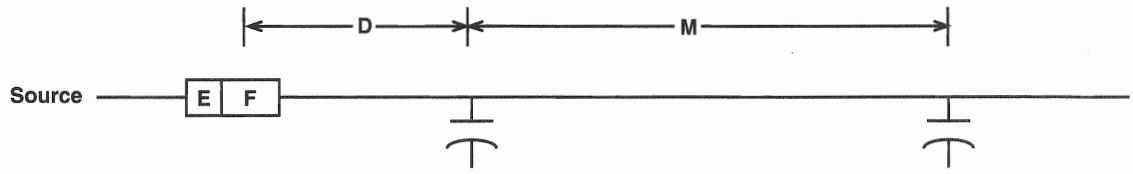
S&C Fault Fiter Voltage Rating, kV, Nom.	Capacitor-Bank Rating, kVAR, Three-Phase	Minimum Distance to Load-Side Capacitor Bank, Feet	
		Overhead Line	Cable
4.16	900 or less	No restrictions apply	No restrictions apply
	1200★	450	1600
13.8	2 700 or less	No restrictions apply	No restrictions apply
	3000 3600★	950 1200	3400 4200
25	3600★ or less	No restrictions apply	No restrictions apply

① Distance restrictions do not apply to Fault Fiters with inverse- or time-delayed compound-curve-type control modules—nor do they apply to capacitor banks located on the remote side of a transformer.

★ For larger capacitor banks, refer to the nearest S&C Sales Office.

TABLE III—Minimum Distances Between Load-Side Capacitor Banks—Two Banks①

TYPICAL ONE-LINE DIAGRAM



S&C Fault Fiter Voltage Rating, kV, Nom.	Capacitor-Bank Rating, kVAR, Three-Phase②	Minimum Distance (M) Between Capacitor Banks, Feet			
		Overhead Line		Cable	
		D = less than 500 feet	D = 500 feet or more	D = less than 1800 feet	D = 1800 feet or more
4.16	450 or less	150	No restrictions apply	550	No restrictions apply
	600	250	No restrictions apply	900	No restrictions apply
	900	1200	400	4200	1400
		D = less than 1500 feet	D = 1500 feet or more	D = less than 5400 feet	D = 5400 feet or more
13.8	1200 or less	450	No restrictions apply	1600	No restrictions apply
	1800	750	No restrictions apply	2700	No restrictions apply
	2400	3600	1200	12 600	4200
		D = less than 2500 feet	D = 2500 feet or more	D = less than 8500 feet	D = 8500 feet or more
25	2 400 or less	No restrictions apply	No restrictions apply	No restrictions apply	No restrictions apply
	2700	750	No restrictions apply	2600	No restrictions apply
	3300	1200	No restrictions apply	4200	No restrictions apply
	3600	1450	No restrictions apply	5100	No restrictions apply

① Distance restrictions do not apply to Fault Fiters with inverse- or time-delayed compound-curve-type control modules—nor do they apply to capacitor banks located on the remote side of a transformer.

② Minimum distances are based on two capacitor banks of the same rating. For applications involving capacitor banks of unlike ratings, ratings larger than those listed, or more than two load-side capacitor banks, refer to the nearest S&C Sales Office.

A Note on System Voltage Ratings

Fault Fiter Electronic Power Fuses should be selected having a maximum voltage rating equal to—or greater than—the system line-to-line voltage since the fuse can be exposed to full system line-to-line voltage in clearing faults. To ensure proper coordination of Fault Fiter with system surge arresters, it is also important that the system voltage not be too low relative to the Fault Fiter's voltage rating. To satisfy both of these requirements, the following specific system-voltage recommendations should be observed:

S&C Fault Fiter Voltage Rating, kV		Applicable System Voltage, kV
Nom.	Max	
4.16	5.5	4.16 and 4.8
13.8	17.0	12.0 through 16.5
25	29	22.9 through 27.6

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