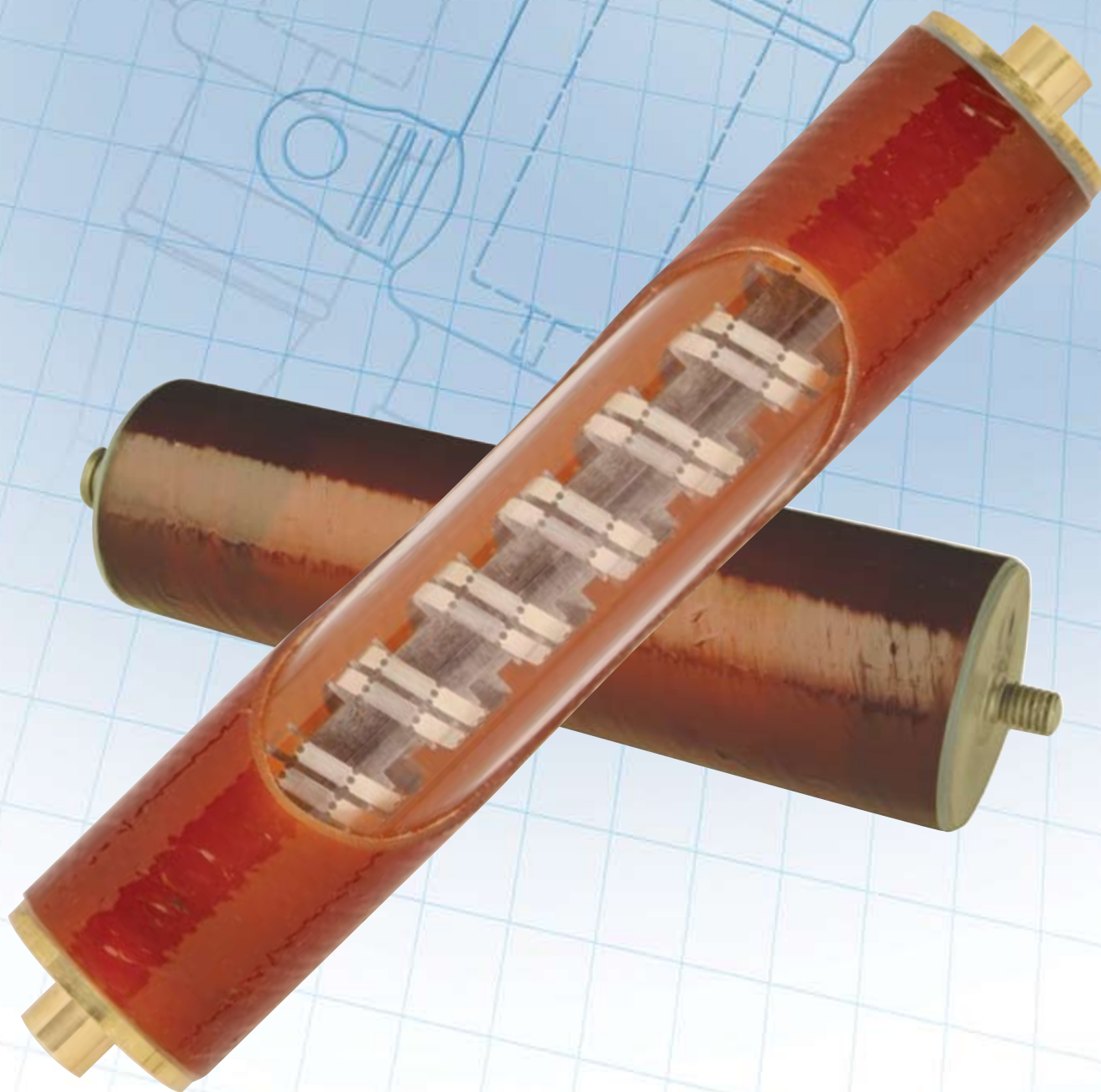


Oil-Submersible Backup Fuses
Full-Range CL Fuses
External Backup Fuses
Molded Fuse Products



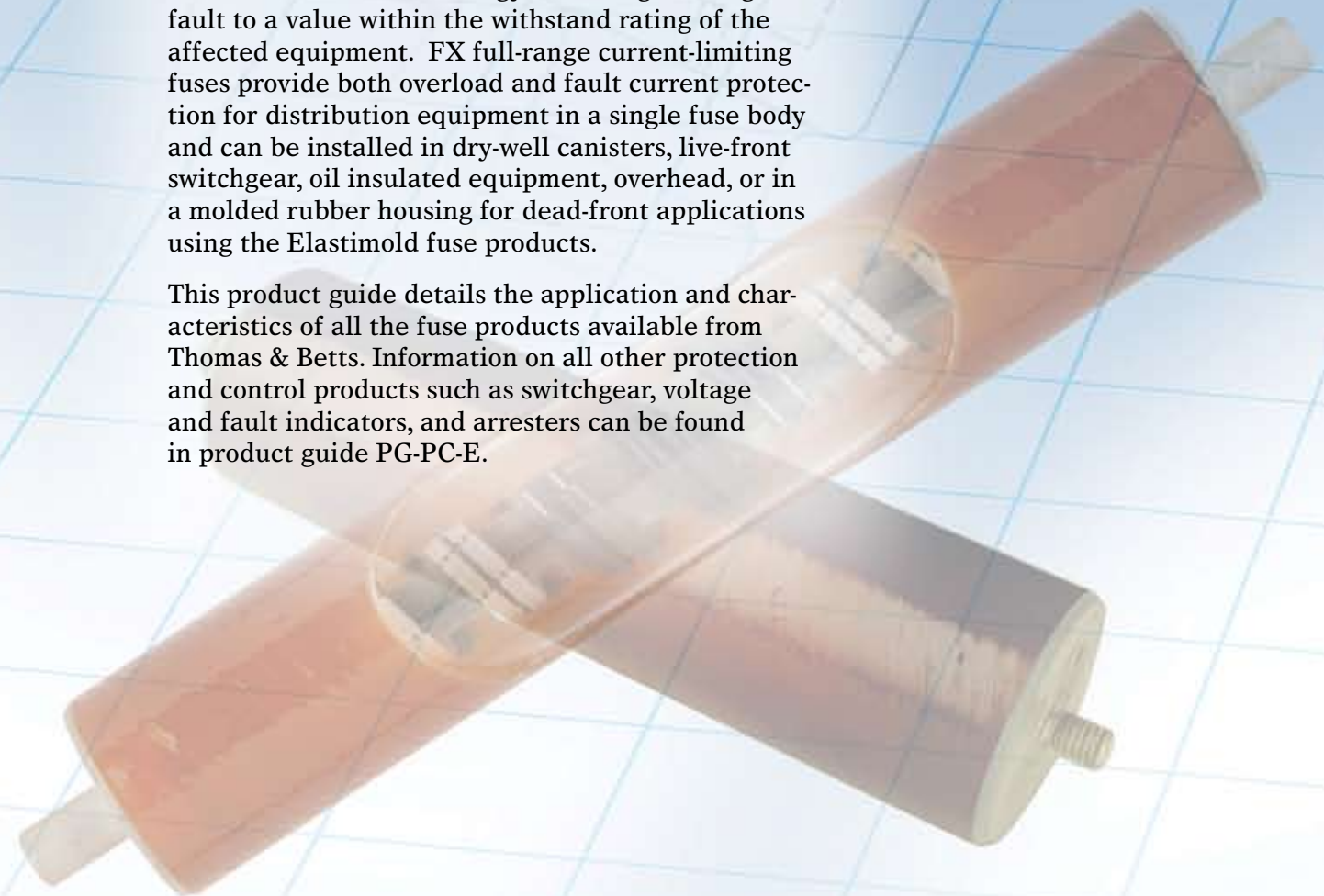
Product Selection Guide



Electric distribution systems demand high levels of reliability, and flexibility of operation. This is directly related to the ability to automatically sectionalize feeders and provide protection where it is most effective within the system.

Thomas & Betts' protection and control products include a wide variety of backup and full-range current-limiting fuses for protection of overhead and underground systems. OS / OS Shorty backup current-limiting fuses, which are typically used in combination with bayonet or weak-link fuses inside distribution transformers, and EXT backup current-limiting fuses, which are used in overhead systems in series with cutout expulsion fuses, protect against high fault currents and limit the energy let-through during a fault to a value within the withstand rating of the affected equipment. FX full-range current-limiting fuses provide both overload and fault current protection for distribution equipment in a single fuse body and can be installed in dry-well canisters, live-front switchgear, oil insulated equipment, overhead, or in a molded rubber housing for dead-front applications using the Elastimold fuse products.

This product guide details the application and characteristics of all the fuse products available from Thomas & Betts. Information on all other protection and control products such as switchgear, voltage and fault indicators, and arresters can be found in product guide PG-PC-E.



Current-Limiting Fuses

Trans-Guard™ OS and OS Shorty Fuse	4-13
Trans-Guard™ FX Fuse	14-21
Trans-Guard™ SX Fuse	22-27
Trans-Guard™ EXT Fuse	28-31



Molded Fuse Products

Elastimold® Product Application	32-33
Fused Elbow	34-39
Molded Current-Limiting Fuse	40-46
Molded Canister Fuse	47-54



The Trans-Guard™ OS is a back-up type current-limiting fuse designed for application within distribution transformers. Its ability to significantly reduce fault energy and its very high interrupting capability (50,000 amperes symmetrical) provide state-of-the-art protection against today's ever increasing available fault currents.

The newer **OS Shorty fuses** were specifically designed to be more compact in size and allow for easier installation in smaller distribution transformers.

As a back-up type current-limiting fuse (refer to ANSI C37.40 for fuse definitions), the Trans-Guard™ OS must always be applied in series with a properly-sized low current protective device. This device is typically an under-oil expulsion fuse (i.e. Bay-O-Net fault or load sensing link, terminal board weak link, etc.). The expulsion fuse and the current-limiting fuse are each selected to provide fault protection over a certain range of currents. The expulsion fuse is chosen to clear

the low magnitude currents such as those caused by faults that occur external to the transformer, high impedance faults within the transformer, and in the case of load sensing links, transformer overloads. Such currents are generally below the minimum interrupting current rating of the current-limiting fuse. The back-up type current-limiting fuse is selected so as to clear all other currents. In addition to interrupting the fault currents resulting from low impedance faults within the transformer, the back-up current-limiting fuse serves the very important function of limiting the amount of energy that is let through to the source of the fault to a value below the withstand capability of the transformer tank. By doing this, the current-limiting fuse minimizes the likelihood of disruptive equipment failures (i.e. transformer tank ruptures, accessories being damaged or broken loose from their mountings, etc.). No other protective device is available to similarly reduce the risk of disruptive transformer failures.



FEATURE	BENEFIT/DESCRIPTION
Highest current ratings available in a single fuse body	Minimizes the costs and physical space associated with paralleling two fuses to achieve the desired current rating
Smaller physical size	Achieved particularly within line of OS Shorty fuse designs
Rigorous testing to meet ANSI/IEEE standards	Internal quality requirements including 100% physical inspection, resistance measurement, and helium mass spectrometer leak testing
Durable design	For long life including machined brass end caps, filament-wound high temperature epoxy tubular bodies, sand filler and hermetic sealing system
High fault current interrupting capability	50,000 amperes symmetrical for most ratings
Broad range of fuse ratings	Available with our Standard OS and OS Shorty lines (30 amps – 400 amps)
Elevated rated maximum voltages designs	10kV, 17.2kV, and 25.5kV for many of the OS Shorty designs

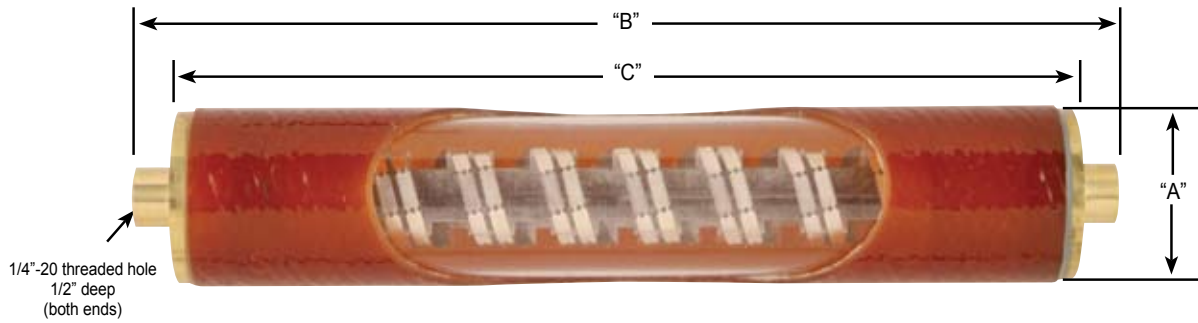


TABLE 1 – DIMENSIONAL INFORMATION FOR TRANS-GUARD™ OS FUSES

Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Fuse Catalog Number	Overall Diameter (A)	Overall Length (B)	Body Length (C)	Fuse Weight	
8.3	35	HTDS232035	2.18-2.22" (55.4-56.4mm)	7.09-7.21" (180.0-183.1mm)	6.05-6.13" (153.7-155.7mm)	2.25lb. 1.02kg	
	40	HTDS232040		10.89-11.01" (276.6-279.7mm)	9.85-9.93" (250.2-252.2mm)	3.25lb. 1.47kg	
	50	HTDS232050					
	65	HTDS232065					
	80	HTDS232080					
	100	HTDS232100					
	125	HTDS332125	3.25-3.32" (82.5-84.3mm)	10.89-11.01" (276.6-279.7mm)	9.85-9.97" (251.2-253.2mm)	7.25lb. 3.29kg	
	150	HTDS332150					
	165	HTDS332165					
	200	HTDS332200					
15.5	35	HTDS242035	2.18-2.22" (55.4-56.4mm)	10.89-11.01" (276.6-279.7mm)	9.85-9.93" (250.2-252.2mm)	3.25lb. 1.47kg	
	45	HTDS242045		16.49-16.61" (418.8-421.9mm)	15.45-15.53" (392.4-394.5mm)	4.75lb. 2.155kg	
	40	HTDS242040					
	50	HTDS242050					
	65	HTDS242065					
	80	HTDS242080					
	100	HTDS242100	3.25-3.32" (82.5-84.3mm)		15.49-15.57" (393.4-395.5mm)	10.75lb. 4.87kg	
	125	HTDS342125					
	150	HTDS242150					
	165	HTDS342165					
	200	HTDS342200					
	23.0	40	HTDS252040	2.18-2.22" (55.4-56.4mm)	16.49-16.61" (418.8-421.9mm)	15.45-15.53" (392.4-394.5mm)	4.75lb. 2.155kg
50		HTDS252050					
65		HTDS252065					
100		HTDS352100	3.25-3.32" (82.5-84.3mm)	19.29-19.41" (490.0-493.0mm)	18.29-18.37" (464.6-466.6mm)	12.0lb. 5.44kg	
125		HTDS352125					
150		HTDS352150					
175		HTDS352175					

NOTE: Other hardware is available, consult the factory.

TABLE 2 – DIMENSIONAL INFORMATION FOR TRANS-GUARD™ OS SHORTY FUSES

Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Fuse Catalog Number	Overall Diameter (A)	Overall Length (B)	Body Length (C)	Fuse Weight
8.3	40	HTSS232040	2.18-2.22" (55.4-56.4mm)	7.09-7.21" (180.0-183.1mm)	6.05-6.13" (153.7-155.7mm)	2.25lb. 1.02kg
	50	HTSS232050		7.68-7.80" (195.1-198.1mm)	6.64-6.72" (168.7-170.7mm)	2.5lb. 1.13kg
	65	HTSS232065				
	80	HTSS232080				
	100	HTSS232100		10.89-11.01" (276.6-279.7mm)	9.85-9.93" (250.2-252.2mm)	3.25lb. 1.45kg
	125	HTSS232125				
	150	HTSS232150				
	165	HTSS232165				
	200	HTSS232200				
17.2	30	HTSS240030	2.18-2.22" (55.4-56.4mm)	9.17-9.29" (232.9-236.0mm)	8.13-8.21" (206.5-208.5mm)	2.75lb. 1.25kg
	40	HTSS240040				
	50	HTSS240050				
	65	HTSS242065		12.01-12.13" (305.1-308.1mm)	10.97-11.05" (278.6-280.7mm)	3.75lb. 1.70kg
	80	HTSS242080				
	100	HTSS242100				
	125	HTSS242125		16.49-16.61" (418.8-421.9mm)	15.45-15.53" (392.4-394.4mm)	4.75lb. 2.15kg
	150	HTSS242150				
15.5	165	HTSS242165				
23.0	30	HTSS252030	2.18-2.22" (55.4-56.4mm)	12.68-12.80" (322.1-325.1mm)	11.64-11.72" (295.7-297.7mm)	3.75lb. 1.70kg
	40	HTSS252040				
	50	HTSS252050				
	65	HTSS252065		16.29-16.41" (413.8-416.8mm)	15.25-15.33" (387.4-389.4mm)	4.75lb. 2.15kg
	80	HTSS252080				
	100	HTSS252100				

NOTE: Other hardware is available, consult the factory.

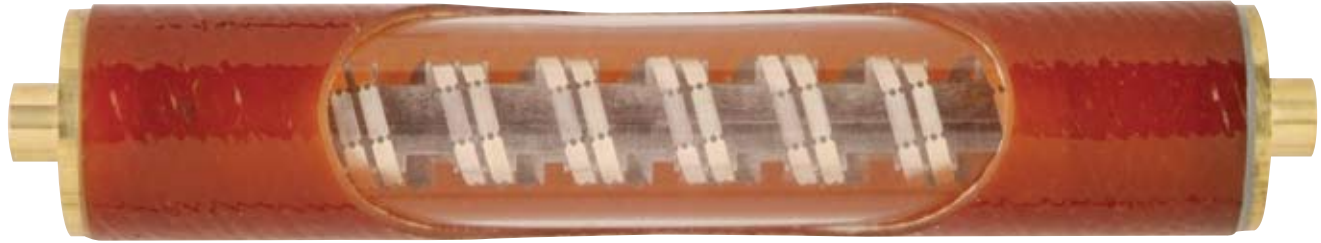


TABLE 3 – ELECTRICAL CHARACTERISTICS OF TRANS-GUARD™ OS FUSES (SINGLE FUSES)

Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Peak Arc Voltage (kV) (3)	Minimum I/C (Amps)	Minimum Melt I ² t (AMP ² SEC)	Maximum Total I ² t (AMP ² SEC) (2)
8.3	35	HTDS232035	8.3	26	415	3,140	10,000
	40	HTDS232040			260	3,200	10,500
	50	HTDS232050			320	5,000	16,000
	65	HTDS232065			430	11,000	34,000
	80	HTDS232080			600	17,000	45,000
	100	HTDS232100			850	39,000	120,000
	125	HTDS332125		22	450	29,000	90,000
	150	HTDS332150			535	45,000	160,000
	165	HTDS332165			1,250	67,300	230,000
	200	HTDS332200			1,700	156,000	580,000
15.5	35	HTDS242035	15.5	49	380	3,140	10,000
	40	HTDS242040		46	270	3,200	9,500
	45	HTDS242045		49	450	4,340	14,500
	50	HTDS242050		46	330	5,000	16,000
	65	HTDS242065		46	450	11,000	34,000
	80	HTDS242080		49	700	17,000	45,000
	100	HTDS242100		49	1,000	39,000	120,000
	125	HTDS342125		44	500	29,000	90,000
	150	HTDS342150			600	45,000	160,000
	165	HTDS342165			1,200	67,300	230,000
	200	HTDS342200			1,530	156,000	580,000
23	40	HTDS252040	23	64	280	3,200	10,500
	50	HTDS252050		65	340	5,000	17,000
	65	HTDS252065		66	465	11,000	38,000
	100	HTDS352100		69	600	20,100	70,000
	125	HTDS352125		67	1,000	31,400	105,000
	150	HTDS352150		65	1,300	66,900	220,000
	175	HTDS352175		63	1,530	108,600	360,000

NOTES:

1. All fuses have a rated maximum interrupting current of 50,000 A rms symmetrical.
2. Maximum total I²t values are reduced for currents below 50,000 A. For example, at 10,000 A, maximum total I²t values are approximately 15% less than the published values.
3. Peak arc voltages quoted are for 50,000 A currents at the rated maximum voltage listed. Reduced voltages and currents will reduce the peak arc voltage. Consult the factory for information.

