Fuses, 27 kV, SMU-20, Type E

1. Scope

This standard covers the requirements for 27 kV, SMU-20, Type E fuses and end fittings.

This standard applies to the following Seattle City Light (SCL) stock numbers:

Stock No.	Type
684721	1 E
684727	15 E
684729	30 E
684731	50 E
684737	200 E
682587	Upper and lower end fittings

2. Application

SMU-20 power fuses, with end fittings, are used with SMD-20 overhead cutouts in unit and industrial stubstations.

S&C Electric Company (S&C) uses “E” ratings to designate slow-speed fuses. Cooper Power Systems (Eaton) uses the “SE” rating to designate the same fuse. S&C refers to the fuses as SMU-20, whereas Eaton refers to them as CMU-20.

When installed on pole-top locations on distribution feeders, the fuse operates promptly to limit the stress on electrical systems due to short circuits. It provides isolation for the faulted circuit, limiting the size of the interrupted service area.

When installed on the primary side of a pole-mounted transformer on a distribution feeder, the fuse detects and interrupts all faults. Faults are detected and interrupted regardless of whether the fuse is located on the primary or secondary side of the transformer and regardless of the transformer winding connections.

Fuses are also well-suited for protection of pole-top or station capacitor banks.

For fuse time-current characteristics curves, see Appendix A and B.

3. Industry Standards

Fuses and accessories shall meet the applicable requirements of the following industry standards:

IEEE Std C37.40; IEEE Standard–Service Conditions and Definitions for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories

IEEE Std C37.41; IEEE Standard–Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories

IEEE Std C37.42; IEEE Standard–Specifications for High-Voltage Expulsion Type Distribution Class Fuses, Cutouts, Fuse Disconnecting Switches and Fuse links

IEEE Std C37.46; IEEE Standard–Specifications for High-Voltage Expulsion and Current-Limiting Type Power Class Fuses and Fuse Disconnecting Switches

IEEE Std C37.48.1; IEEE Standard–Guide for the Operation, Classification, Application, and Coordination

4. Requirements

Fuses shall meet the requirements shown in Table 4a.

Table 4a. Requirements

Overall design	Suitable for outdoor use
Top and bottom terminals	Suitable for use with S&C 3090 and Eaton CMU3095 outdoor end fittings
Fuse type	Expulsion
Speed	Slow speed – Type “E” or “SE”
Operation action	Dropout
Element type	Silver
Interrupting medium	Boric acid
Color	Gray
Fuse tube material	Reinforced fiberglass or equivalent, UV resistant
Rated maximum voltage	27 kV
Maximum interrupting current, rms, symmetrical (kA)	12.5

Fuse shall have current ratings as shown in Table 4b.

Table 4b. Fuse Current Ratings

Type	Continuous Current (A)
1 E	1
15 E	15
30 E	30
50 E	50
200 E	200

5. Marking

Fuse units shall be marked according to the requirements of IEEE C37.42, Section 10.2, which includes:

- Manufacturer name or symbol
- Manufacturer type or identification
- Rated current
- Rated maximum voltage
- Rated minimum interrupting current
- Rated maximum interrupting current
- Rated frequency
- Identifying date code (month and year)

6. Packaging

Fuses and end fitting sets shall be packaged individually to prevent damage during shipping, handling, and storage.

Shipping containers shall be legibly marked with the SCL purchase order number.

7. Issuance

Stock Unit: EA

8. Approved Manufacturers

Stock No.	Type	Continuous Current (A)	Cooper Catalog No.	S&C Catalog No.
684721	1 E	1	–	703001
684727	15 E	15	CMU713015	713015
684729	30 E	30	CMU713030	713030
684731	50 E	50	CMU713050	713050
684737	200 E	200	CMU713200	713200
682587	Upper and lower end fitting set		CMU3095	3090

9. Sources

Fusing Equipment Catalog Data CA132038EN; “CMU Medium Voltage Power Fuses,” October 2015