TABLE 4 – ELECTRICAL CHARACTERISTICS OF TRANS-GUARD™ OS SHORTY FUSES (SINGLE FUSES)

Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Peak Arc Voltage (kV) (4)	Minimum I/C (Amps)	Minimum Melt I ² t (AMP ² SEC)	Maximum Total I ² t (AMP ² SEC) (2) (3)
8.3	40	HTSS232040	8.3	26	415	3,140	10,000
	50	HTSS232050	10.0	25	300	2,500	14,000
	65	HTSS232065			350	3,700	18,000
	80	HTSS232080			430	6,300	31,000
	100	HTSS232100			570	12,800	66,000
	125	HTSS232125	8.3	26	850	39,000	120,000
	150	HTSS232150		24.5	900	23,000	110,000
	165	HTSS232165		24	1,020	39,500	175,000
	200	HTSS232200			1,120	54,500	225,000
17.2	30	HTSS240030	17.2	49	240	1,260	6,800
	40	HTSS240040			330	2,680	12,000
	50	HTSS240050			440	4,440	17,000
	65	HTSS242065			360	3,700	22,000
	80	HTSS242080			440	6,300	36,000
	100	HTSS242100			580	12,800	76,000
	125 ⁽¹⁾	HTSS242125			540	14,800	66,000
	150 ⁽¹⁾	HTSS242150			700	34,800	137,000
15.5	165 ⁽¹⁾	HTSS242165	15.5	48	780	51,200	195,000
23.0	30	HTSS252030	25.5	71	300	920	4,250
	40	HTSS252040			390	1,580	9,750
	50	HTSS252050			570	3,200	20,000
	65	HTSS252065		70	360	3,700	17,000
	80	HTSS252080			440	6,300	28,000
	100	HTSS252100			575	12,800	70,000

NOTES:

- (1) These fuses have only been tested at a rated maximum interrupting current of 44,000 A rms symmetrical. All other fuses have a rated maximum interrupting current of 50,000 A rms symmetrical.
- (2) Tabulated maximum total I²t values are at the nominal voltage of the fuse. Values for 17.2kV fuses at 15.5kV are reduced by approximately 12%, while values for 8.3kV and 23kV fuses at 10kV and 25.5kV are increased by approximately 30% and 13% respectively.
- (3) Maximum total I²t values are reduced for currents below 50,000 A. For example, at 10,000 A, maximum total I²t values are approximately 15% less than the published values.
- (4) Peak arc voltages quoted are for 50,000 A currents at the rated maximum voltage listed. Reduced voltages and currents will reduce the peak arc voltage. Consult the factory for information.


TABLE 5 – ELECTRICAL CHARACTERISTICS OF TRANS-GUARD™ OS FUSES (FUSES TESTED FOR USE IN PARALLEL)

Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Fuse Catalog Number (Order Two Fuses)	Rated Maximum Voltage (kV)	Peak Arc Voltage (kV) (5)	Minimum I/C (Amps)	Minimum Melt I ² t (AMP ² SEC)	Maximum Total I ² t (AMP ² SEC) (3) (4)
8.3	250	HTDS332125	8.3	22	850	116,000	350,000
	300	HTDS332150			1,000	180,000	650,000
15.5	250	HTDS342125	15.5	44	850	116,000	350,000
	300	HTDS342150			1,000	180,000	650,000

TABLE 6 – ELECTRICAL CHARACTERISTICS OF TRANS-GUARD™ OS SHORTY FUSES (FUSES TESTED FOR USE IN PARALLEL)

Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Fuse Catalog Number (Order Two Fuses)	Rated Maximum Voltage (kV)	Peak Arc Voltage (kV) (5)	Minimum I/C (Amps)	Minimum Melt I ² t (AMP ² SEC)	Maximum Total I ² t (AMP ² SEC) (3) (4)
8.3	130	HTSS232065	8.3	25	420	14,800	65,000
	160	HTSS232080			500	25,200	114,000
	200	HTSS232100			630	51,200	240,000
	300	HTSS232150		24.5	1,900	92,000	425,000
	330	HTSS232165		24	2,150	158,000	675,000
	400	HTSS232200		23.5	2,380	218,000	850,000
17.2	130	HTSS242065	17.2	47	420	14,800	92,000
	160	HTSS242080			500	25,200	162,000
	200	HTSS242100			630	51,200	310,000
	250 ⁽¹⁾	HTSS242125		49	1,130	59,200	265,000
15.5	300 ⁽¹⁾	HTSS242150	15.5	49	1,500	139,200	515,000
	330	HTSS242165		46	1,670	204,800	733,000
23.0	130	HTSS252065	25.5	69	360	14,800	68,000
	160	HTSS252080			450	25,200	115,000
	200	HTSS252100			560	51,200	280,000

NOTES FOR TABLES 5 AND 6:

- (1) These fuses have only been tested at a rated maximum interrupting current of 44,000 A rms symmetrical due to test station limitations. All other fuses have a rated maximum interrupting current of 50,000 A rms symmetrical.
- (2)  Current ratings shown above are achieved by using a parallel combination of two fuses (order two fuses). To facilitate equal sharing of the interrupting duty, the two fuses should be resistance matched (±2%) and be mounted such that current paths to and from each fuses are symmetrical.
- (3) Tabulated maximum total I²t values are at the nominal voltage of the fuse. Values for 17.2kV fuses at 15.5kV are reduced by approximately 12%, while values for 23kV fuses at 25.5kV are increased by approximately 13%.
- (4) Maximum total I²t values are reduced for currents below 50,000 A. For example, at 10,000 A, maximum total I²t values are approximately 15% less than the published values.
- (5) Peak arc voltages quoted are for 50,000 A currents at the rated maximum voltage listed. Reduced voltages and currents will reduce the peak arc voltage. Consult the factory for information.

Fuse Selection

For a detailed explanation on selecting the appropriate backup current limiting fuse for a given application, please refer to Hi-Tech Fuses Application Bulletin FS-10.

For a quicker method of selecting the proper Trans-Guard™ OS or OS Shorty fuse for applications involving coordination with Bay-O-Net expulsion fuses and transformers having impedances equal to, or higher, than those listed in Table 7, please refer to fuse coordination Tables 8-11. These tables include columns that specify both OS and OS Shorty fuses for each application. More comprehensive tables listing fusing alternatives for transformers having any impedance can be found at www.tnb.com/utility.

TABLE 7 – ASSUMED TRANSFORMER IMPEDANCES USED FOR FUSES COORDINATION (TABLES 8-11)

Transformer Size (kVA)	1 Impedances (%)	3 Impedances (%)
5	1.90	–
10	1.90	–
15	1.90	–
25	1.90	–
37.5	1.90	–
45	–	1.60
50	1.90	–
75	1.90	1.60
100	2.00	–
112.5	–	1.80
150	–	2.00
167	2.60	–
225	–	3.00
250	4.00	–
300	–	3.50
333	5.00	–
500	5.00	4.00
750 and up	5.75	5.75

TABLE 8 – 1 ϕ TRANSFORMER COORDINATION TABLE FOR EXPULSION & TRANS-GUARD™ OS/OS SHORTY FUSES


	Trans-Guard™ OS/OS Shorty Fuse Voltage Rating (kV)																							
FuseVoltage	8.3kV												15.5/17.2kV									23kV		
kVA	Transformer Voltage Rating (kV) Phase-to-Ground																							
	2.4			4.16 - 4.8			7.2 - 7.96			12 - 12.47			13.2 - 14.4			16			19.9					
	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY			
	Dual Sensing Bay-O-Net (4000358___) ^{a,c} and OS/OS Shorty Fuse Coordinations																							
5	C03	35	40	C03	35	40	C03	35	40	C03	35	30	C03	35	30	C03	–	30	C03	40	30			
10	C05	35	40	C05	35	40	C03	35	40	C03	35	30	C03	35	30	C03	–	30	C03	40	30			
15	C08	50	65	C05	35	40	C03	35	40	C03	35	30	C03	35	30	C03	–	30	C03	40	30			
25	C10	100	100	C08	50	65	C05	35	40	C03	35	30	C03	35	30	C03	–	30	C03	40	30			
37.5	C12	165	150	C10	80	100	C08	50	50	C05	35	30	C05	35	30	C03	–	30	C03	40	30			
50	C12	200	165	C10	100	125	C08	65	65	C05	35	30	C05	35	30	C05	–	30	C05	40	30			
75	C14	–	300	C12	165	150	C10	100	100	C08	50	65	C08	50	50	C08	–	50	C05	40	30			
100	C14	–	330	C12	200	165	C10	100	125	C08	65	80	C08	65	65	C08	–	65	C05	40	40			
167	–	–	–	C14	–	300	C12	165	150	C10	100	100	C10	100	100	C10	–	100	C08	50	65			
250	–	–	–	C18	–	330	C14	250	200	C12	125	125	C12	125	125	C10	–	100	C10	65	80			
333	–	–	–	C18	–	330	C14	250	200	C12	125	125	C12	125	125	C12	–	125	C10	100	80			
500	–	–	–	–	–	–	C18	–	330	C14	250	165	C14	250	165	C12	–	125	C12	100	130			
Current Sensing Bay-O-Net (4000353___) ^{a,b} and OS/OS Shorty Fuse Coordinations																								
5	C04	35	40	C04	35	40	C04	35	40	C04	35	30	C04	35	30	C04	–	30	C04	40	30			
10	C06	35	40	C04	35	40	C04	35	40	C04	35	30	C04	35	30	C04	–	30	C04	40	30			
15	C08	35	40	C06	35	40	C04	35	40	C04	35	30	C04	35	30	C04	–	30	C04	40	30			
25	C10	65	80	C08	35	40	C06	35	40	C04	35	30	C04	35	30	C04	–	30	C04	40	30			
37.5	C10	80	100	C08	50	65	C06	35	40	C06	35	30	C06	35	30	C04	–	30	C04	40	30			
50	C12	100	125	C10	80	100	C08	35	40	C06	35	30	C06	35	30	C06	–	30	C04	40	30			
75	C14	165	165	C12	100	125	C10	65	80	C08	35	40	C08	35	40	C06	–	30	C06	40	30			
100	C14	200	200	C12	150	150	C10	80	100	C08	35	50	C08	35	40	C08	–	40	C06	40	30			
167	C17	–	300	C14	165	165	C12	100	125	C10	65	80	C10	65	80	C10	–	65	C08	40	40			
250	–	–	–	C16	200	200	C14	150	150	C12	100	100	C12	80	100	C10	–	65	C10	50	65			
333	–	–	–	C17	300	300	C16	200	200	C14	150	150	C12	80	100	C12	–	100	C12	100	80			
500	–	–	–	–	–	–	C17	300	300	C14	150	150	C14	150	150	C14	–	150	C12	100	100			
Dual Element Bay-O-Net (4038108___) ^{a,c} and OS/OS Shorty Fuse Coordinations																								
5	C03	35	40	C03	35	40	C03	35	40	C03	35	30	C03	35	30	C03	–	30	C03	40	30			
10	C05	35	40	C04	35	40	C03	35	40	C03	35	30	C03	35	30	C03	–	30	C03	40	30			
15	C07	50	50	C05	35	40	C03	35	40	C03	35	30	C03	35	30	C03	–	30	C03	40	30			
25	C09	80	100	C06	35	40	C04	35	40	C03	35	30	C03	35	30	C03	–	30	C03	40	30			
37.5	C11	100	125	C09	65	80	C06	35	40	C05	35	30	C04	35	30	C03	–	30	C03	40	30			
50	C12	100	125	C09	80	100	C07	50	50	C06	35	40	C05	35	30	C04	–	30	C03	40	30			
75	–	–	–	C12	100	125	C09	80	100	C07	45	50	C06	35	40	C06	–	40	C05	40	30			
100	–	–	–	C12	100	125	C09	80	100	C09	65	80	C07	50	65	C07	–	50	C06	40	40			
167	–	–	–	–	–	–	C12	100	125	C11	80	100	C09	65	80	C07	–	65	C07	50	50			
250	–	–	–	–	–	–	–	–	–	C12	80	100	C11	80	100	C09	–	80	–	–	–			
333	–	–	–	–	–	–	–	–	–	C12	100	100	C12	80	100	C12	–	100	–	–	–			

NOTES:

Bay-O-Net fuse selection is based on Cooper Power Systems recommendations.

Bay-O-Net fuses are selected to meet inrush criteria of 12 times transformer full load current for 0.1 second.

Backup OS / OS Shorty fuses are selected to melt only on internal transformer faults, where transformer impedance is equal to, or greater than, the value given in Table 7. If the impedance is higher, a smaller fuse can often be used.

 Shaded areas indicate parallel fuse applications.

a Or equivalent Bay-O-Net link.

b Current Sensing Bay-O-Net fuses are selected to melt with 3 to 4 times transformer full load current at 300 seconds.

c Dual Sensing and Dual Element Bay-O-Net fuses are selected to limit transformer load to approximately 160% for 7 hours and 200% for 2 hours with the transformer initially carrying 75% of load at an ambient temperature of 35°C.

TABLE 9 – 3Φ TRANSFORMER COORDINATION TABLE FOR EXPULSION & TRANS-GUARD™ OS/OS SHORTY FUSES


kVA	Trans-Guard™ OS/OS Shorty Fuse Voltage Rating (kV)																													
	8.3kV										15.5/17.2kV										23kV									
	Transformer Voltage Rating (kV) Phase-to-Phase																													
	2.4			4.16-4.8			7.2-7.96			12-12.47			13.2-14.4			20.8 ^d			24.9 ^d			23.0			27.6 ^d			34.5 ^d		
	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY
Dual Sensing Bay-O-Net (4000358) ^{a,c} and OS / OS Shorty Fuse Coordinations																														
45	C10	100	125	C08	65	65	C05	35	40	C03	35	30	C03	35	30	C03	35	30	C03	35	30	C03	40	30	C03	40	30	C03	40	30
75	C12	200	165	C10	100	125	C08	65	65	C05	35	30	C05	35	30	C03	35	30	C03	35	30	C03	40	30	C03	40	30	C03	40	30
112.5	C14	-	300	C12	165	150	C08	65	80	C08	50	50	C08	50	50	C05	35	30	C05	35	30	C05	40	30	C05	40	30	C03	40	30
150	C14	-	300	C12	200	165	C10	100	125	C08	65	65	C08	50	65	C05	35	30	C05	35	30	C05	40	30	C05	40	30	C05	40	30
225	C18	-	400	C14	300	300	C12	125	150	C10	80	100	C10	80	80	C08	40	50	C08	40	50	C08	40	65	C08	40	65	C05	40	30
300	C18	-	400	C14	300	300	C12	150	150	C10	80	100	C10	80	100	C08	40	50	C08	40	50	C08	40	65	C08	40	65	C05	40	30
500	-	-	-	C18	-	400	C14	250	200	C12	125	125	C12	125	125	C10	80	80	C10	65	80	C10	65	80	C10	65	80	C08	40	65
750	-	-	-	C18	-	400	C18	300	330	C14	250	150	C14	150	150	C12	125	125	C12	125	125	C12 ^a	100	130	C10	65	80	C10	65	80
1000	-	-	-	-	-	-	C18	-	330	C14	250	165	C14	250	165	C12	125	125	C12	125	125	C12 ^a	100	130	C12	100	130	C10	65	80
1500	-	-	-	-	-	-	-	-	-	C18 ^d	-	300	C18 ^a	300	300	C14	250	165	C14	250	150	C14 ^a	-	200	C14	-	200	C12	100	130
2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C14	250	165	-	-	-	C14	-	200	C14	-	200
Current Sensing Bay-O-Net (4000353) ^{a,b} and OS / OS Shorty Fuse Coordinations																														
45	C10	80	100	C08	35	40	C06	35	40	C04	35	30	C04	35	30	C04	35	30	C04	35	30	C04	40	30	C04	40	30	C04	40	30
75	C12	100	125	C10	80	100	C06	35	40	C06	35	30	C06	35	30	C04	35	30	C04	35	30	C04	40	30	C04	40	30	C04	40	30
112.5	C12	165	165	C10	80	100	C08	50	65	C06	35	40	C06	35	30	C06	35	30	C04	35	30	C04	40	30	C04	40	30	C04	40	30
150	C14	165	165	C12	100	125	C10	80	100	C08	35	40	C08	35	40	C06	35	30	C06	35	30	C06	40	30	C06	40	30	C04	40	30
225	C16	200	200	C14	150	150	C10	80	100	C10	65	65	C10	50	65	C08	35	40	C08	35	30	C08	40	30	C06	40	30	C06	40	30
300	C17	300	300	C14	150	150	C12	100	125	C10	65	80	C10	65	65	C08	35	40	C08	35	30	C08	40	30	C08	40	30	C06	40	30
500	-	-	-	C17	300	300	C14	150	150	C12	100	125	C12	100	100	C10	65	65	C10	50	65	C10	50	65	C10	50	65	C08	40	30
750	-	-	-	C17	300	300	C16	200	200	C14	150	150	C14	150	150	C12	80	80	C12	80	80	C12	100	80	C10	50	65	C10	40	65
1000	-	-	-	-	-	-	C17	300	300	C14	150	150	C14	150	150	C12	80	100	C12	80	100	C12	100	100	C12	100	80	C12	100	80
1500	-	-	-	-	-	-	-	-	-	C16	200	250	C16	200	250	C14	150	150	C14	150	150	C14 ^a	125	160	C14	125	160	C12	100	100
2000	-	-	-	-	-	-	-	-	-	-	-	-	C17 ^a	300	300	C16	200	250	C16	200	250	C16 ^a	-	200	C14	125	160	C14	125	160
2500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C17 ^a	300	300	C16	200	250	-	-	-	-	-	-	-	-	-
Dual Element Bay-O-Net (4038108) ^{a,c} and OS / OS Shorty Fuse Coordinations																														
45	C09	80	100	C07	50	65	C04	35	40	C03	35	30	C03	35	30	C03	35	30	C03	35	30	C03	40	30	C03	40	30	C03	40	30
75	C12	100	125	C09	80	100	C06	35	40	C04	35	30	C04	35	30	C03	35	30	C03	35	30	C03	40	30	C03	40	30	C03	40	30
112.5	-	-	-	C11	100	125	C07	65	65	C06	35	40	C06	35	40	C05	35	30	C04	35	30	C04	40	30	C03	40	30	C03	40	30
150	-	-	-	C12	100	125	C09	80	100	C07	50	50	C07	45	50	C06	35	40	C05	35	30	C05	40	30	C04	40	30	C03	40	30
225	-	-	-	-	-	-	C11	80	100	C09	65	65	C09	65	65	C07	35	50	C06	35	30	C06	40	40	C06	40	40	C05	40	30
300	-	-	-	-	-	-	C12	100	125	C09	65	80	C09	65	80	C09	50	65	C07	35	50	C07	40	50	C07	40	50	C06	40	40
500	-	-	-	-	-	-	-	-	-	C12	100	100	C12	80	100	C11	65	80	C09	65	65	-	-	-	-	-	-	C07	40	50
750	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C12	80	100	C11	65	80	-	-	-	-	-	-	-	-	-
1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C12	80	100	-	-	-	-	-	-	-	-	-

NOTES:

Bay-O-Net fuse selection is based on Cooper Power Systems recommendations.

Bay-O-Net fuses are selected to meet inrush criteria of 12 times transformer full load current for 0.1 second.

Backup OS / OS Shorty fuses are selected to melt only on internal transformer faults, where transformer impedance is equal to, or greater than, the value given in Table 7. If the impedance is higher, a smaller fuse can often be used.

 Shaded areas indicate parallel fuse applications.

a Or equivalent bayonet link.

b Current Sensing Bay-O-Net fuses are selected to melt with 3 to 4 times transformer full load current at 300 seconds

c Dual Sensing and Dual Element Bay-O-Net fuses are selected to limit transformer load to approximately 160% for 7 hours and 200% for 2 hours with the transformer initially carrying 75% of load at ambient temperature of 35°C.

d Applications are limited to gnd Y-gnd Y connected transformers with no more than 50% delta connected secondary load. Phase-to-ground rated fuses are frequently recommended for gnd Y-gnd Y connected transformers.

e Bay-O-Net assembly may be subjected to damage during fault clearing at currents above the Bay-O-Net's Maximum I/C.

TABLE 10 – 1φ TRANSFORMER COORDINATION TABLE FOR COOPER HIGH AMPERE OVERLOAD BAY-O-NET (4038361_CB) & TRANS-GUARD™ OS/OS SHORTY FUSES

	Trans-Guard™ OS/OS Shorty Fuse Voltage Rating (kV)														
FuseVoltage	8.3kV									15.5/17.2kV					
kVA	Transformer Voltage (kV) Phase-to-Ground														
	2.4			4.16-4.8			7.2-7.96			12-12.47			13.2-14.4		
	Link	OS	Shorty	Link	OS	Shorty	Link	OS	Shorty	Link	OS	Shorty	Link	OS	Shorty
75	C03	200	165	–	–	–	–	–	–	–	–	–	–	–	–
100	C03	200	200	–	–	–	–	–	–	–	–	–	–	–	–
167	C04	200	300	C03	165	165	–	–	–	–	–	–	–	–	–
250	C05	300	300	C04	200	165	–	–	–	–	–	–	–	–	–
333	–	–	–	C05	200	300	C03	150	150	–	–	–	–	–	–
500	–	–	–	C05	300	300	C04	200	165	C03	125	125	C03	125	125
833	–	–	–	–	–	–	C05	300	300	C04	165	165	C04	165	150

TABLE 11 – 3φ TRANSFORMER COORDINATION TABLE FOR COOPER HIGH AMPERE OVERLOAD BAY-O-NET (4038361_CB) & TRANS-GUARD™ OS/OS SHORTY FUSES


	Trans-Guard™ OS/OS Shorty Fuse Voltage Rating (kV)																					
FuseVoltage	8.3kV									15.5/17.2kV												
kVA	Transformer Voltage Rating (kV) Phase-to-Phase																					
	2.4			4.16 - 4.8			7.2 - 7.62			12 - 12.47			13.2 - 14.4			20.8 ^a			24.9 ^a			
	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	LINK	OS	SHORTY	
112.5	C03	165	165	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
150	C03	165	165	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
225	C04	200	200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
300	C04	200	300	C03	150	150	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
500	C05	—	300	C04	200	200	C03	150	150	—	—	—	—	—	—	—	—	—	—	—	—	
750	—	—	—	C05	200	300	C04	165	150	C03	125	125	—	—	—	—	—	—	—	—	—	
1000	—	—	—	—	—	—	C05	200	200	C04	165	150	C03	125	125	—	—	—	—	—	—	
1500	—	—	—	—	—	—	C05	300	300	C04	200	165	C04	165	165	C03	125	125	C03	125	125	
2000	—	—	—	—	—	—	—	—	—	C05	200	250	C05	200	250	C04	165	150	C04	165	150	
2500	—	—	—	—	—	—	—	—	—	C05 ^b	300	300	C05 ^b	300	300	C04	165	165	C04	165	150	

NOTES:

Bay-O-Net fuse selection is based on Cooper Power Systems recommendations.

Bay-O-Net fuses are selected to meet inrush criteria of 12 times transformer full load current for 0.1 second.

Backup OS Shorty & OS fuses are selected to melt only on internal transformer faults, where transformer impedance is equal to, or greater than, the value given in Table 7. If the impedance is higher, a smaller fuse can often be used.

 Shaded areas indicate parallel fuse applications.

High Ampere Overload Bay-O-Net fuses are selected to limit transformer load to approximately 160% for 7 hours and 200% for 2 hours with the transformer initially carrying 75% of load at ambient temperature of 35°C.

a Applications are limited to gnd Y-gnd Y connected transformers with no more than 50% delta connected secondary load. Phase-to-ground rated fuses are frequently recommended for gnd Y-gnd Y connected transformers.

b Bay-O-Net assembly may be subjected to damage during fault clearing at currents above the Bay-O-Net's maximum I/C.

The Trans-Guard™ FX full-range current-limiting fuse provides both overload and fault current protection for distribution equipment in a single fuse body. As a full-range fuse, it is capable of interrupting any continuous current between the minimum current that can cause melting of its elements and its rated maximum interrupting current (50,000 amps). The fuses are capable of interrupting

in elevated ambient temperatures up to their rated maximum application temperature (RMAT). The Trans-Guard™ FX fuse is hermetically sealed and thus discharges no gasses during fuse operation. An additional design distinction is its Patented Damage Sensor that significantly reduces the potential for fuse failure in the event of element damaging current surges.



Figure 1



Figure 2

Applications:

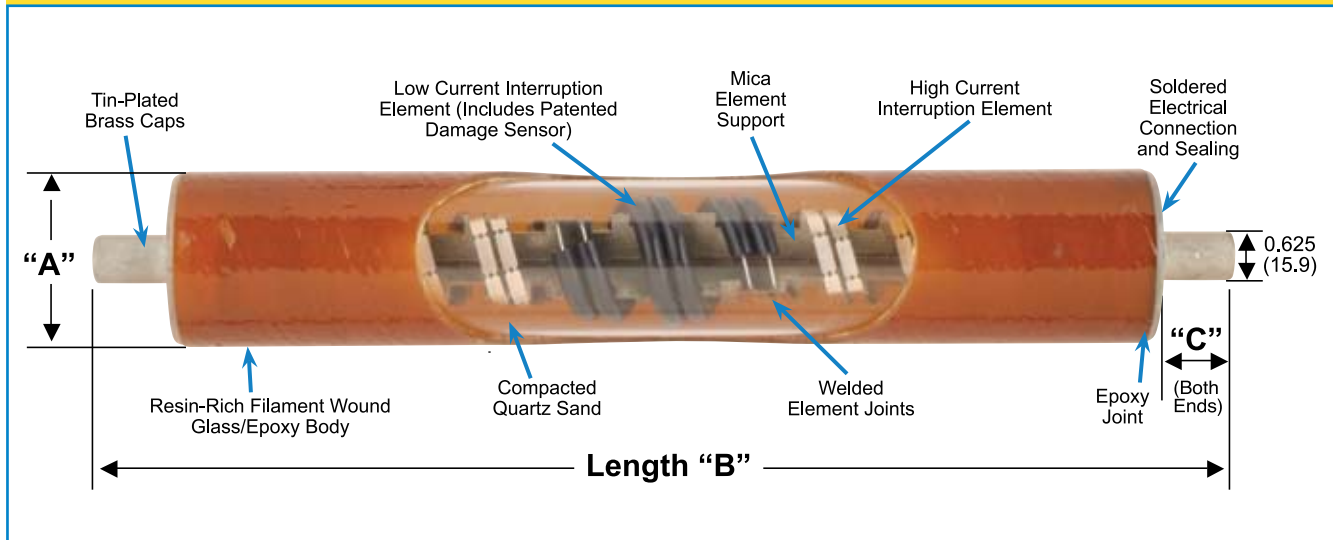
Trans-Guard™ FX fuses are available in a broad range of ratings. For ease of application, all designs are compatible with the industry-recognized standard mounting codes. Common applications include the Trans-Guard™ FX:

- Installed in drywell canisters for distribution transformer protection (see Figure 1)
- Clip mounted in live-front switchgear (see Figure 2)
- Externally mounted on overhead distribution systems (several outdoor versions available – contact factory for more information)
- Installed in Elastimold MCAN rubber molded canister for dead-front/submersible applications (see page 47)
- Installed directly in oil (contact factory for more information)



FEATURE	BENEFIT/DESCRIPTION
Patented Damage Sensor	Designed to significantly reduce the risk of fuse failure should the fuse be subjected to an element damaging current surge
Hermetically sealed construction	Ensures that no gasses escape from the fuse during current interruption. All Trans-Guard™ FX fuses are helium mass spectrometer leak tested to ensure sealing system integrity
Rugged machined brass end caps	Used for greater ferrule strength resulting in less distortion and more secure fuse attachment in dry-well canisters
Tested in accordance with the most recent ANSI/IEEE standards	Includes requirements for short circuit testing at the manufacturer's specified rated maximum application temperature (RMAT)
Optional blown fuse indicator (See Figure 3)	Reliable indication of fuse operation with a unique design that does not affect the fuse's arcing performance

CONSTRUCTION



FX Full-Range
CL Fuses

TABLE 12 – DIMENSIONAL INFORMATION FOR TRANS-GUARD™ FX FUSES

Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Dimensions inches (mm)			Standard Mounting Code
		A	B	C	
5.5	80-200	3.32-3.25" (84.4-82.5mm)	17.51-17.35" (444.8-440.7mm)	1.21-1.17" (30.7-29.7mm)	6
8.3	3-50	2.25-2.18" (57.0-55.3mm)	10.00-9.90" (254.0-251.5mm)	1.02-1.00" (25.9-25.4mm)	4
	65-80	2.25-2.18" (57.0-55.3mm)	14.31-14.21" (363.5-360.9mm)	1.02-1.00" (25.9-25.4mm)	5
	65-125	3.32-3.25" (84.4-82.5mm)	14.70-14.54" (373.4-369.3mm)	1.21-1.17" (30.7-29.7mm)	5
15.5	3-50	2.25-2.18" (57.0-55.3mm)	14.31-14.21" (363.5-360.9mm)	1.02-1.00" (25.9-25.4mm)	5
	65-100	3.32-3.25" (84.4-82.5mm)	17.51-17.35" (444.8-440.7mm)	1.21-1.17" (30.7-29.7mm)	6
23.0	6-50	2.25-2.18" (57.0-55.3mm)	17.12-17.02" (434.8-432.3mm)	1.02-1.00" (25.9-25.4mm)	6

BLOWN FUSE INDICATOR



Before Operation

After Operation

Figure 3

TABLE 13 – ELECTRICAL CHARACTERISTICS OF TRANS-GUARD™ FX FUSES (SINGLE FUSES)

Nominal Fuse Voltage Rating (kV)	Fuse Diameter (in)	Current Rating (Amps)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Maximum Continuous Current (In Air) (6)			Peak Arc Voltage (5) (kV)	Minimum Melt I ² t (AMP ² SEC)	Maximum Melt I ² t (3),(4) (AMP ² SEC)	RMAT (8) (°C)
					25°C	40°C	55°C				
5.5	3.3	80	HTFX320080	5.5	99	96	94	15.0	22,100	110,000	71
		100	HTFX320100		126	122	118	15.0	56,700	280,000	
		125	HTFX320125		142	138	134	15.0	78,300	380,000	
		150	HTFX320150		184	178	173	15.0	176,000	860,000	
		200	HTFX320200		208	202	196	15.0	259,000	1,270,000	
8.3	2.2	3	HTFX230003	10.0	5.0	4.9	4.7	30	100	350	140
		6	HTFX230006		11.0	10.5	10.0	32	620	2,700	
		8	HTFX230008		13.5	13.0	12.5	28	800	4,000	
		10	HTFX230010		16.0	15.5	15.0	28	800	4,000	
		12	HTFX230012		20.5	19.5	19.0	26	920	8,000	
		18	HTFX230018		23.5	22.5	22.0	26	1,310	9,500	
		20	HTFX230020		27.5	26.5	25.5	26	1,620	11,000	
		25	HTFX230025		37.0	35.5	34.5	26	3,660	22,000	
		30	HTFX230030		41.0	39.5	38.5	26	5,250	30,000	
		40	HTFX230040		50.0	48.5	47.0	26	8,700	50,000	
		50	HTFX230050		57.0	55.0	53.5	26	12,800	70,000	
		65	HTFX230065	8.8	87.0	84.0	81.5	23	34,000	200,000	
		80	HTFX230080		100.0	98.0	95.0	22	51,200	280,000	
	3.3	65	HTFX330065	8.3	81.0	79.0	77.0	25	25,200	100,000	71
		80	HTFX330080		95.0	92.0	89.0	25	47,200	185,000	
		100	HTFX330100		120.0	117.0	113.0	25	78,300	330,000	
		125	HTFX330125		135.0	131.0	127.0	25	115,150	480,000	
15.5	2.2	3	HTFX240003	17.2	5.0	4.9	4.7	51	100	510	140
		6	HTFX240006		11.0	10.5	10.0	54	620	2,600	
		8	HTFX240008		13.5	13.0	12.5	46	800	3,700	
		10	HTFX240010		16.0	15.5	15.0	46	800	3,700	
		12	HTFX240012		20.5	19.5	19.0	43	920	6,500	
		18	HTFX240018		23.5	22.5	22.0	45	1,310	8,000	
		20	HTFX240020		27.5	26.5	25.5	45	1,620	10,000	
		25	HTFX240025		37.0	35.5	34.5	45	3,660	22,000	
		30	HTFX240030		41.0	39.5	38.5	45	5,250	30,000	
		40	HTFX240040		50.0	48.5	47.0	45	8,700	50,000	
		50	HTFX240050		53.0	51.5	50.0	45	12,800	70,000	
	3.3	65	HTFX340065	15.5	78.0	75.0	73.0	40	25,200	110,000	71
		80	HTFX340080		88.0	85.0	82.0	40	39,400	185,000	
		100	HTFX340100		114.0	110.0	107.0	40	80,000	380,000	
23.0	2.2	6	HTFX250006	23.0	11.0	10.5	10.0	67	620	3,100	140
		8	HTFX250008		13.5	13.0	12.5	61	800	4,800	
		10	HTFX250010		16.0	15.5	15.0	61	800	4,800	
		12	HTFX250012		20.5	19.5	19.0	60	920	8,300	
		18	HTFX250018		23.5	22.5	22.0	60	1,310	11,200	
		20	HTFX250020		27.5	26.5	25.5	60	1,620	13,000	
		25	HTFX250025		37.0	35.5	34.5	60	3,660	28,000	
		30	HTFX250030		41.0	39.5	38.5	60	5,250	38,000	
		40	HTFX250040		48.0	46.5	45.0	60	8,700	61,000	
		50	HTFX250050		55.0	53.0	51.5	60	12,800	82,000	

TABLE 14 – ELECTRICAL CHARACTERISTICS OF TRANS-GUARD™ FX FUSES (PARALLEL FUSES)

Nominal Fuse Voltage Rating (kV)	Fuse Diameter (in)	Current Rating (Amps)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Maximum Continuous Current (In Air) (6)			Peak Arc Voltage (5) (kV)	Minimum Melt I ² t (AMP ² SEC)	Maximum Melt I ² t (3) (4) (AMP ² SEC)	RMAT (8) (°C)
					25°C	40°C	55°C				
8.3	2.2	60	HTFX230030	10.0	80.0	77.0	75.0	26	21,000	120,000	140
		80	HTFX230040		98.0	95.0	92.0	26	34,000	180,000	
		100	HTFX230050	8.3	111.0	108.0	105.0	24	51,200	250,000	
		130	HTFX230065	8.8	170.0	165.0	160.0	22	136,000	670,000	
		160	HTFX230080		198.0	191.0	186.0	21	204,800	890,000	
	3.3	130	HTFX330065	8.3	158.0	154.0	151.0	24	100,800	400,000	71
		160	HTFX330080		186.0	180.0	175.0	24	189,000	740,000	
		200	HTFX330100		235.0	229.0	221.0	24	313,000	1,300,000	
		250	HTFX330125		265.0	256.0	249.0	24	460,500	1,800,000	
15.5	2.2	60	HTFX240030	17.2	80.0	77.0	75.0	45	21,000	110,000	140
		80	HTFX240040		98.0	95.0	92.0	45	34,800	170,000	
		100	HTFX240050		104.0	101.0	98.0	45	51,200	310,000	
	3.3	130	HTFX340065	15.5	152.0	147.0	143.0	39	100,800	440,000	71
		160	HTFX340080		172.0	167.0	160.0	39	157,500	740,000	
		200	HTFX340100		222.0	214.0	208.0	39	320,000	1,520,000	

FX Full-Range
CL Fuses

NOTES FOR TABLES 13 AND 14:


1. Designs have a 50,000 Amps rms. Symmetrical Rating (except 3A 17.2 kV which was tested at 44 kA maximum).
2.  Current ratings shown in Table 14 are achieved by using a parallel combination of two fuses (order two fuses). To facilitate equal sharing of the interrupting duty, the two fuses should be resistance matched ($\pm 2\%$) and be mounted such that the current paths to and from each fuse are symmetrical.
3. Tabulated Maximum Total I²t values are for currents of 50,000 amperes at the nominal voltage of the fuse (except for fuses having a rated maximum voltage of 8.8kV, in which case the maximum total I²t values are at 8.8kV). Fuses that have a rated maximum voltage higher than their nominal voltage rating will have a higher I²t let-through when applied at voltages up to these higher values. For example, maximum total I²t values are increased by approximately 30% when 8.3 kV fuses are applied at 10 kV and approximately 25% when 15.5 kV fuses are used at 17.2 kV.
4. Maximum total I²t values are reduced for currents below 50,000 A. For example, at 10,000 A, maximum total I²t values are approximately 15% less than the published values.
5. Peak arc voltages quoted are for 50,000 A currents at the rated maximum voltage listed. Reduced currents and voltages will reduce the peak arc voltage. Consult the factory for further information.
6. Maximum continuous currents at higher ambient temperatures, and in confining enclosures:
 - These may be determined by derating the fuses by 0.2% per degree C over 25°C (for example at 85°C the derating would be $60 \times .2 = 12\%$, making the maximum continuous current of a 30 A fuse $41 \times .88 = 36.1$ A).
 - When fuses are applied in a confining enclosure, such as a drywell canister, additional derating of a fuse's maximum continuous current is necessary. Specifically, the maximum continuous current for fuses used in a dry-well canister, with the canister completely submerged in oil, will be reduced by an additional 2% (3% for fuses having a rated maximum voltage of 8.8kV). When calculating the derating for temperature, as described above, the temperature of the oil surrounding the canister should be used. For other types of enclosures, please consult the factory.
7. Reduction in the long time melting current of the fuses (approximately one hour and longer) due to higher ambient temperatures and use in enclosures is the same as described above for "maximum continuous currents". See time-current characteristics for melting characteristics in this time region.
8. The 2.2" dia. 80A and 160A (paralleled 80A) fuses have an RMAT of 140°C at a reduced rated maximum voltage of 5.5kV.