Descriptive Bulletin 242-32; “SMD-20 Power Fuses: Outdoor Distribution (14.4 kV through 34.5 kV),” April 2020

Shetab, Muneer; SCL Standards Engineer, originator, and subject matter expert for 6840.30

Specification Bulletin 242-31; “Type SM-4, SM-5, SMD-20, and SMD-40 Power Fuses: Outdoor Distribution (14.4 kV through 34.5 kV),” August 2020

TCC R240-91-151, Cooper Power Systems; Time-Current Characteristics Curves; Minimum Melt Slow “E” Speed

TCC R240-91-157, Cooper Power Systems; Time-Current Characteristics Curves; Total

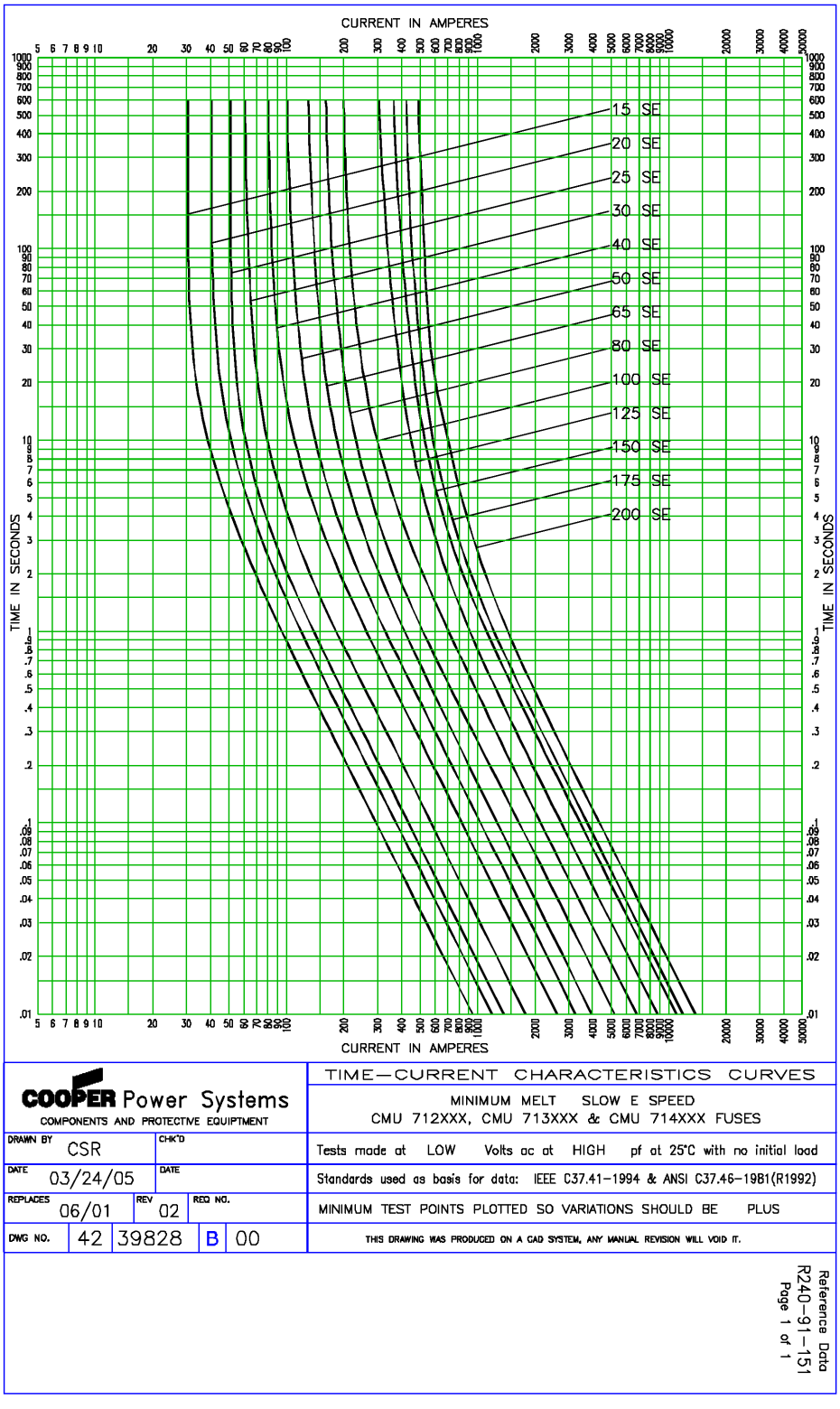
TCC 119-2, S&C Electric Company; Minimum Melting Time-Current Characteristic Curves; SMU Fuse Units – S&C Slow Speed