TABLE 15 – RECOMMENDED TRANS-GUARD™ FX MOUNTED IN A STANDARD DRYWELL CANISTER IN OIL (AT A MAX. OIL TEMP. OF 100°C)

	Recommended Fuse Current Ratings (Amperes)																	
FuseVoltage	8.3kV									15.5kV						23kV		
1-Phase Transformer kVA	Transformer 1-Phase Voltage Rating (kV) Phase-to-Ground																	
	2.4		4.16		4.8		7.2		7.62		12		14.4		16		19.9	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
10	6 ^b	8		6 ^a		3		3 ^a		3 ^a		3 ^a		3 ^a		3 ^a		6 ^a
15	8	12		6		6		3		3		3 ^a		3 ^a		3 ^a		6 ^a
25	18	20	8	12	8 ^b	10		6		6		3		3		3		6 ^a
37.5	20	30	12	18	12 ^b	18	8	10		8		6		6 ^a		6 ^a		6 ^a
50	30	40	18	20	18	20	10	12	10	12		6		6		6		6 ^a
75	50	80	25	40	20	30	12	20	12	20	8	12	8	10		8		6
100	60	80	30	50	25	40	20	25	20	25	12 ^b	18	10	12	10 ^b	12		8
167	100		60	80	50	80	30	50	30	50	20	25	18	25	18	20	12	18
250			80		80		50	60	50	60	25	40	20	40	20	30	18	25
333					100		60	100	60	100	40	60	30	50	25	40	20	30
500											60	80	50	80	40	60	40	50
750											80		80		60	100		
1000															100			

TABLE 16 – RECOMMENDED 8.3KV TRANS-GUARD™ FX MOUNTED IN 15.5KV DRYWELL CANISTER IN OIL (AT A MAX. OIL TEMP. OF 100°C)

FuseVoltage	Recommended Fuse Current Ratings (Amperes)									
	8.3kV									
	Transformer 1-Phase Voltage Rating (kV) Phase-to-Ground									
	2.4		4.16		4.8		7.2		7.62	
1-Phase Transformer kVA	A	B	A	B	A	B	A	B	A	B
75		80								
100	65	80								
167	X*	160	65	80		80				
250	160		80	130	80	130		65		65
333			130	160	X*	160	65	X*	65	X*
500			160		160			130		130


*X=Use an 8.3kV Drywell Canister. See Table 15 for fuse recommendations.

NOTES FOR TABLES 15 AND 16:

Column A = 140-200% of transformer rating and Column B = 200-300% of transformer rating.

Fuses recommended in Table 16 must be mounted in a 15.5kV mounting code 5 drywell canister.

Recommended fuses meet inrush criteria of 12 times transformer full load current for 0.1 second and 25 times transformer full load current for 0.01 second. Fuses also meet cold load pickup criteria of 6 times transformer full load current for 1 second and 3 times transformer full load current for 10 seconds.

 Shaded areas indicate parallel fuse applications.

- a. Fuse allows greater than 300% of transformer rating.
- b. Fuse allows greater than 200% of transformer rating.

TABLE 17 – RECOMMENDED TRANS-GUARD™ FX MOUNTED IN A STANDARD DRYWELL CANISTER IN OIL (AT A MAX. OIL TEMP. OF 100°C)

	Recommended Fuse Current Ratings (Amperes)																			
FuseVoltage	8.3kV										15.5kV				23kV					
3-Phase Transformer kVA	Transformer 3-Phase Voltage Rating (kV) Phase-to-Phase																			
	2.4		4.16		4.8		7.2-7.96		8.32		12.47		13.2-14.4		20.8		22.9-24.9 ^c		34.5 ^c	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
15		6		3		3		3 ^a		3 ^a		3 ^a		3 ^a		6 ^a		6 ^a		6 ^a
22.5	8	10		6		6 ^a		3		3		3 ^a		3 ^a		6 ^a		6 ^a		6 ^a
30	10	18		6		6		6 ^a		3		3 ^a		3 ^a		6 ^a		6 ^a		6 ^a
45	18	20	8	12	8 ^b	10		6		6		3		3		6 ^a		6 ^a		6 ^a
75	25	40	18	20	12	18	8	12	8 ^b	10		6		6		6 ^a		6 ^a		6 ^a
100	40	50	20	25	18	20	12 ^b	18	10	12		8	6	8		6 ^a		6 ^a		6 ^a
112.5	40	60	20	30	20	25	12	18	12 ^b	18	8 ^b	10		8		6		6 ^a		6 ^a
150	50	80	25	40	25	40	18	20	18	20	10	18	10 ^b	12		6		6		6 ^a
200	80	100	40	60	30	50	20	30	20	25	12	20	12 ^b	18	8	10		8		6
225	80		40	60	40	60	25	40	20	30	18	20	12	20	8	12	8	10		6
300			60	80	50	80	30	50	30	40	20	25	20	25	12	18	12 ^b	18		8
500			100		80		60	80	50	80	30	50	30	40	20	25	18	25	12	18
750							80		80		50	80	50	60	25	40	25	40	18	25
1000											60	100	60	80	40		40		20	30
1500													100				50		40	
2000																			50	

TABLE 18 – RECOMMENDED 8.3KV TRANS-GUARD™ FX MOUNTED IN 15.5KV DRYWELL CANISTER IN OIL (AT A MAX. OIL TEMP. OF 100°C)

FuseVoltage	Recommended Fuse Current Ratings (Amperes)									
	8.3kV									
	Transformer 3-Phase Voltage Rating (kV) Phase-to-Phase									
	2.4		4.16		4.8		7.2-7.96		8.32	
3-Phase Transformer kVA	A	B	A	B	A	B	A	B	A	B
112.5		65								
150		80								
200	80	X*		65						
225	80	130		65		65				
300	130 ^b	160	65	80		80				
500	160		X*	160	80	130	65	80 ^c		80 ^c
750			160		130		80 ^c	130	80 ^c	130
1000					160		130	160 ^c	130 ^b	160 ^c
1500							160 ^c		130	


*X=Use an 8.3kV Drywell Canister. See Table 17 for fuse recommendations.

NOTES FOR TABLES 17 AND 18:

Column A = 140-200% of transformer rating and Column B = 200-300% of transformer rating.

Fuses recommended in Table 18 must be mounted in a 15.5kV mounting code 5 drywell canister.

Recommended fuses meet inrush criteria of 12 times transformer full load current for 0.1 second and 25 times transformer full load current for 0.01 second. Fuses also meet cold load pickup criteria of 6 times transformer full load current for 1 second and 3 times transformer full load current for 10 seconds.

 Shaded areas indicate parallel fuse applications.

- a Fuse allows greater than 300% of transformer rating.
- b Fuse allows greater than 200% of transformer rating.
- c Recommendations limited to gndY-gndY transformers with no more than 50% delta connected secondary load. Phase-to-ground rated fuses are frequently recommended for gndY-gndY three phase transformers. In some cases, the fuses recommended in Table 18 may be suitable for use with transformers that are not gndY-gndY (contact the factory further information).


TABLE 19 – RECOMMENDED TRANS-GUARD™ FX MOUNTED IN AIR AT 40°C AMBIENT TEMPERATURE

	Recommended Fuse Current Ratings (Amperes)																			
FuseVoltage	8.3kV										15.5kV				23kV					
3-Phase Transformer kVA	Transformer 3-Phase Voltage Rating (kV) Phase-to-Phase																			
	2.4		4.16		4.8		7.2-7.96		8.32		12.47		13.2-14.4		20.8		22.9-24.9 ^c		34.5 ^c	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
15		6		3		3		3 ^a		3 ^a		3 ^a		3 ^a		6 ^a		6 ^a		6 ^a
22.5		8		6 ^a		6 ^a		3 ^a		3 ^a		3 ^a		3 ^a		6 ^a		6 ^a		6 ^a
30	10 ^b	12		6		6		6 ^a		3		3 ^a		3 ^a		6 ^a		6 ^a		6 ^a
45	12	18		8		8		6 ^a		6 ^a		3		3		6 ^a		6 ^a		6 ^a
75	20	40	12	18	12 ^b	18		8		8		6		6 ^a		6 ^a		6 ^a		6 ^a
100	25	40	18	20	18	20		12	10 ^b	12		8		6		6 ^a		6 ^a		6 ^a
112.5	30	50	20	25	18	20	12 ^b	18		12		8		8		6 ^a		6 ^a		6 ^a
150	40	(65)	25	30	20	25	18	20	12	18	10 ^b	12	8 ^b	10		6		6		6 ^a
200	(65)	(80)	30	50	25	40	20	25	18	20	12 ^b	18	12 ^b	18		8		8		6 ^a
225	(65)	100	40	(65)	40	50	25	30	20	30	12	18	12 ^b	18	8	10		8		6
300	(80)	(130)	50	(80)	40	(65)	25	40	25	30	18	20	18	20		12	10	12		8
500	(160)	250	(80)	(130)	(80)	125	50	(65)	40	(65)	25	40	25	40	18	25	18	25	12 ^b	18
750	250		(130)	200	125	(160)	(65)	100	(65)	(80)	40	65	40	65	25	40	20	40	18	25
1000			200	250	(160)	250	100	(130)	(80)	(130)	65	100	65	80	30	50	30	50	20	25
1500					250		(160)	200	(130)	200 ^c	100	130	80	130	50		50		25	50
2000							200		200 ^c	250 ^c	130	200	100	160					40	
2500											160	200	130	200					50	
3000											200		200							

NOTES:

Column A = 140-200% of transformer rating and Column B = 200-300% of transformer rating.

Recommended fuses meet inrush criteria of 12 times transformer full load current for 0.1 second and 25 times transformer full load current for 0.01 second. Fuses also meet cold load pickup criteria of 6 times transformer full load current for 1 second and 3 times transformer full load current for 10 seconds.

 Shaded areas indicate parallel fuse applications.

Ratings in parenthesis are 2.2" dia. fuses (model numbers HTFX230065 and HTFX230080).

a Fuse allows greater than 300% of transformer rating.

b Fuse allows greater than 200% of transformer rating.

c Recommendations limited to gndY-gndY transformers with no more than 50% delta connected secondary load. Phase-to-ground rated fuses are frequently recommended for gndY-gndY three phase transformers.


FUSE ORDERING INFORMATION

To order the proper fuse for a particular application, first determine the correct fuse voltage and current rating using either the appropriate application table (Tables 15-19) or the published performance data (Tables 13-14, the applicable TCC's and Peak Let-through Characteristics). Then refer to Table 20 to determine the appropriate catalog number.

TABLE 20 – FUSE CATALOG NUMBERS

Current Rating (Amps)	Fuse Diameter (in)	Catalog Number			
		5.5kV	8.3kV	15.5kV	23.0kV
3	2.2	–	HTFX230003	HTFX240003	–
6		–	HTFX230006	HTFX240006	HTFX250006
8		–	HTFX230008	HTFX240008	HTFX250008
10		–	HTFX230010	HTFX240010	HTFX250010
12		–	HTFX230012	HTFX240012	HTFX250012
18		–	HTFX230018	HTFX240018	HTFX250018
20		–	HTFX230020	HTFX240020	HTFX250020
25		–	HTFX230025	HTFX240025	HTFX250025
30		–	HTFX230030	HTFX240030	HTFX250030
40		–	HTFX230040	HTFX240040	HTFX250040
50		–	HTFX230050	HTFX240050	HTFX250050
60		–	HTFX230030	HTFX240030	–
65		–	HTFX230065	–	–
80		–	HTFX230080	–	–
80		–	HTFX230040	HTFX240040	–
100		–	HTFX230050	HTFX240050	–
130		–	HTFX230065	–	–
160		–	HTFX230080	–	–
65	3.3	–	HTFX330065	HTFX340065	–
80		HTFX320080	HTFX330080	HTFX340080	–
100		HTFX320100	HTFX330100	HTFX340100	–
125		HTFX320125	HTFX330125	–	–
130		–	HTFX330065	HTFX340065	–
150		HTFX320150	–	–	–
160		–	HTFX330080	HTFX340080	–
200		HTFX320200	–	–	–
200		–	HTFX330100	HTFX340100	–
250		–	HTFX330125	–	–

NOTES:

- To order a fuse having a blown fuse indicator, replace the 7th character ("0") in the catalog number with a "1" (EXAMPLE: HTFX241040). Please note that indicator fuses are not suitable for use in drywell canister applications. Also, an indicator option is not available on 3A fuses.
- Contact factory for ordering information concerning available outdoor and under-oil fuse versions.
-  Shaded current ratings shown are achieved by using a parallel combination of two fuses (order two fuses).

The Trans-Guard™ SX full-range current-limiting fuse provides both overload and fault current protection for distribution equipment in a single fuse body. As a full-range fuse, it is capable of interrupting any continuous current between the minimum current that can cause melting of its elements and its rated maximum interrupting current (50,000 amps). The fuses are capable of interrupting in elevated ambient temperatures up to their rated maximum


application temperature, which is 140°C and 71°C for the 2.2 inch and 3.3 inch diameter designs, respectively. The Trans-Guard™ SX fuse is hermetically sealed and thus discharges no gasses during fuse operation. An additional design distinction is its Patented Damage Sensor that significantly reduces the potential for fuse failure in the event of element damaging current surges.



SX Full-Range
CL Fuses

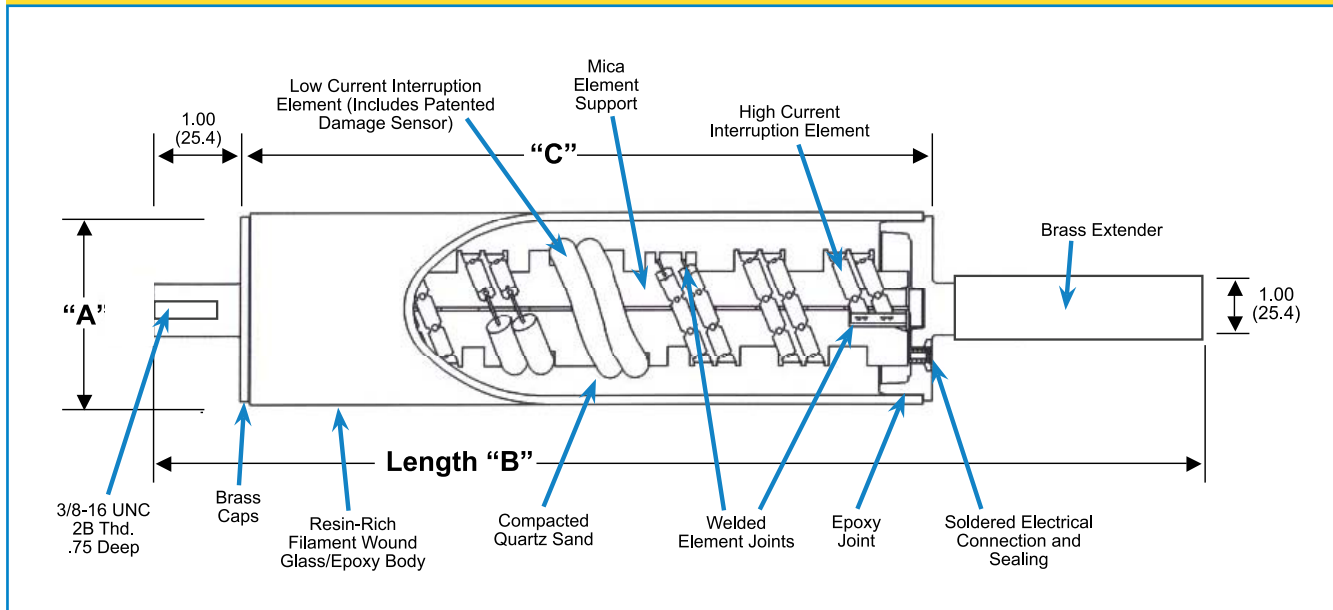
Application:

Trans-Guard™ SX fuses are specifically designed to be installed in “wet-well” fuse holders for oil-filled padmounted switchgear and transformer applications (only 2.2 inch diameter designs are suitable for wet-well fuses holders mounted directly in transformers).

**CAUTION:** Trans-Guard™ SX fuses are **NOT** designed for any type of live switching operation.

FEATURE	BENEFIT/DESCRIPTION
Patented Damage Sensor	Designed to significantly reduce the risk of fuse failure should the fuse be subjected to an element damaging current surge
Hermetically sealed construction	Ensures that no gasses escape from the fuse during current interruption. All Trans-Guard™ SX fuses are helium mass spectrometer leak tested to ensure sealing system integrity
Rugged machined brass end caps	Used for greater ferrule strength resulting in less distortion and more secure fuse attachment in wet-well fuse holders
Tested in accordance with the most recent ANSI/IEEE standards	Includes requirements for short circuit testing at the manufacturer's specified rated maximum application temperature (140°C and 71°C for 2.2 inch and 3.3 inch diameter Trans-Guard™ SX designs, respectively)

CONSTRUCTION



SX Full-Range
CL Fuses

TABLE 21 – DIMENSIONAL INFORMATION FOR TRANS-GUARD™ SX FUSES

Wet Well Holder (kV)	Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Dimensions inches (mm)		
			A	B	C
8.3	5.5	100-250	3.29" (83.6mm)	19.06" (484.1mm)	14.66" (372.4mm)
	8.3	5-75	2.22" (56.3mm)	19.06" (484.1mm)	7.93" (201.4mm)
		90-160	3.29" (83.6mm)	19.06" (484.1mm)	11.85" (300.1mm)
	15.5 ¹	5-75	2.22" (56.3mm)	19.06" (484.1mm)	12.24" (310.9mm)
		90-150	3.29" (83.6mm)	19.06" (484.1mm)	14.66" (372.4mm)
15.5	15.5	5-75	2.22" (56.3mm)	21.12" (536.4mm)	12.24" (310.9mm)
		90-150	3.29" (83.6mm)	21.12" (536.4mm)	14.66" (372.4mm)
23.0	23.0	10-65	2.22" (56.3mm)	21.12" (536.4mm)	15.05" (382.3mm)

NOTES:

1. To order a 15.5kV fuse that will fit in an 8.3kV wet-well fuseholder, replace the 7th character ("0") in the catalog number (see Table 22) with a "2" (Example: HTSX242050).

TABLE 22 – ELECTRICAL CHARACTERISTICS OF TRANS-GUARD™ SX FUSES

Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Maximum Continuous Current (in Oil @ 60°C) (5)	Peak Arc Voltage (6) (kV)	Minimum Melt I ² t (AMP ² SEC)	Maximum Melt I ² t (3) (4) (AMP ² SEC)
5.5	100	HTSX320100	5.5	114.0	15	22,100	110,000
	150	HTSX320150		147.0		56,700	280,000
	175	HTSX320175		172.0		78,300	380,000
	225	HTSX320225		230.0		176,000	860,000
	250	HTSX320250		253.0		259,000	1,270,000
8.3	5	HTSX230005	10.0	5.0	30	100	350
	10	HTSX230010		11.5	32	620	2,700
	12	HTSX230012		14.0	28	800	4,000
	15	HTSX230015		17.0	28	800	4,000
	20	HTSX230020		22.5	26	920	8,000
	25	HTSX230025		25.0	26	1,310	9,500
	30	HTSX230030		30.0	26	1,620	11,000
	40	HTSX230040		43.0	26	3,660	22,000
	50	HTSX230050		53.0	26	5,250	30,000
	65	HTSX230065		65.0	26	8,700	50,000
	75	HTSX230075		75.0	26	12,800	70,000
	90	HTSX330090	8.3	92.0	25	25,200	100,000
	100	HTSX330100		105.0		47,500	185,000
	150	HTSX330150		150.0		78,300	330,000
	160	HTSX330160		163.0		115,150	480,000
15.5	5	HTSX240005	17.2	5.0	51	100	510
	10	HTSX240010		11.5	54	620	2,600
	12	HTSX240012		14.0	46	800	3,700
	15	HTSX240015		17.0	46	800	3,700
	20	HTSX240020		22.5	43	920	6,500
	25	HTSX240025		25.0	45	1,310	8,000
	30	HTSX240030		30.0	45	1,620	10,000
	40	HTSX240040		43.0	45	3,660	22,000
	50	HTSX240050		53.0	45	5,250	30,000
	65	HTSX240065		65.0	45	8,700	50,000
	75	HTSX240075		75.0	45	12,800	70,000
	90	HTSX340090	15.5	98.0	40	25,200	110,000
	100	HTSX340100		117.0		39,400	185,000
	150	HTSX340150		150.0		80,000	380,000
23.0	10	HTSX250010	23.0	11.5	67	620	3,100
	12	HTSX250012		14.0	61	800	4,800
	15	HTSX250015		17.0	61	800	4,800
	20	HTSX250020		22.5	60	920	8,300
	25	HTSX250025		25.0	60	1,310	11,200
	30	HTSX250030		30.0	60	1,620	13,000
	40	HTSX250040		42.0	60	3,660	28,000
	50	HTSX250050		51.0	60	5,250	38,000
	65	HTSX250065		65.0	60	8,700	61,000

NOTES:

- Designs have a 50,000 Amps rms. Symmetrical Rating (except 5A 17.2kV which was tested at 44kA maximum).
- Fuses rated 75A and below are 2.25" in diameter. Higher ratings are 3.3" in diameter.
- Tabulated Maximum Total I²t values are for currents of 50,000 amperes at the nominal voltage of the fuse. Fuses which have a Rated Maximum Voltage higher than their Nominal Voltage Rating will have a higher I²t let-through when applied at voltages up to these higher values. For example, Maximum Total I²t values are increased by approximately 30% when 8.3kV fuses are applied at 10 kV and approximately 25% when 15.5kV fuses are used at 17.2 kV.
- Maximum total I²t values are reduced for currents below 50,000 A. For example, at 10,000 A, I²t values are approximately 15% less than the published values.
- Maximum continuous currents at different ambient temperatures: These may be determined by derating the fuses by 0.2% per degree C over 60°C (for example at 80°C the derating would be 20 x .2 = 4%, making the maximum continuous current of a 20 A fuse 22.5 x .96 = 21.6A) or derating the fuses by .2 % per degree C under 60°C (for example at 40°C the derating would be 20 x .2 = 4 %, making the maximum continuous current of a 20 A fuse 22.5 / .96 = 23.4A). The long time melting current of the fuses (approximately one hour and longer) due to different ambient temperatures is the same as described above for "maximum continuous currents". See time current characteristics for melting characteristics in this time region.
- Peak arc voltages quoted are for 50,000 A currents at the rated maximum voltage listed. Reduced currents and voltages will reduce the peak arc voltage. Consult the factory for further information.

TABLE 23 – RECOMMENDED TRANS-GUARD™ SX FOR SWITCHGEAR (MOUNTED IN A WET WELL FUSEHOLDER WITH A MAX. OIL TEMP. OF 60°C)

	Recommended Fuse Current Ratings (Amperes)																	
FuseVoltage	(5.5kV) 8.3kV									15.5kV						23kV		
1-Phase Transformer kVA	Transformer 1-Phase Voltage Rating (kV) Phase-to-Ground																	
	2.4		4.16		4.8		7.2		7.62		12		14.4		16		19.9	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
10		10		10 ^a		5		5 ^a		5 ^a		5 ^a		5 ^a		5 ^a		10 ^a
15		12		10 ^a		10 ^a		5		5		5 ^a		5 ^a		5 ^a		10 ^a
25	20 ^b	25		12		12		10 ^a		10 ^a		5		5 ^a		5 ^a		10 ^a
37.5	30 ^b	40		20		20 ^a		12		12 ^a		10 ^a		10 ^a		10 ^a		10 ^a
50	40 ^b	50	25 ^b	30	20 ^b	25		15		15		10		10 ^a		10 ^a		10 ^a
75	50	65	30	40	30 ^b	40	20 ^b	25		20		15		12		12 ^a		10 ^a
100	65	(100)	40	50	40 ^b	50	25	30	25	30		20		15		15		12
167	(150) ^b	(175)	65	(100)	50	75	40	50	40 ^b	50	25	30	25 ^b	30	20 ^b	25		20
250	(150)	(225)	(100)	(150)	75	(100)	50	75	50	65	40 ^b	50	30	40	30 ^b	40	25 ^b	30
333	(225)		(150)	(175)	(150) ^b	(175)	75	90	65	90	50	65	40	50	40 ^b	50	30	40
500	(250) ^c		(175)	(250)	(150)	(225)	100	150	100	150	65	90	50	75	50	65	40	50
833			(250) ^c		(250)		160		160		100	150	90	100	75		65	
1000					(250) ^c				160 ^c		150		100	150				
1500											150 ^c		150					

NOTE: Column A = 140-200% of transformer rating and Column B = 200-300% of transformer rating. See additional notes on page 26.

TABLE 24 – RECOMMENDED TRANS-GUARD™ SX FOR SWITCHGEAR: PROTECTING DELTA CONNECTED TRANSFORMERS (MOUNTED IN A WET WELL FUSEHOLDER WITH A MAX. OIL TEMP. OF 60°C)

	Recommended Fuse Current Ratings (Amperes)															
FuseVoltage	(5.5kV) 8.3kV										15.5kV				23kV	
3-Phase Transformer kVA	Transformer 3-Phase Voltage Rating (kV) Phase-to-Phase															
	2.4		4.16		4.8		7.2-7.96		8.32		12.47		13.2-14.4		20.8	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
15		10 ^a		5		5		5 ^a		5 ^a		5 ^a		5 ^a		10 ^a
22.5		12		10 ^a		10 ^a		5		5 ^a		5 ^a		5 ^a		10 ^a
30		15		10		10 ^a		10 ^a		5		5 ^a		5 ^a		10 ^a
45	20 ^b	25		15		12		10		10 ^a		5		5		10 ^a
75	30	40	20 ^b	25		20		12		12		10 ^a		10 ^a		10 ^a
100	40	50	25	30	25 ^b	30		20		15		12 ^a		10 ^a		10 ^a
112.5	40	65	30 ^b	40	25	30		20		20 ^a		12		12 ^a		10 ^a
150	65	75	40 ^b	50	30	40	25 ^b	30	20 ^b	25		15		15		10
200	75	(100)	50	65	40	50	30	40	25	30		20		20		12
225	75	(100)	50	75	40	65	30	40	30 ^b	40	20 ^b	25		20		15
300	(150) ^b	(175)	65	(100)	65	75	40	50	40 ^b	50	25	30	25	30		20
500	(175)	(250)	(150) ^b	(175)	(100)	(150)	65	90	50	75	40	50	40 ^b	50	25	30
750	(250)		(150)	(225)	(150)	(225)	90	150	75	100 ^d	50	75	50	65	40 ^b	50
1000			(225)		(175)	(250)	150	160	100 ^d	150 ^d	75	90	65	90	50	65
1500			(250) ^c		(250)		160		150 ^d		100	150	100	150	65	
2000											150		150			
2500											150 ^c		150			
3000													150 ^c			

NOTE: Column A = 140-200% of transformer rating and Column B = 200-300% of transformer rating. See additional notes on page 26.

TABLE 25 – RECOMMENDED TRANS-GUARD™ SX FOR SWITCHGEAR: PROTECTING GNDY-GNDY* CONNECTED TRANSFORMERS WITH LESS THAN 50% DELTA CONNECTED SECONDARY LOAD (MOUNTED IN A WET WELL FUSEHOLDER WITH A MAX. OIL TEMP. OF 60°C)

	Recommended Fuse Current Ratings (Amperes)																			
FuseVoltage	(5.5kV) 8.3kV												15.5kV				23kV			
3-Phase Transformer kVA	Transformer 3-Phase Voltage Rating (kV) Phase-to-Phase																			
	2.4		4.16		4.8		7.2-7.96		8.32		12.47		13.2-14.4		20.8		22.9-24.9		34.5	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
15		10 ^a		5		5		5 ^a		5 ^a		5 ^a		5 ^a		5 ^a		5 ^a		10 ^a
22.5		12		10 ^a		10 ^a		5		5 ^a		5 ^a		5 ^a		5 ^a		5 ^a		10 ^a
30		15		10		10 ^a		10 ^a		5		5 ^a		5 ^a		5 ^a		5 ^a		10 ^a
45	20 ^b	25		15		12		10		10 ^a		5		5		5 ^a		5 ^a		10 ^a
75	30	40	20 ^b	25		20		12		12		10 ^a		10 ^a		5		5		10 ^a
100	40	50	25	30	25 ^b	30		20		15		12 ^a		10 ^a		10 ^a		10 ^a		10 ^a
112.5	40	65	30 ^b	40	25	30		20		20 ^a		12		12 ^a		10 ^a		10 ^a		10 ^a
150	65	75	40 ^b	50	30	40	25 ^b	30	20 ^b	25		15		15		10		10 ^a		10 ^a
200	75	(100)	50	65	40	50	30	40	25	30		20		20		12		12		10 ^a
225	75	(100)	50	75	40	65	30	40	30 ^b	40	20 ^b	25		20		15		12		10 ^a
300	(150) ^b	(175)	65	(100)	65	75	40	50	40 ^b	50	25	30	25	30		20		20 ^a		12
500	(175)	(250)	(150) ^b	(175)	(100)	(150)	65	(100)	50	75	40	50	40 ^b	50	25	30	25 ^b	30		20
750	(250)		(150)	(225)	(150)	(225)	(100)	(150)	75	(100)	50	75	50	65	40 ^b	50	40 ^b	50	25 ^b	30
1000			(225)		(175)	(250)	(150)	(175)	(150) ^b	(175)	75	90	65	90 ^d	50	65	40	50	30	40
1500			(250) ^c		(250)		(175)	(250)	(150)	(225)	100	150	100 ^d	150 ^d	65	90	65	75	40	50
2000							(225)		(225)		150		150 ^d		75	100	75	90	50	
2500							(250) ^c		(250)		160		150 ^d		100	150	90	150	65	
3000											160 ^c				150		100	150		

*Phase-to-Ground rated fuses are commonly used for GndY/GndY connected transformers having no more than 50% Delta connected secondary load.

NOTES FOR TABLES 23, 24 AND 25:

Column A = 140-200% of transformer rating and Column B = 200-300% of transformer rating.

- Recommended fuses meet inrush criteria of 12 times transformer full load current for 0.1 second and 25 times transformer full load current for 0.01 second. Fuses also meet cold load pickup criteria of 6 times transformer full load current for 1 second and 3 times transformer full load current for 10 seconds.
- Ratings in parentheses are 5.5 kV rated fuses.
 - a Fuse allows more than 300% of transformer rating.
 - b Fuse allows more than 200% of transformer rating.
 - c Fuse allows at least 125% of transformer rating.
 - d 15.5kV fuse must be used for voltages over 8.32 kV for delta configurations or 13.8kV GndY/8.32kV.

Ordering Information:

To order the proper fuse for a particular application, first determine the correct fuse voltage and current rating using the published performance data (Table 22 and the applicable TCC). Then refer to Table 26 to determine the appropriate catalog number. Alternatively, fuse selection can be determined using the accompanying application Tables 23-25.

TABLE 26 – ORDERING INFORMATION FOR TRANS-GUARD™ SX FUSES

Continuous Current Rating (Amps)	Catalog Number			
	5.5kV	8.3kV	15.5kV	23.0kV
5	–	HTSX230005	HTSX240005	–
10	–	HTSX230010	HTSX240010	HTSX250010
12	–	HTSX230012	HTSX240012	HTSX250012
15	–	HTSX230015	HTSX240015	HTSX250015
20	–	HTSX230020	HTSX240020	HTSX250020
25	–	HTSX230025	HTSX240025	HTSX250025
30	–	HTSX230030	HTSX240030	HTSX250030
40	–	HTSX230040	HTSX240040	HTSX250040
50	–	HTSX230050	HTSX240050	HTSX250050
65	–	HTSX230065	HTSX240065	HTSX250065
75	–	HTSX230075	HTSX240075	–
90	–	HTSX330090	HTSX340090	–
100	HTSX320100	HTSX330100	HTSX340100	–
150	HTSX320150	HTSX330150	HTSX340150	–
160	–	HTSX330160	–	–
175	HTSX320175	–	–	–
225	HTSX320225	–	–	–
250	HTSX320250	–	–	–

SX Full-Range
CL Fuses

NOTES:

To order a 15.5kV fuse that will fit in an 8.3kV Wet-well fuseholder, replace the 7th character ("0") in the catalog number with a "2" (EXAMPLE: HTSX24**2**050).

Important Notice When Using Trans-Guard™ SX Fuses

When replacing the obsolete AB Chance SL fuse with a Hi-Tech Fuses Trans-Guard™ SX fuse, it is important to recognize that the SX fuse designs should not be used on distribution systems where the primary line-to-line voltage exceeds the rated maximum voltage of the fuse as shown in the chart to the right:

This should be considered when choosing a proper replacement for the AB Chance SL fuse as they were, in some cases, used on systems having line-to-line voltages greater than that of the current-limiting fuse component of the assembly.

Again, when choosing the appropriate Hi-Tech SX fuse to replace the AB Chance SL fuse, care must be taken to ensure that the rated maximum voltage of the SX fuse exceeds the system line-to-line voltage. The only exception to this requirement is when all the transformers that are downstream from the switches where the SX fuses are to be installed are GndY-GndY connected with less than 50% delta connected secondary load. In that case, a fuse having a rated maximum voltage exceeding the system line-to-neutral voltage may often be used.

TRANS-GUARD™ SX		
Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Rated Maximum Voltage (kV)
5.5	100-250	5.5kV
8.3	5-75	10.0kV
	90-160	8.3kV
15.5	5-75	17.2kV
	90-150	15.5kV
23.0	10-65	23.0kV

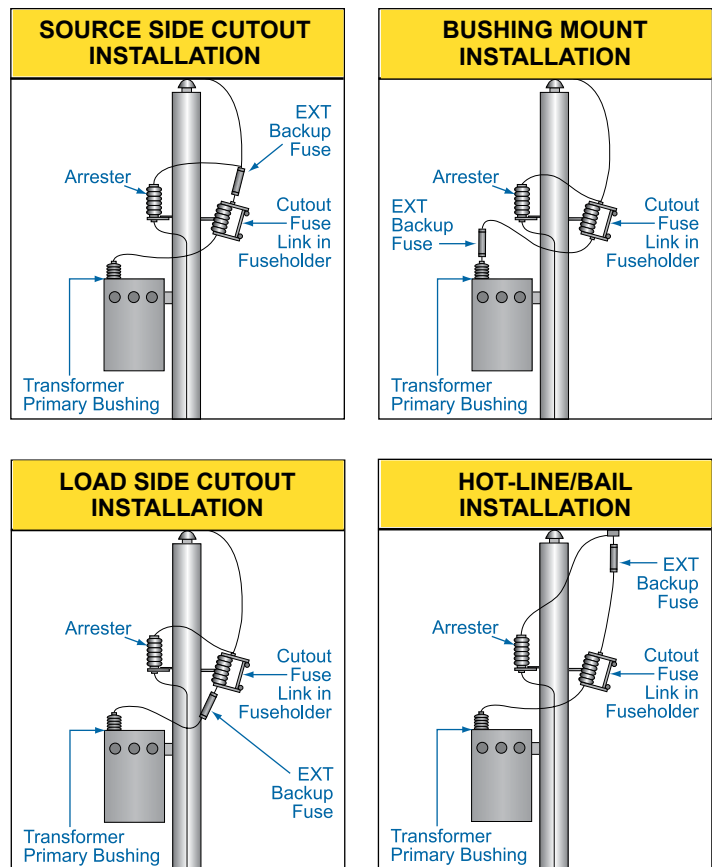
The Trans-Guard™ EXT is a back-up type current-limiting fuse designed for application on overhead distribution systems. Its ability to significantly reduce fault energy and its very high interrupting capability (50,000 amperes symmetrical) provide state-of-the-art protection against today's ever increasing available fault currents.

As a back-up type current-limiting fuse (refer to ANSI C37.40 for fuse definitions), the Trans-Guard™ EXT must always be applied in series with a properly-sized low current protective device. This device is typically an expulsion fuse (i.e. cutout fuse link transformer internal weak link, etc.). The expulsion fuse and the current limiting fuse are each selected to provide fault protection over a certain range of currents. The expulsion fuse is chosen to clear the low magnitude currents such as those produced by overloads and high impedance faults. Such currents are generally below the minimum interrupting current rating of the current-limiting fuse. The back-up type current-limiting fuse is selected so as to clear all other currents. In addition to interrupting the fault current, the back-up current-limiting fuse serves the very important function of limiting the amount of energy that is let through to the source of the fault to a value below the withstand capability of the equipment being protected. By doing this, the current-limiting fuse minimizes the likelihood of disruptive equipment failures (i.e. transformer covers being blown off or capacitor casings rupturing) resulting from high magnitude fault currents. No other protective device is available to similarly reduce the risk of disruptive equipment failures.

Applications

Although Trans-Guard™ EXT fuses are used primarily to protect single-phase distribution transformers, they are also used to provide fault protection for distribution capacitor banks and three-phase distribution transformers. The selection of the proper Trans-Guard™ EXT for a particular application should be based upon matching it with the low current interrupter that is being used. The procedures to be followed in selecting the correct Trans-Guard™ EXT are discussed in Bulletin FS-10.

The Trans-Guard™ EXT is designed to be easily retrofittable to equipment already in service. It can be installed in a variety of ways. These include attaching the fuse to the terminal of a cutout, mounting it in the terminal of a transformer's HV bushing, suspending it in a drop lead, and using the fuse with a hot line connector.