TCC 119-2-4, S&C Electric Company; Total Clearing Time-Current Characteristic Curves; SMU Fuse Units – S&C Slow Speed

Stock Catalog Page 68-7; July 29, 2008

Appendix A. Eaton (Cooper Power Systems) TCC Fuse Curves

Time-Current Characteristics Curves: Minimum Melt Slow "E" Speed
TCC Number: R240-91-151



COOPER Power Systems
COMPONENTS AND PROTECTIVE EQUIPTMENT

TIME—CURRENT CHARACTERISTICS CURVES

MINIMUM MELT SLOW E SPEED
CMU 712XXX, CMU 713XXX & CMU 714XXX FUSES

DRAWN BY: CSR	CHK'D:
DATE: 03/24/05	DATE:
REPLACES: 06/01	REV: 02 REQ NO.
DWG NO.: 42 39828 B 00	

Tests made at LOW Volts ac at HIGH pf at 25°C with no initial load

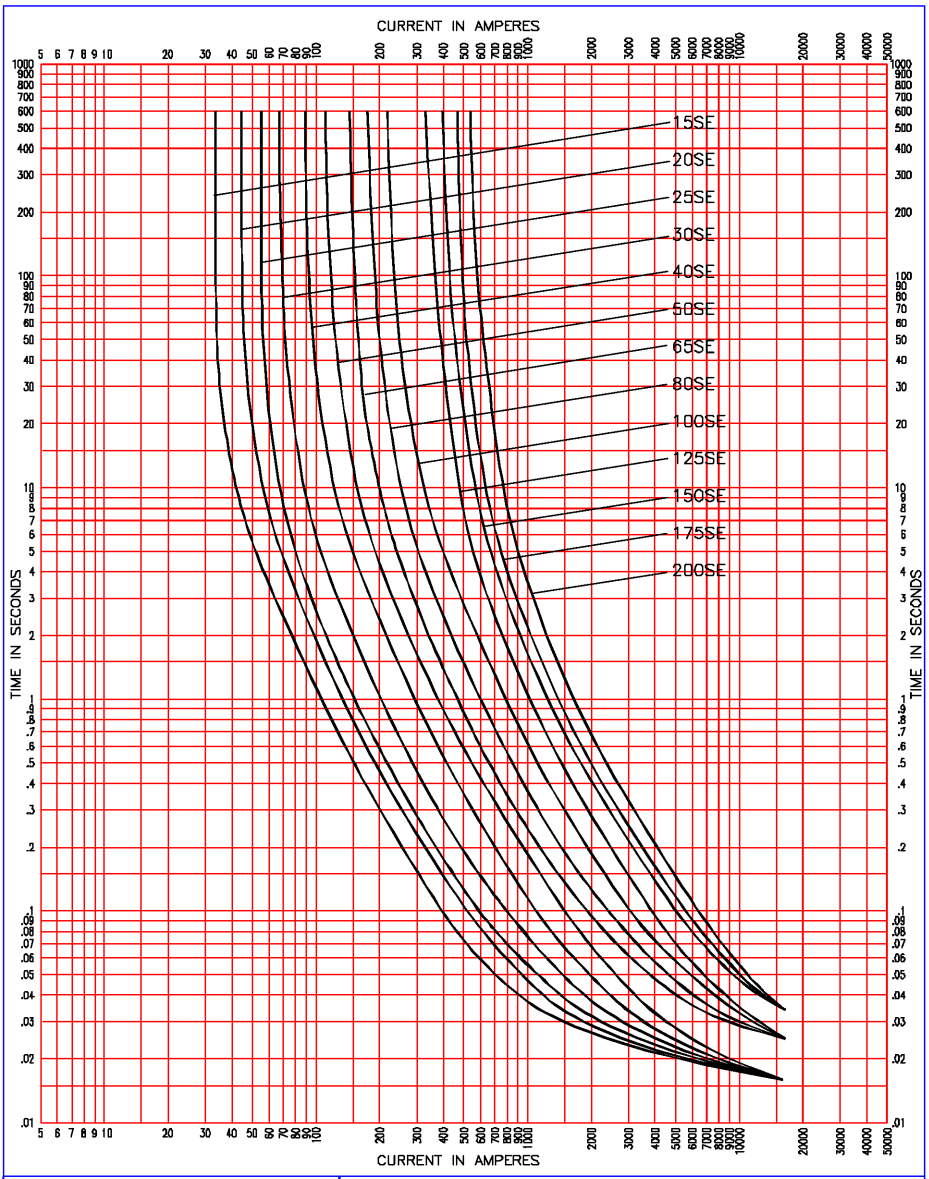
Standards used as basis for data: IEEE C37.41-1994 & ANSI C37.46-19B1(R1992)

MINIMUM TEST POINTS PLOTTED SO VARIATIONS SHOULD BE PLUS

THIS DRAWING WAS PRODUCED ON A CAD SYSTEM, ANY MANUAL REVISION WILL VOID IT.

Reference Data
R240-91-151
Page 1 of 1

Time-Current Characteristics Curves: Total Clear Slow "E" Speed
TCC Number: R240-91-157



COOPER Power Systems
COMPONENTS AND PROTECTIVE EQUIPTMENT

TIME—CURRENT CHARACTERISTICS CURVES

27kV & 38kV TOTAL CLEAR SLOW E SPEED
CMU 713XXX & CMU714XXX FUSES

DRAWN BY	CSR	CHK'D	
DATE	03/24/05	DATE	
REPLACES	06/01	REV 02	REQ NO.
DWG NO.	42 39834	B	00

Tests made at HIGH Volts ac at LOW pf at 25°C with no initial load

Standards used as basis for data: IEEE 37.41–1994 & ANSI C37.46–1981(R1992)

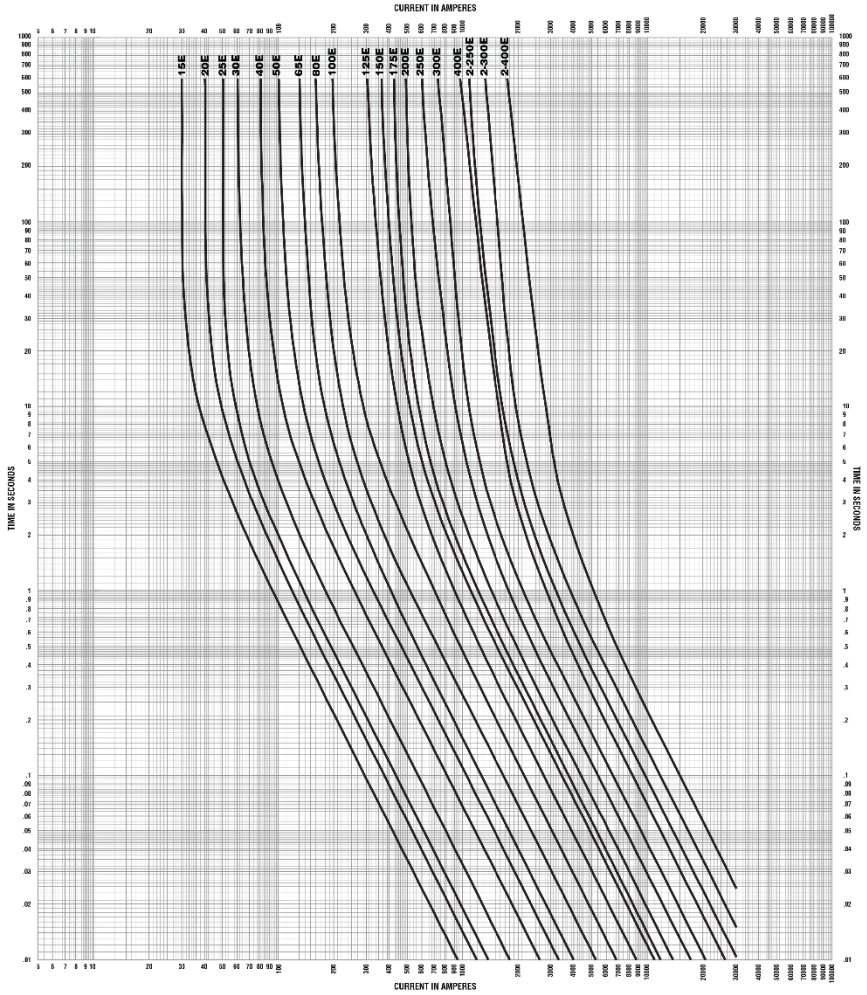
MAXIMUM TEST POINTS PLOTTED SO VARIATIONS SHOULD BE MINUS

THIS DRAWING WAS PRODUCED ON A CAD SYSTEM, ANY MANUAL REVISION WILL VOID IT.

Reference Data
R240–91–157
Page 1 of 1

Appendix B. S&C Electric Company TCC Fuse Curves

Minimum Melting Time-Current Characteristic Curves: SMU Fuse Units – S&C Slow Speed
TCC Number: 119-2



Minimum Melting Time-Current Characteristic Curves

SMU Fuse Units–S&C Slow Speed

BASIS–These fuse units are tested in accordance with the procedures described in IEEE Standard C37.41, and they are rated to comply with IEEE Standard C37.46. As required by these standards, the minimum melting current is not less than 200% of fuse-unit ampere rating, and the minimum melting curves are based on tests starting with the fuse unit at an ambient temperature of 25°C (77°F) and no initial load.

CONSTRUCTION–Fusible elements are silver, helically coiled, and of solderless construction.

TOLERANCES–Curves are plotted to minimum test points. Maximum variations expressed in current values are plus 10%.