FEATURE	BENEFIT/DESCRIPTION
Lowest total I ² t (energy let-through)	Lowest values available in the industry
Higher melt I ² t to total I ² t ratios	Makes fuses less susceptible to damage from current surges
High fault current interrupting capability	50,000 amperes symmetrical at the Nominal Voltage Rating of each fuse
Broadest range of current ratings available	Available up to 100K at 8.3kV and 15.5kV, and 80K at 23kV
Durable design	For extended life outdoors including brass end caps and filament wound epoxy tubular bodies which are centerless-ground and coated with an oven baked acrylic paint
Current-limiting action with high fault currents	Reduces the magnitude of flame discharge and loud operation of the series-connected cutout
Hardware options	Wide variety of mounting and connection hardware options

TABLE 27 – ELECTRICAL CHARACTERISTICS OF TRANS-GUARD™ EXT FUSES

Nominal Fuse Voltage Rating (kV)	K-Link Coordination	Rated Maximum Voltage (kV)	System Voltage Class (kV)	Peak Arc Volts (kV)	Maximum Continuous Current (Amps)	Minimum Interrupting Current (Amps)	Minimum Melt I²t (AMP²SEC)	Maximum Total I²t (AMP²SEC) (2)	Recommended Maximum Size of Series-Connected Expulsion Fuses		
									K	T	QA
8.3	12	8.3	15	26	30	415	3,200	10,000	12	8	15
	25			26	50	500	11,000	33,000	25	15	30
	40			26	70	750	28,000	80,000	40	20	50
	50			26	80	850	39,000	120,000	50	25	60
	65			22	125	1,250	67,300	230,000	65	30	60
	80			22	160	1,700	156,000	580,000	80	50	125
	100			23.5	195	2,380	218,000	850,000	100	65	125
	15.5			12 ⁽¹⁾	17.2	27	49	30	440	3,200	10,000
25 ⁽¹⁾		49	50	580			11,000	33,000	25	15	30
40 ⁽¹⁾		49	65	850			28,000	80,000	40	20	50
50		15.5	49	75	1,000		39,000	120,000	50	25	60
65			44	125	1,200		67,300	230,000	65	30	60
80			44	160	1,530		156,000	580,000	80	50	125
100			46	190	1,670		204,000	733,000	100	65	125
23.0			12	23	35		64	30	280	3,200	10,500
	25	66	45			465	11,000	38,000	25	15	30
	30	69	80			800	20,100	70,000	30	20	40
	40	67	85			1,000	31,400	105,000	40	25	50
	50	65	100			1,300	66,900	220,000	50	30	60
	80	63	120			1,530	108,600	360,000	80	40	100

NOTES:

- These fuses have been tested at a Rated Maximum Interrupting Current of 43kA at 17.2kV due to test station limitations and 50kA at 15.5kV.
- Tabulated Maximum Total I²t values are at the Nominal Voltage of the fuse. Values for 15.5kV fuses at 17.2kV are approx. 25% higher.

TABLE 28 – ORDERING & DIMENSIONAL INFORMATION FOR 2" DIAMETER TRANS-GUARD™ EXT FUSES

Nominal Fuse Voltage Rating (kV)	Fuse Catalog Number	K-Link Coordination	Dimensions (in)	
			A	B
8.3	HTDE23(X)012	12	6.13-6.05	10.07-9.75
	HTDE23(X)025	25	9.93-9.85	13.87-13.55
	HTDE23(X)040	40		
	HTDE23(X)050	50		
15.5	HTDE24(X)012	12	15.73-15.65	19.67-19.35
	HTDE24(X)025	25		
	HTDE24(X)040	40		
	HTDE24(X)050	50		
23.0	HTDE25(X)012	12		
	HTDE25(X)025	25		

Instructions: Replace (X) in the above model numbers by one of the following end cap configuration codes.

(X)	Spade Cap	Stud Cap	Integral Eyebolt	Loose Hardware			Special Features
				Eyebolt	Parallel Groove	Universal Adapter	
0	2			1	1		
1	1	1					
2	2						
3	1	1		1			
4	2			1			
5	1	1			1		
6	2				1		
7	2			1		1	
8		1	1				
9	2					1	
A							2x1/2-13 THREADED STUDS
C	1	1				1	
F			2				
H	1		1				
J	1		1			1	
R		1	1				OFFSET STUD CAP

NOTES:

Fuse diameter = 2.22" – 2.18", knurled stud diameter = 0.29" and spade hole diameter = 0.42".

Eyebolt is suitable for conductors of AWG 8 SOL. – 2/0 STR.

Parallel-Groove connector is suitable for conductors of 6 SOL. – 2/0 STR.

Other hardware options are available, please consult the factory.

UNIVERSAL ADAPTER

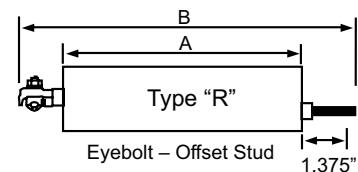
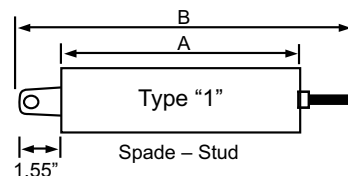
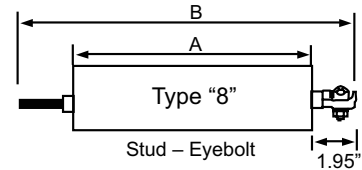
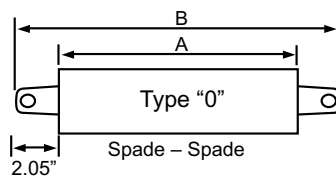
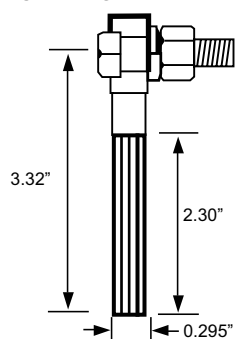


TABLE 29 – ORDERING & DIMENSIONAL INFORMATION FOR 3" DIAMETER TRANS-GUARD™ EXT FUSES

Rated Maximum Voltage (kV)	Fuse Catalog Number	K-Link Coordination	Dimensions (in)				
			A	B Type "A"	B Type "E"	B Type "F"	B Type "U"
8.3	HTDE33(X)065	65	10.0-9.9	13.9-13.5	14.2-13.8	14.0-13.6	14.6-14.2
	HTDE33(X)080	80					
15.5	HTDE34(X)065	65	15.6-15.5	19.5-19.1	19.8-19.4	19.6-19.2	20.2-19.8
	HTDE34(X)080	80					
23.0	HTDE35(X)030	30	18.4-18.3	22.3-21.9	22.6-22.2	22.4-22.0	23.0-22.6
	HTDE35(X)040	40					
	HTDE35(X)050	50					
	HTDE35(X)080	80					

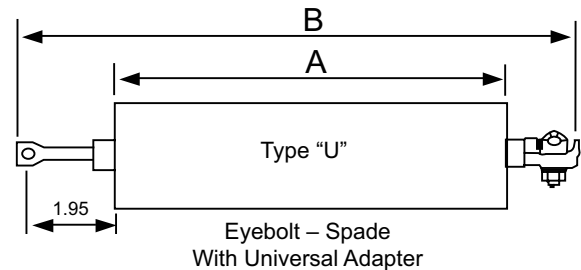
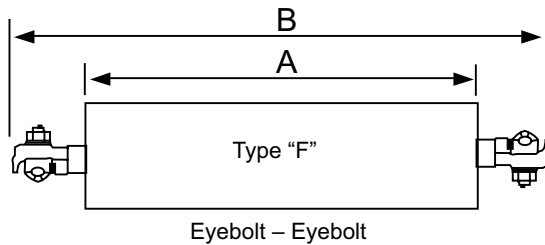
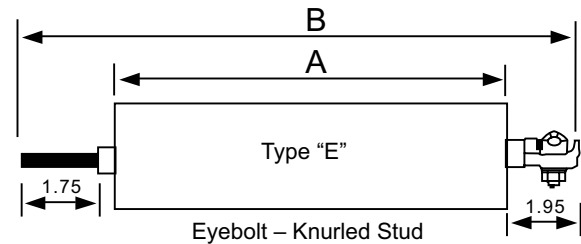
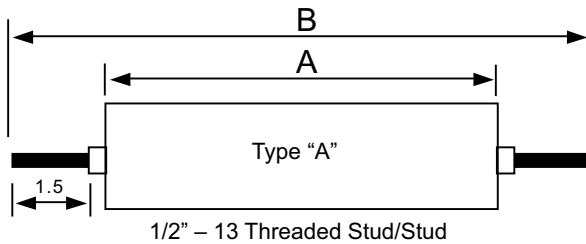
NOTES:

Replace (X) in the above model numbers with "A", "E", "F" or "U" (see below).

Other hardware options are available, please consult the factory.

Fuse dia. = 3.32" – 3.25", spade hole dia. = 0.42" and knurled stud dia. = 0.46".

Eyebolt is suitable for conductors of AWG 8 SOL. – 2/0 STR



EXT Backup
CL Fuses

TABLE 30 – ORDERING & DIMENSIONAL INFORMATION FOR 100K TRANS-GUARD™ EXT FUSES (PARALLEL 2" DIA. FUSES)

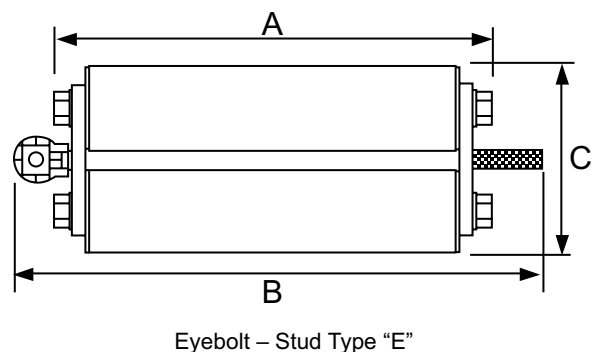
Rated Maximum Voltage (kV)	Fuse Catalog Number	Dimension (in)		
		A	B	C
8.3	HTDE23E100	11.9	14.0	4.9
15.5	HTDE24E100	17.5	19.6	4.9

NOTES:

Eyebolt is suitable for conductors of 8 Sol. – 2/0 Str.

Stud is 1.8" long and 0.46" in diameter.

Other hardware options are available, contact the factory.



Thomas & Betts' Elastimold® Fused Products cover a wide range of applications and ratings. Molded Current-Limiting Fuses (MCLF), Molded Canister Fuses (MCAN), and Fused Elbows (FLR) provide full-range protection through 50 kA using Hi-Tech™ full-range fuses. The fuses in these products can easily be replaced with minimal down time. MCAN and MCLF are suitable for single-phase tap/load protection and can be used in vault, subsurface, or padmount installations. Fused loadbreak elbows provide low cost, convenient protection for radial taps, junctions, transformers and other equipment. They combine the advantages of full-range current-limiting fusing with the convenience of 15/25kV, 200 Amp hotstick operable, loadbreak elbow switching.

In this guide you will find a description and basic features for Elastimold® fused products, as well as information on how to order.

Hi-Tech™ Fuses provide the benefits of current-limiting protection with fault clearing occurring in less than one half cycle, thereby limiting the let-through fault current and dramatically reducing stresses on equipment. They also provide both overload and fault current protection for distribution equipment in a single fuse body. As full-range fuses, they are capable of interrupting any continuous current between the minimum current that can cause melting of the elements and its rated maximum interrupting current (50,000 amps).

All fuses are capable of interrupting in elevated ambient temperature. Hi-Tech™ design features include:

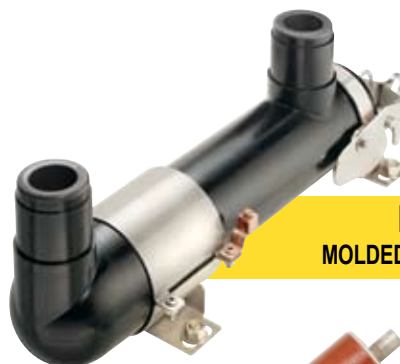
- Patented Damage Sensor designed to significantly reduce the risk of fuse failure should the fuse be subjected to an element damaging current surge. (e.g. lightning)



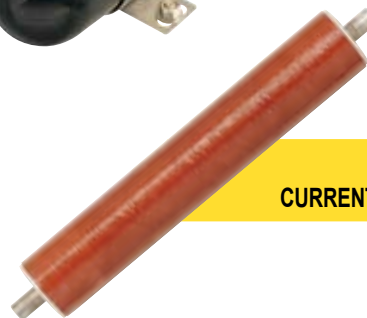
FLR
FUSED LOADBREAK ELBOW



MCLF
MOLDED CURRENT-LIMITING FUSE



MCAN
MOLDED CANISTER FUSE

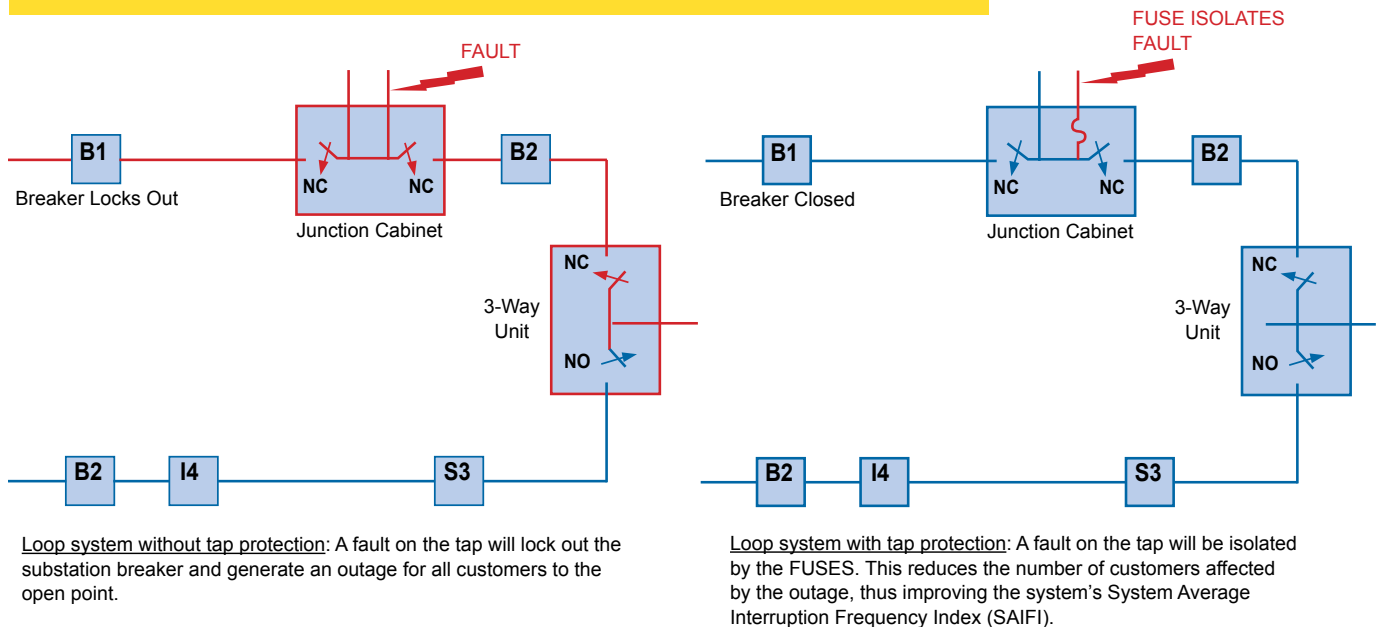


FX
CURRENT-LIMITING FUSE

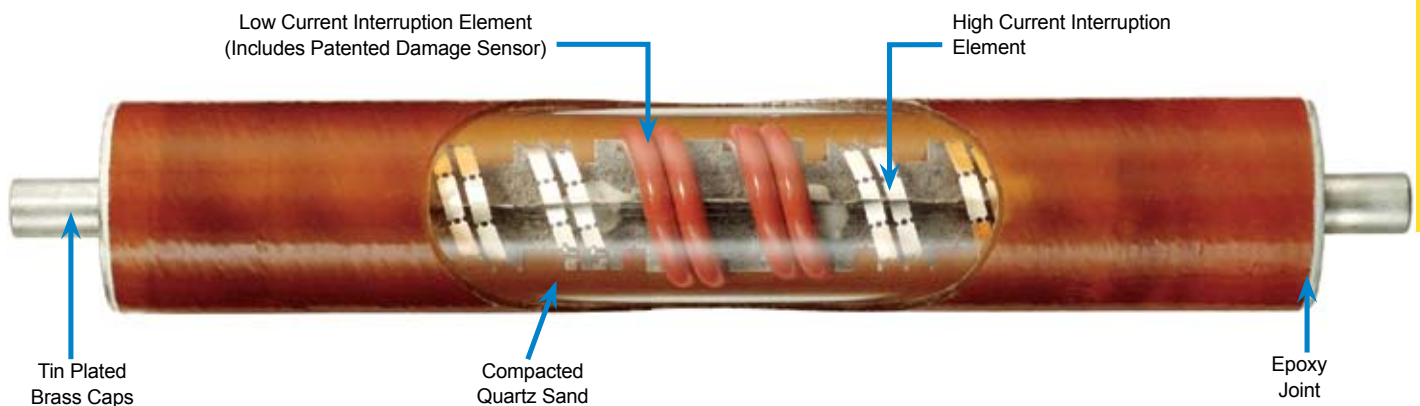
- Hermetically sealed construction ensures that no gasses escape from the fuse during current interruption. All fuses are helium mass spectrometer leak tested to ensure sealing system integrity.
- Rugged machined brass end caps used for greater ferrule strength resulting in less distortion and more secure fuse attachment.

Elastimold® FLR, MCAN, and MCLF fused products constitute some of the fastest and easiest ways to improve system reliability. As an example, loads that branch out along underground loops can be protected by installing any of these fuses into existing junction cabinets.

THE FOLLOWING EXAMPLE SHOWS HOW MUCH IMPROVEMENT IN RELIABILITY IS ACHIEVED BY ADDING PROTECTION TO A TAP.



Full-Range Current-Limiting Fuse



Molded Fuse Products

Elastimold® Fused Elbows combine the advantages of Full-Range Current-Limiting Fusing with the convenience of 15/25kV hot stick operable, loadbreak elbow switching.

This is the fastest, most cost effective way to improve the distribution system’s reliability without adding a separate piece of switchgear or replacing existing sectionalizing cabinets. Simply replace existing 200 Amp tap elbows with Elastimold® Fused Elbows to protect light duty underground distribution systems including sub-loops, and radial taps.



FEATURE	BENEFIT/DESCRIPTION
EPDM Molded Rubber Deadfront Construction	Fully sealed and submersible Insulate, shield and eliminate exposed live parts
Split Center Section	Easy fuse replacement
Built-in Voltage test points or direct test ports	Quick and convenient blown fuse indication
Full-range current-limiting fusing with 50kA interrupting capability Rated 5kV Ungrounded to 25kV Grounded Wye 15/25kV hot stick operable, loadbreak elbow switching	Facilitates fusing of light duty underground distribution systems including sub-loops, radial taps, junctions, transformers, and other equipment

Molded Fuse Products

CERTIFIED TESTS & PERFORMANCE

Elastimold® fused elbows have been designed and tested per applicable portions of IEEE, ANSI, and other industry standards including:

ANSI C37.40 Standard for Current-Limiting Fuse Service Conditions.

ANSI C37.41 Standard for Current-Limiting Fuse Design & Testing.

ANSI C37.47 Standard for Current-Limiting Fuse Ratings & Specifications.

IEEE 386 Standard for Separable Connectors.

RATINGS

System Voltage Class (kV)	15	25*	25/28*
Nominal Fuse Voltage (kV)	8.3	15.5	17.2
Rated Maximum Fuse Voltage (kV)	10	15.5	17.2
Frequency (Hz)	50/60	50/60	50/60
BIL Impulse Withstand (kV)	95	125	140
One Minute AC Withstand (kV)	34	40	45
Fifteen Minute DC Withstand (kV)	53	78	78
Corona Extinction (kV)	11	19	21.5
Symmetrical Interrupting Capability (Amp)	50,000	50,000	50,000
Current Rating (Amp)	3-80	6-20	3-45

APPLICATION INFORMATION

Construction: Submersible, non-venting, deadfront, corrosion resistant.

Ambient Temperature Range: – 30 to +65 degrees centigrade.

Fuses are only suitable for the system voltage class shown if the recovery voltage across the fuse will not exceed its rated maximum voltage. For three-phase applications, this generally requires that protected transformers be gndy-gndy and have at least 50% grounded load.

* The 15.5kV L-G rated fuse requires 75% grounded load to be applied on a 25kV system. The 17.2kV L-G rated fuse requires at least 75% grounded load to be applied on a 28kV system.

Fuse replacement requires the elbow to be de-energized.