APPLICATION–As with all high-voltage fuses, these fuse units are intended to accommodate overloads, not to interrupt them. Accordingly, they feature fusible elements designed with a minimum melting current of 200% of the fuse-unit ampere rating (for fuse units rated 100 amperes or less) or 240% of the fuse-unit ampere rating (for fuse units rated over 100 amperes). As a result, these fuse units have considerable peak-load capabilities; however, they should never be exposed to loading in excess of the peak-load capabilities listed in S&C Information Bulletin 242-190.

Because these fuse units have silver element construction not subject to damage by aging or transient overcurrents, it is unnecessary to replace unblown fuse units in single-phase or three-phase installations when one or more fuse units has blown.

COORDINATION—Any preloading reduces melting time. While this phenomenon is especially pronounced in other makes of fuses having minimum melting currents appreciably less than 200% of rating, the effect of preloading must nonetheless be determined for the S&C fuse units represented by these curves (see S&C Information Bulletin 242-190) and adjustments to these curves must be made when:

- Close coordination is required
- Regardless of the preciseness of coordination, the fuse unit is subjected to temporary overloads

There are cases where the coordination requirements may be very exacting, for example, in coordinating a transformer primary fuse with a secondary breaker and a source-side breaker. The time interval between the operating characteristics of the two breakers may be very narrow. Under these circumstances, an extremely short time interval must occur between the minimum melting and the total clearing characteristics of the fuse.