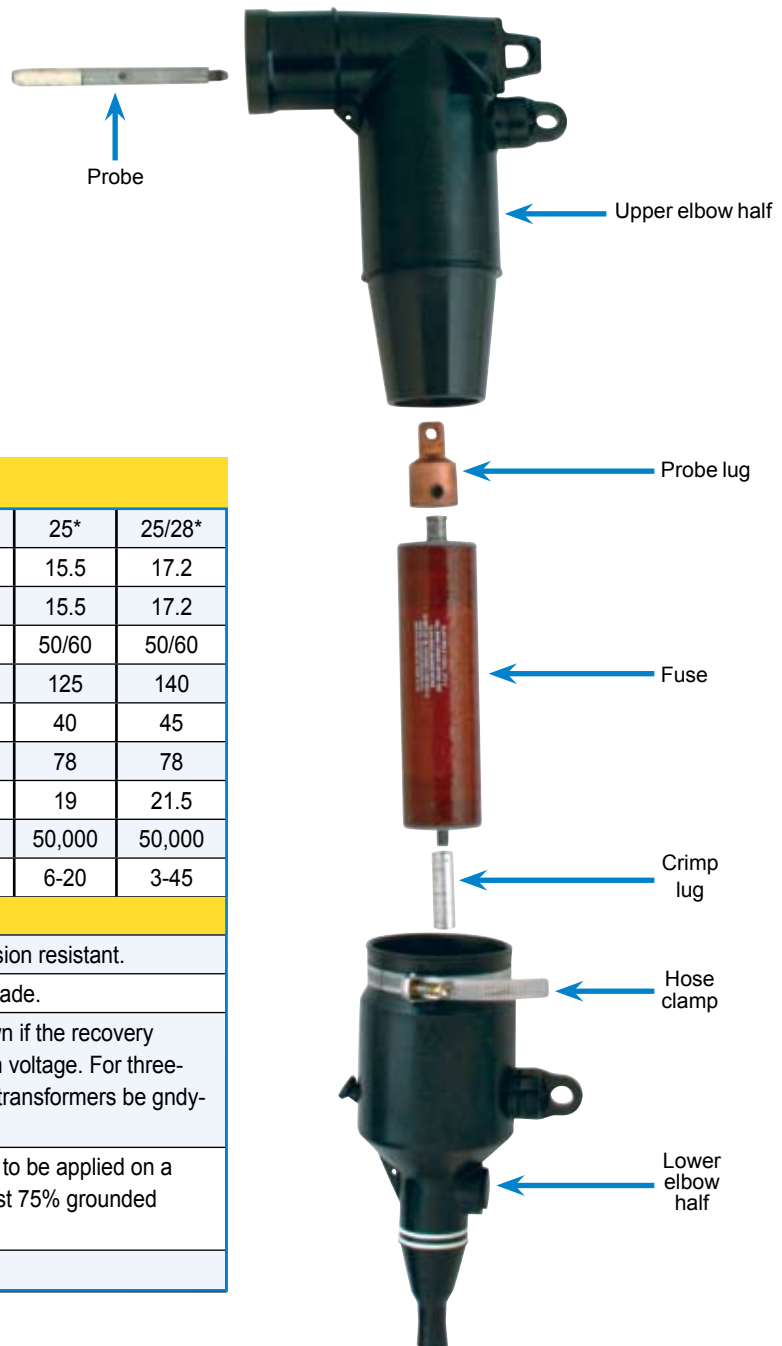


TABLE 31 – ELECTRICAL CHARACTERISTICS OF EFX-ELBOW FUSES

System Voltage Class (kV)	Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Maximum Continuous Current (2) (6)			Peak Arc Voltage (kV) (5)	Minimum Melt I ² t (AMP ² -SEC)	Maximum Total I ² t (3) (4) (AMP ² -SEC)
					25°C	40°C	65°C			
15	8.3	3	EFX083003-E	10.0	4.3	4.2	3.9	30	100	350
		6	EFX083006-E		9.5	9.0	8.5	32	620	2,700
		8	EFX083008-E		11.5	11.0	10.5	28	800	4,000
		10	EFX083010-E		14.0	13.5	13.0	28	800	4,000
		12	EFX083012-E		19.0	18.5	17.5	26	920	8,000
		18	EFX083018-E		21.0	20.0	19.0	26	1,310	9,500
		20	EFX083020-E		26.0	25.0	24.0	26	1,620	11,000
		25	EFX083025-E		34.0	33.0	31.0	26	3,660	22,000
		30	EFX083030-E		37.5	36.5	34.5	26	5,250	30,000
		40	EFX083040-E		43.0	42.0	40.0	26	8,700	50,000
		45	EFX083045-E		49.0	47.0	45.0	26	12,800	70,000
		65	EFX083065-E	8.8	70.0	68.0	64.5	23	34,000	200,000
		80	EFX083080-E		80.0	77.5	73.5	22	51,200	280,000
25	15.5	6	EFX155006-E	15.5	8.5	8.0	7.7	52	620	3,000
		8	EFX155008-E		10.5	10.0	9.5	40	800	4,300
		10	EFX155010-E		13.0	12.5	12.0	40	800	4,300
		12	EFX155012-E		16.0	15.5	15.0	38	920	8,000
		18	EFX155018-E		20.0	19.5	18.5	38	1,620	13,000
		20	EFX155020-E		23.5	22.5	21.5	38	2,200	16,500
25/28	17.2	3	EFX172003-E	17.2	4.3	4.2	3.9	51	100	510
		6	EFX172006-E		9.5	9.0	8.5	54	620	3,250
		8	EFX172008-E		11.5	11.0	10.5	46	800	4,600
		10	EFX172010-E		14.0	13.5	13.0	46	800	4,600
		12	EFX172012-E		18.0	17.5	16.5	43	920	8,500
		18	EFX172018-E		20.0	19.5	18.5	45	1,310	10,000
		20	EFX172020-E		24.0	23.0	22.0	45	1,620	12,500
		25	EFX172025-E		31.5	30.5	29.0	45	3,660	27,500
		30	EFX172030-E		35.5	34.5	32.5	45	5,250	37,500
		40	EFX172040-E		41.0	40.0	38.0	45	8,700	62,500
		45	EFX172045-E		46.0	45.0	42.5	45	12,800	87,500

NOTES:

1. Designs have a 50,000 Amps rms. Symmetrical Rating (except 3A 17.2kV which was tested at 44kA maximum).
2. Fuses have a Rated Maximum Application Temperature of 65°C (RMAT is the maximum temperature of the air, in contact with the elbow housing, at which they have been shown to be suitable for use).
3. Tabulated Maximum Total I²t values are for currents of 50,000 amperes at the nominal voltage of the fuse. Values for 8.3kV fuses at 10kV are approximately 30% higher. Values for 17.2kV fuses at 15.5kV are approximately 20% lower.
4. Maximum total I²t values are reduced for currents below 50,000 A. For example, at 10,000 A, maximum total I²t values are approximately 15% less than the published values.
5. Peak arc voltages quoted are for 50,000 A currents at the rated maximum voltage listed. Reduced currents and voltages will reduce the peak arc voltage. Consult the factory for further information.
6. Maximum continuous currents at ambient temperatures other than those listed may be determined by derating the fuses by 0.2% per degree C over 25°C. For example: At 40°C the derating would be 15 x .2 = 3%, making the maximum continuous current of a 17.2kV 25A fuse 31.5 x .97 = 30.5A.
7. Time-current characteristic curves are published at 25°C. Reduction in the long time melting current of the fuses (approximately one hour and longer) due to higher ambient temperatures is the same as described above for "maximum continuous currents".

TABLE 32 – RECOMMENDED EFX-E: ELBOW FUSE AT 40°C AMBIENT TEMPERATURE

	Recommended Fuse Current Ratings (Amperes)															
FuseVoltage	8.3kV										15.5kV (17.2kV)					
1-Phase Transformer kVA	Transformer 1-Phase Voltage Rating (kV) Phase-to-Ground															
	2.4		4.16		4.8		7.2		7.62		12		14.4		16	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
10		6		6 ^a		3		3		3		6 ^a		6 ^a		(3) ^a
15		10		6		6 ^a		3		3		6 ^a		6 ^a		(3) ^a
25	12	20		8		8		6		6		6 ^a		6 ^a		(3)
37.5	20	25		12		12		8		8		6		6 ^a		(6) ^a
50	25	40	18	20	12	20	10	12		10		6		6		(6) ^a
75	45	65	20	30	20	25	12	20	12	18		10		8		(8)
100	65	80	30	45	25	40	18	25	18	25	12	18	10	12		(10)
167			65	80	45	65	25	45	25	45	18	(25)	18	20	(12)	(20)
250			80		80		45	65	45	65	(25)	(45)	20	(30)	(20)	(30)
333							65		80		(40)		(30)	(45)	(25)	(45)
500													(45)		(45)	

TABLE 33 – RECOMMENDED EFX-E: ELBOW FUSE AT 40°C AMBIENT TEMPERATURE

	Recommended Fuse Current Ratings (Amperes)																	
FuseVoltage	8.3kV									15.5kV (17.2kV)								
3-Phase Transformer kVA	Transformer 3-Phase Voltage Rating (kV) Phase-to-Phase																	
	2.4		4.16		4.8		7.2-7.96		8.32		12.47		13.2-14.4		20.8 ^b		22.9-24.9 ^b	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
15		6		3		3		3 ^a		3 ^a		6 ^a		6 ^a		6 ^a		(3) ^a
22.5		8		6 ^a		6 ^a		3		3		6 ^a		6 ^a		6 ^a		(3) ^a
30	10	12		6		6		6 ^a		3		6 ^a		6 ^a		6 ^a		(3) ^a
45	12	20		10		8		6		6 ^a		6 ^a		6 ^a		6 ^a		(3) ^a
75	20	30	12	20		12		8		8		6		6		6 ^a		(3)
100	30	45	18	25	18	20		12		10		8		8		6 ^a		(6) ^a
112.5	40	65	20	25	18	25		12		12		8		8		6		(6) ^a
150	45	80	25	40	20	30	18	20	12	20	10	12	10	12		6		(6)
200	65	80	40	65	30	45	20	25	18	25	12	18	12	18	8	10		(8)
225	80		45	65	40	65	20	30	20	25	12	20	12	18	8	10		(10)
300			65	80	45	80	30	45	25	40	18	(25)	18	(25)	12	18		(12)
500					80		65	80	45	80	(30)	(45)	(30)	(45)	18	(25)	(18)	(25)
750							80		80				(45)		(25)	(45)	(25)	(40)
1000															(40)		(40)	

NOTES FOR TABLES 32 AND 33:

Column A = 140-200% of transformer rating and Column B = 200-300% of transformer rating.

- Ratings in parenthesis are 17.2kV fuses.
 - 8.3kV 3-45A fuses and 15.5kV 6-20A fuses are used in the small elbow housing. 8.3kV 65-80A fuses and 17.2kV 3-45A fuses are used in the large elbow fuse housing.
 - Recommended fuses meet inrush criteria of 12 times transformer full load current for 0.1 second and 25 times transformer full load current for 0.01 second. Fuses also meet cold load pickup criteria of 6 times transformer full load current for 1 second and 3 times transformer full load current for 10 seconds.
- a Fuse allows greater than 300% of transformer rating.
- b Recommendations limited to gndY-gndY transformers with no more than 50% delta connected secondary load, and involve certain assumptions. Phase-to-ground rated fuses are frequently recommended for gndY-gndY three phase transformers.

PROTECTION AND CONTROL

Fused Elbow

ORDERING INFORMATION FOR FUSE HOUSINGS

YYY A **FLR** H - WØX

NOMINAL FUSE VOLTAGE RATING

168	8.3kV
274	15.5kV
274	17.2kV

FUSE TEST PORT

A	Two Direct Test Ports
Blank	Two Capacitive Test Points

HOUSING

1	Small*
3	Large**

CONDUCTOR SIZE

Stranded / Comp.	Solid / Compact	Size (AWG)
180	-	6
200	190	4
220	210	2
230	220	1
240	230	1/0
250	240	2/0
260	250	3/0
270	260	4/0

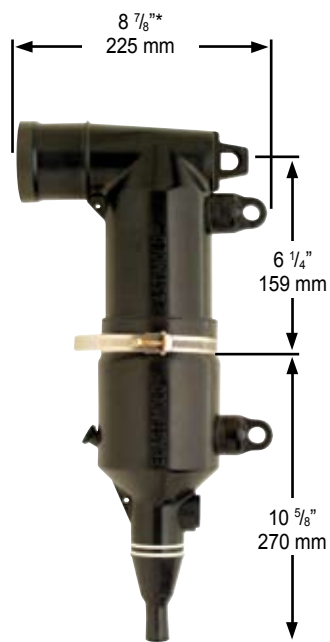
CABLE INSULATION DIAMETER (IN.)

A	0.575" - 0.740"	15mm - 19mm
B	0.635" - 0.905"	16mm - 23mm
C	0.805" - 1.060"	20mm - 27mm
D	0.890" - 1.220"	25mm - 31mm

* Small Housing is used with 8.3kV (3-45Amp) and 15.5kV (6-20Amp) rated fuses

** Large Housing is used with 8.3kV (65 and 80Amp) and 17.2kV (3-45Amp) rated fuses

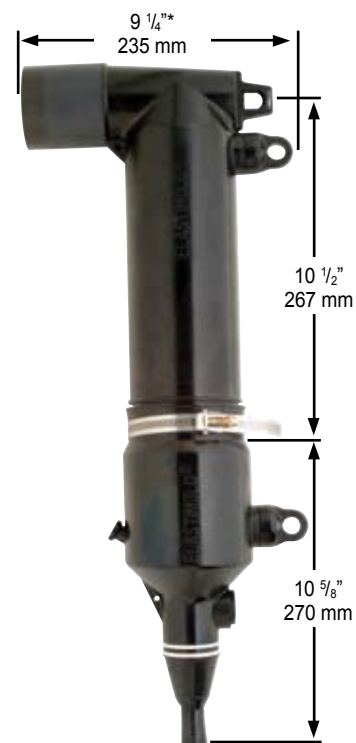
Molded Fuse Products



168FLR1



274FLR1



274FLR3
168FLR3

NOTES:

- All dimensions rounded up to the nearest eighth inch.
- Also available with direct test port.
- Dimensions for Direct Test Port units are * 10 1/4 (260mm) or ** 10 5/8 (270mm)
- 168FLR3 uses a large housing with a 15kV, 200 Amp elbow interface

ORDERING INFORMATION FOR FULL-RANGE CURRENT-LIMITING FUSES

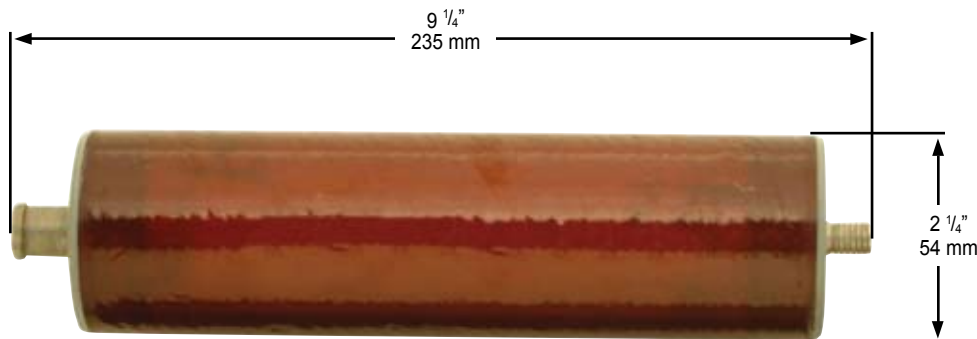
EFX **YYY** **AAA** - **E**

VOLTAGE RATING

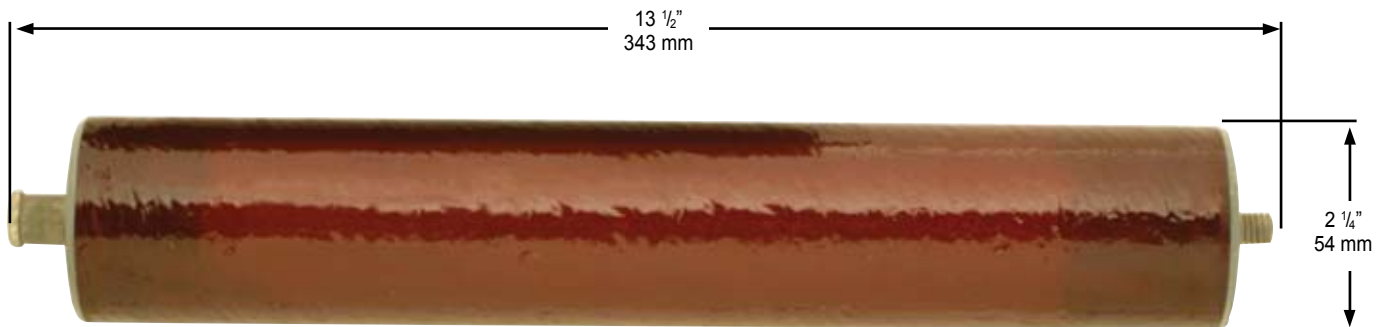
083	8.3kV
155	15.5kV
172	17.2kV

AMPERAGE RATING

003	3 Amps	8.3 / 17.2kV
006	6 Amps	8.3 / 15.5 / 17.2kV
008	8 Amps	8.3 / 15.5 / 17.2kV
010	10 Amps	8.3 / 15.5 / 17.2kV
012	12 Amps	8.3 / 15.5 / 17.2kV
018	18 Amps	8.3 / 15.5 / 17.2kV
020	20 Amps	8.3 / 15.5 / 17.2kV
025	25 Amps	8.3 / 17.2kV
030	30 Amps	8.3 / 17.2kV
040	40 Amps	8.3 / 17.2kV
045	45 Amps	8.3 / 17.2kV
065	65 Amps	8.3kV
080	80 Amps	8.3kV



8.3/15.5 kV Fuse



8.3/17.2kV Fuse

NOTE:

- All dimensions rounded up to the nearest eighth inch.

Molded Current-Limiting Fuses provide full-range fault current protection through 50kA interrupting current.

Construction is modular with a center replaceable fuse section and interchangeable end fittings for elbow connection or direct attachment to equipment mounted bushings. The various end fittings allow fuses to be applied throughout the system including switchgear, junctions, transformers, cable runs and taps.

Elastimold® Molded Current-Limiting Fuses are available in:

- 80 thru 180 Amp ratings for applications on 5kV systems
- 6 thru 115 Amp ratings for applications on 8.7/15kV grounded Wye systems
- 6 thru 100 Amp ratings for applications on 15/25kV grounded Wye systems
- 6 thru 50 Amp ratings for applications on 20/35kV grounded Wye systems



FEATURE	BENEFIT/DESCRIPTION
EPDM Molded Rubber Deadfront Construction	Fully sealed and submersible Light weight Insulate, shield and eliminate exposed live parts
Specially designed fuse elements with built-in low and high current interrupting capability	Full-Range fault current protection through 50kA
Current-limiting protection. Fault clearing occurs in less than one half cycle	Limits the system available fault current and dramatically reduces stresses on equipment
Modular construction with a center replaceable fuse section and interchangeable end fittings	Allow elbow connection or direct attachment to equipment mounted bushings Flexibility of installation on junctions, transformers, cable runs, taps
Compact	Suitable for padmount, subsurface or vault installations
304 stainless steel brackets and hold down straps available	Accommodate a wide variety of mounting arrangements

CERTIFIED TESTS & PERFORMANCE

Elastimold® Molded Current-Limiting Fuses have been designed and tested per applicable portions of IEEE, ANSI, NEMA and other industry standards including:

ANSI C37.40 Standard for Current-Limiting Fuse Service Conditions.