The fuse units represented by these curves possess this short time interval feature because—having a nondamageable fusible element of precise construction—they require:

- As little as 10% total tolerance in melting current compared to the 20% tolerance of many fuses (20% and 40% respectively in terms of time)
- No "safety-zone" or setback allowances

This narrow time band normally will provide the desired coordination. If the selected S&C Slow Speed fuse unit does not meet the coordination requirements, check whether the same ampere rating in the S&C Very Slow Speed will satisfy.

Sometimes a selected ampere rating will fail to meet the coordination requirements in any available speed. In this case, the selection of another ampere rating for either the protecting or protected fuse usually will satisfy all requirements.

Do not assume other fuses that do not use S&C's silver, helically coiled fusible element construction can better resolve a coordination impasse than the use of another ampere rating in one of the S&C speed options. Such other fuses, including "time-lag" speeds, "super-slow" speeds, and "high-surge" speeds, require the use of "safety-zone" or setback allowances, and they have larger construction tolerances (plus 20% in current; plus 40% in terms of time). The application of these two factors will give a time interval between the adjusted minimum melting curve and the total clearing curve greater than in the case of S&C speed options.

FUSE UNITS AVAILABLE

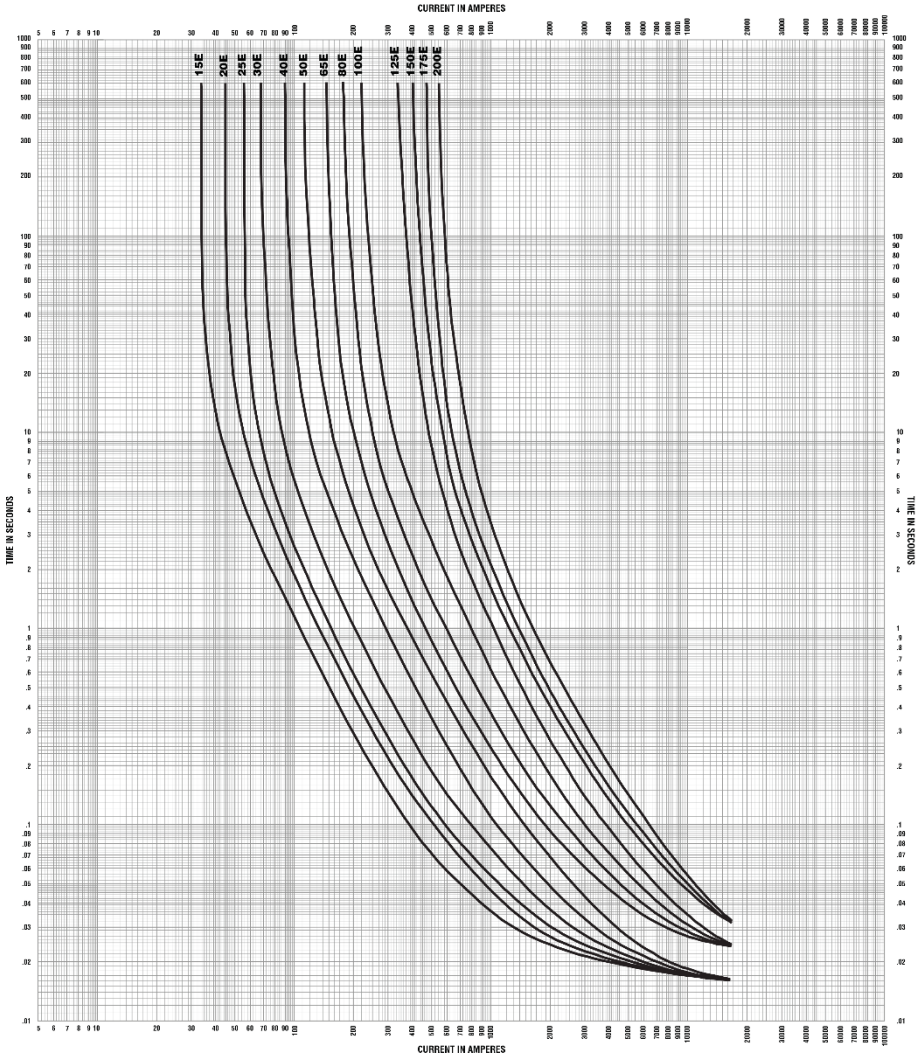
Fuse Unit	kV Nom. Ratings	Ampere Ratings
SMU-20●●	14.4 and 34.5	15E through 200E
SMD-40●	4.8 and 25	15E through 400E

●● These curves are also applicable to a previous SMD-20 Fuse Unit design.

June 3, 2019

TCC Number 119-2

Total Clearing Time-Current Characteristic Curves: SMU Fuse Units – S&C Slow Speed
TCC Number: 119-2-4



Total Clearing Time–Current Characteristic Curves

SMU Fuse Units–S&C Slow Speed

BASIS–These fuse links are tested in accordance with the procedures described in IEEE Standard C37.41, and they are rated to comply with IEEE Standard C37.46. As required by these standards, the minimum melting current is not less than 200% of the fuse-link ampere rating, and the minimum melting curves are based on tests starting with the fuse link at an ambient temperature of 25°C (77°F) and no initial load.

CONSTRUCTION–Fusible elements are silver, helically coiled, and of solderless construction.

TOLERANCES–Curves are plotted to maximum test points. All variations are minus.

APPLICATION–As with all high-voltage fuses, these fuse links are intended to accommodate overloads, not to interrupt them. Accordingly, they feature fusible elements designed with a minimum melting current of 200% of the fuse-link ampere rating (for fuse links rated 100 amperes or less) or 220% of the fuse-link ampere rating (for fuse links rated over 100 amperes). As a result, these fuse links have considerable peak-load capabilities; however, they should never be exposed to loading in excess of the peak-load capabilities listed in S&C Information Bulletin 242-190.

Because these fuse units have silver element construction not subject to damage by aging or transient overcurrents, it is unnecessary to replace unblown fuse units in single-phase or three-phase installations when one or more fuse units has blown.

COORDINATION–These curves represent the total time required for a fuse unit to melt and interrupt a fault current, and they should be followed in coordination problems where fuses are applied as "protecting" devices.

Any preloading reduces melting time. With respect to the "protected" fuse, the effect of preloading must be determined and adjustments made to its minimum melting curve when:

- Close coordination is required
- Regardless of the preciseness of coordination, the protected fuse is subjected to temporary overloads

There are cases where the coordination requirements may be very exacting, for example, in coordinating a transformer primary fuse with a secondary breaker and a source-side breaker. The time interval between the operating characteristics of the two breakers may be very narrow. Under these circumstances, there must be an extremely short time interval between the minimum melting and the total clearing characteristics of the fuse.

The fuse units represented by these curves possess this short time interval feature because—having a nondamageable fusible element of precise construction—they require:

- As little as 10% *total* tolerance in melting current compared to the 20% tolerance of many fuses (20% and 40% respectively in terms of time)
- No "safety-zone" or setback allowances

This narrow time band normally will provide the desired coordination. If the selected S&C Slow Speed fuse unit does not meet the coordination requirements, check whether the same ampere rating in the S&C Standard Speed will satisfy.

Sometimes a selected ampere rating will fail to meet the coordination requirements in any available speed. In this case, the selection of another ampere rating for either the protecting or protected fuse usually will satisfy all requirements.

Do not assume other fuses that do not use S&C's silver, helically coiled fusible element construction can better resolve a coordination impasse than the use of another ampere rating in one of the S&C speed options. Such other fuses, including "time-lag" speeds, "super-slow" speeds, and "high-surge" speeds, require the use of "safety-zone" or setback allowances, and they have larger construction tolerances (plus 20% in current; plus 40% in terms of time). The application of these two factors will give a time interval between the adjusted minimum melting curve and the total clearing curve greater than in the case of S&C speed options.

FUSE UNITS AVAILABLE

Fuse unit	kV nom. Ratings	Ampere ratings
SMU-20®	25 and 34.5	15E through 200E