ANSI C37.41 Standard for Current-Limiting Fuse Design and Testing.

ANSI C37.47 Standard for Current-Limiting Fuse Ratings and Specifications.

ANSI/IEEE 386 Standard for Separable Connectors & Bushing Interfaces.

RATINGS

System Voltage Class (kV)	5	15	25/28+	35
Rated Maximum Fuse Voltage (kV)	5.5	10*	17.2*	23
Frequency (Hz)	50/60	50/60	50/60	50/60
BIL Impulse Withstand (kV)	60	95	125/140	150
One Minute AC Withstand (kV)	34	34	40-45	50
Fifteen Minute DC Withstand (kV)	53	53	78	103
Corona Extinction (kV)	11	11	19/21.5	26
Symmetrical Interrupting Capability (Amp)	50,000	50,000	50,000	50,000
Current Rating (Amp)	80-180	10-115	10-100	10-50

APPLICATION INFORMATION

Construction: Submersible, non-venting, deadfront, corrosion resistant.

Ambient Temperature Range: – 30 to +65 degrees centigrade for 6-50 Amp fuses;
– 30 to +40 degrees centigrade for >50 Amp fuses.

Fuses are only suitable for the system voltage class shown if the recovery voltage across the fuse will not exceed its rated maximum voltage. For three-phase applications, this generally requires that protected transformers be gndy-gndy and have at least 50% grounded load.

* These maximum design voltages apply to fuses rated between 6-50 Amp; for fuses with higher amperage rating the maximum design voltage is 8.3 kV for 15 kV systems and 15.5 kV for 25/28 kV systems.

+15.5kV L-G rated fuses require 75% grounded load to be applied on a 25kV system. The 17.2kV L-G rated fuses require at least 75% grounded load to be applied on a 28kV system.

Fuse replacement requires the MCLF to be de-energized.

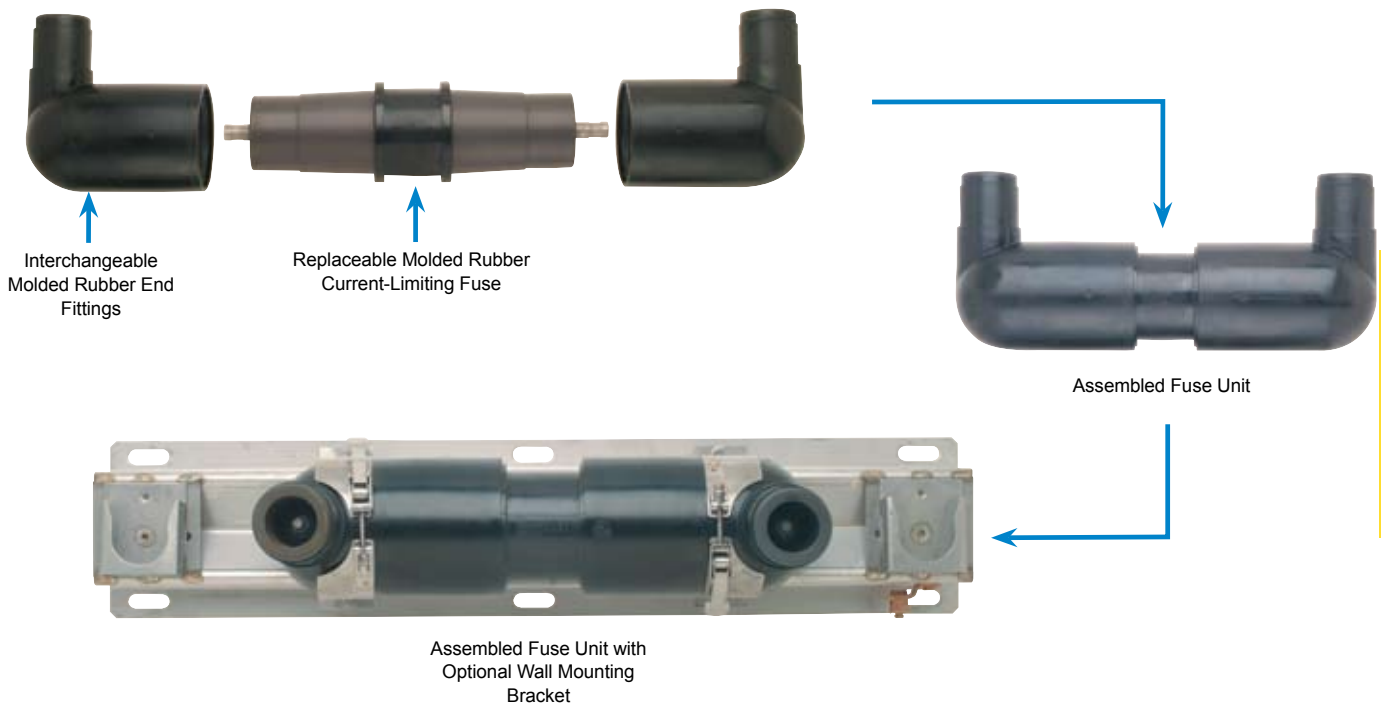


TABLE 34 – ELECTRICAL CHARACTERISTICS OF ENCAPSULATED FUSES USED IN MCLF

Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Maximum Continuous Current (2) (6)		Peak Arc Voltage (kV) (5)	Minimum Melt I ² t (AMP ² -SEC)	Maximum Total I ² t (3) (4) (AMP ² -SEC)
				25°C	40°C			
5.5	80	M05CLF080	5.5	86	84	15	22,100	110,000
	100	M05CLF100		108	105	15	56,700	280,000
	125	M05CLF125		137	133	15	109,200	530,000
	150	M05CLF150		159	154	15	176,000	860,000
	180	M05CLF180		185	180	15	259,000	1,270,000
8.3	10	M15CLF010	10.0	14	13	28	800	4,000
	20	M15CLF020		23	22	26	1,620	11,000
	30	M15CLF030		35	33	26	5,250	30,000
	40	M15CLF040		43	41	26	8,700	50,000
	50	M15CLF050		50	47	26	12,800	70,000
	65	M15CLF065	8.3	73	71	25	25,200	100,000
	80	M15CLF080		87	84	25	47,000	185,000
	100	M15CLF100		106	103	25	78,300	330,000
	115	M15CLF115		120	116	25	115,150	480,000
15.5	10	M25CLF010	17.2	14	13	46	800	3,700
	20	M25CLF020		23	22	45	1,620	10,000
	30	M25CLF030		35	33	45	5,250	30,000
	40	M25CLF040		43	41	45	8,700	50,000
	50	M25CLF050		47	45	45	12,800	70,000
	65	M25CLF065	15.5	68	66	40	25,200	110,000
	80	M25CLF080		88	85	40	54,400	255,000
	100	M25CLF100		100	100	40	80,000	380,000
23.0	10	M35CLF010	23.0	14	13	61	800	4,800
	20	M35CLF020		23	22	60	1,620	13,000
	30	M35CLF030		35	33	60	5,250	38,000
	40	M35CLF040		41	40	60	8,700	61,000
	50	M35CLF050		47	46	60	12,800	82,000

NOTES:

1. Designs have a 50,000 Amps rms. Symmetrical Rating.
2. 10-50A fuses have a Rated Maximum Application Temperature of 65°C, and 65-180A fuses have a Rated Maximum Application Temperature of 40°C (RMAT is the maximum temperature of the air in contact with the MCLF housing, at which the fuses have been shown suitable for use).
3. Tabulated Maximum Total I²t values are for currents of 50,000A at the nominal voltage of the fuse. Fuses that have a Rated Maximum Voltage higher than their Nominal Voltage Rating will have a higher I²t let-through when applied at voltages up to these higher values. For example, Maximum Total I²t values are increased by approximately 30% when 8.3kV fuses are applied at 10kV and approximately 25% when 15.5kV fuses are used at 17.2kV.
4. Maximum total I²t values are reduced for currents below 50,000A. For example, at 10,000A, I²t values are approximately 15% less than the published values.
5. Peak arc voltages quoted are for 50,000A currents at the rated maximum voltage listed. Reduced currents and voltages will reduce the peak arc voltage. Consult the factory for further information.
6. Maximum continuous currents at higher ambient temperatures may be determined by derating the fuses by 0.2% per degree C over 25°C. For example: At 40°C the derating would be 15 x .2 = 3%, making the maximum continuous current of a 20A fuse 23 x .97 = 22A.

TABLE 35 – RECOMMENDED MCLF AT 40°C AMBIENT TEMPERATURE

	Recommended Fuse Current Ratings (Amperes)																	
FuseVoltage	(5.5kV) 8.3kV										15.5kV						23kV	
1-Phase Transformer kVA	Transformer 1-Phase Voltage Rating (kV) Phase-to-Ground																	
	2.4		4.16		4.8		7.2		7.62		12		14.4		16		19.9	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
10		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a
15		10		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a
25		20		10		10		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a
37.5	20	30		20		20		10		10		10 ^a		10 ^a		10 ^a		10 ^a
50	30	40	20	30		20		10		10		10 ^a		10 ^a		10 ^a		10 ^a
75	50	65	30	40	20	30		20		20		10		10		10		10 ^a
100	65	(80)	40	50	30	50	20	30	20	30		20		10		10		10
167	(100)	(150)	65	(80)	50	65	30	50	30	50	20	30	20	30		20		20
250	(150)		(100)	(125)	(80)	(100)	50	65	50	65	30	50	30	40	20	30	20	30
333	(180)		(125)	(180)	(100)	(150)	65	100	65	100	50	65	30	50	30	50	20	40
500			(180)		(150)		115		115		65	100	65	80	50		40	
750											100		80	100				
1000													100					

TABLE 36 – RECOMMENDED MCLF AT 40°C AMBIENT TEMPERATURE

	Recommended Fuse Current Ratings (Amperes)																			
FuseVoltage	(5.5kV) 8.3kV										15.5kV						23kV			
3-Phase Transformer kVA	Transformer 3-Phase Voltage Rating (kV) Phase-to-Phase																			
	2.4		4.16		4.8		7.2-7.96		8.32		12.47		13.2-14.4		22.9-24.9 ^b		20.8		34.5 ^b	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
15		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a
22.5		10		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a
30		10		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a
45		20		10		10		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a
75	30	40		20		20		10		10		10 ^a		10 ^a		10 ^a		10 ^a		10 ^a
100	40	50	20	30	20	30		20		10		10		10		10 ^a		10 ^a		10 ^a
112.5	40	65	20	30	20	30		20		20		10		10		10 ^a		10 ^a		10 ^a
150	50	(80)	30	50	30	40	20	30		20		10		10		10 ^a		10 ^a		10 ^a
200	65	(100)	40	65	40	50	20	30	20	30		20		20		10		10		10 ^a
225	(80)	(125)	50	65	40	65	30	40	30	50		20		20		10		10		10 ^a
300	(100)	(150)	65	(100)	65	(80)	40	50	30	50	20	30	20	30	10	20		20		10
500	(180)		(100)	(150)	(100)	(125)	65	80	50		30	50	30	50	20	30	20	30		20
750			(180)		(125)	(180)	80	115			65	80	50	65	30	40	30	50	20	30
1000					(180)		115				65	100	65	100	40		50		30	40
1500											100		100						40	

NOTES FOR TABLES 35 AND 36:

Column A = 140-200% of transformer rating and Column B = 200-300% of transformer rating.

- Ratings in parenthesis are 5.5kV fuses.

- Recommended fuses meet inrush criteria of 12 times transformer full load current for 0.1 second and 25 times transformer full load current for 0.01 second. Fuses also meet cold load pickup criteria of 6 times transformer full load current for 1 second and 3 times transformer full load current for 10 seconds.

a Fuse allows greater than 300% of transformer rating.

b Recommendations limited to gndY-gndY transformers with no more than 50% delta connected secondary load. Phase-to-ground rated fuses are frequently recommended for gndY-gndY three phase transformers.

FUSE ORDERING INFORMATION

To completely specify and order a Molded Current-Limiting Fuse:

1. Select the Fuse Catalog Number from Table 34 based on the amperage and system voltage. This table is also used to order spare or replacement fuses.
2. From Table 37 select a suffix for the Model Number based on the required fuse end fittings. If end fittings are to be ordered and shipped separately from the fuse, use Table 39.
3. Select Mounting Options (if required) from Table 38.

EXAMPLE:

To order a fuse for application in a 25kV gndy-gndy system (17.2 line-to-ground), rated 50 Amp with factory assembled 200 Amp Deepwell end fittings and no mounting provision, specify: **CATALOG NO. M25CLF050-22**

Mounting Options (See Table 38)

TABLE 37 – FUSE END FITTING ARRANGEMENTS

Outline	Model No.	Description
<p>Approx. Weight 30 lbs. / 13.6 kg.</p>	22	200 Amp Deepwell on both ends.
<p>Approx. Weight 35 lbs. / 15.8 kg.</p>	222	200 Amp Deepwell on one end and two 200 Amp Deepwells on the other end.
<p>Approx. Weight 40 lbs. / 18.1 kg.</p>	2222	Two 200 Amp Deepwell on both ends.
<p>Approx. Weight 30 lbs. / 13.6 kg.</p>	66	600 Amp Bushing on both ends.

TABLE 37 – FUSE END FITTING ARRANGEMENTS (CONTINUED)

Outline	Model No.	Description
<p>Approx. Weight 30 lbs. / 13.6 kg.</p>	6E2	<p>600 Amp Elbow Connector on one end for attachment to equipment and a 200 Amp Deepwell on the other end.</p> <p>This arrangement is not available at 20/35kV</p>
<p>Approx. Weight 30 lbs. / 13.6 kg.</p>	6E6	<p>600 Amp Elbow Connector on one end for attachment to equipment and a 600 Amp bushing on the other end.</p> <p>This arrangement is not available at 20/35kV</p>

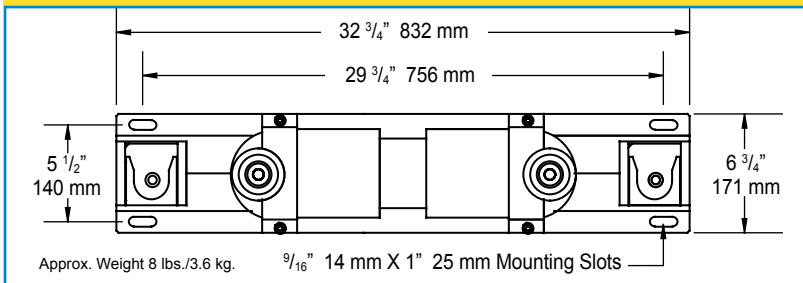
NOTE: Other models are available such as 26.

TABLE 38 – FUSE MOUNTING OPTIONS

Option Number	Description
HDS	Bolted Style Hold Down Strap (Qty: 1 required per end fitting)
QRS	Quick Release Style Hold Down Strap (Qty: 1 required per end fitting)
WMB	Wall Mounting Bracket with Parking Stands and Bolted Style Hold Down Straps (HDS)
WMBQ	Wall Mounting Bracket with Parking Stands and Quick Release Style Hold Down Straps (QRS)
SMB	Support Mounting Bracket for use with Models 6E2 or 6E6 endfitting arrangements. Includes Bolted Style Hold Down Strap (HDS).
TMA-EM	Tilt Mounting Adapter. Bolts to bottom of Wall Mounting Bracket WMB or WMBQ to allow up to 60° angle mounting. (Qty 2 required per installation)

NOTE: The Option number should be added as a suffix to the MCLF catalog number.

OPTIONAL MOUNTING BRACKET WITH ADJUSTABLE PARKING STANDS FOR VERTICAL MOUNTING AND FUSE HOLD DOWN STRAPS



OPTIONAL UNIVERSAL MOUNTING TILT ADAPTERS

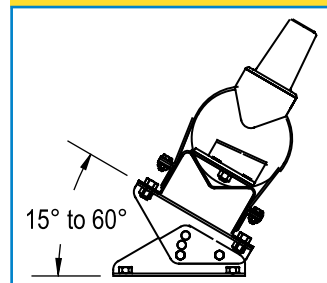


TABLE 39 – END FITTING CATALOG NUMBERS

Use this table only if end fittings are to be ordered and shipped separately from the fuse. Use Table 37 for assembled units.

Catalog Number	Description	System Voltage Class	IEEE 386-1995 Interface Reference
EF2	200 Amp Deepwell End Fitting (kV)	5,15,25 & 35	Figure 3
EF22	Double 200 Amp Deepwell End Fitting (kV)	5,15,25 & 35	Figure 3
EF6	600 Amp Bushing End Fitting(kV)	5, 15, 25 & 35	Figures 11 & 13
EF6E	600 Amp Elbow Connector End Fitting (kV)	5,15 & 25	Figure 11

NOTE: EF6E is equipped with a standard thru hole spade lug (Type 03700).

OTHER OPTIONS

Catalog Number	Description
MCLF-ADT (Assembly/Disassembly Tool)	Hex Wrench for set screw removal and replacement when disassembling end fittings. Supplied as standard with replacement fuses.
3/8" 10mm Sq. Drive 	

MCAN Molded Canister Fuse is a compact, lightweight EPDM Molded Rubber Fuse Enclosure Package. MCAN fuse canisters are maintenance-free, completely sealed and submersible. Designs are deadfront using molded rubber to insulate, shield and eliminate exposed live parts. Units are ideally suited for padmount, subsurface or vault applications, for systems through 35kV gndy-gndy.

The MCAN Molded Canister Fuse will accommodate and has been thoroughly tested with Hi-Tech Trans-Guard™ FX fuses. Contact the factory before using fuses from other manufacturers.



FEATURE	BENEFIT/DESCRIPTION
EPDM Molded Rubber Deadfront Construction	Fully sealed and submersible Insulate, shield and eliminate exposed live parts
Compact	Suitable for padmount, subsurface or vault installations
Modular construction	Allow elbow connection or direct attachment to equipment-mounted bushings Neon voltage indicators (V2) attached to elbow test points, allow quick and convenient blown fuse indication
Various end fittings and bushings	Flexibility of installation on switchgear, junctions, transformers, cable runs, taps
Replaceable fuse section	Ease of fuse replacement without full removal from installation
Current-limiting protection. Fault clearing occurs in less than one half cycle	Limits the system available fault current and dramatically reduces stresses on equipment
304 series stainless steel mounting brackets, and wall mounted parking stands available	Accommodate a wide variety of mounting arrangements

CERTIFIED TESTS & PERFORMANCE

Elastimold® Molded Canister Fuses have been designed and tested per applicable portions of IEEE, ANSI, NEMA and other industry standards including:

ANSI C37.40 Standard for Current-Limiting Fuse Service Conditions.

ANSI C37.41 Standard for Current-Limiting Fuse Design & Testing.

ANSI C37.47 Standard for Current-Limiting Fuse Ratings & Specifications.

ANSI/IEEE 386 Standard for Separable Connectors & Bushing Interfaces.

FUSE CANISTER RATINGS

System Voltage Class (kV)	15	25/28+	35
Maximum Line to Ground Voltage (kV)	8.8/10.0	17.2	23
BIL Impulse Withstand (kV)	95	125-140	150
One Minute AC Withstand (kV)	34	40-45	50
Fifteen Minute DC Withstand (kV)	53	78	103
Corona Extinction (kV)	11	19-21.5	26
Maximum Continuous Current (Amps)	200*	200*	200*
Momentary Current (kA)	10*	10*	10*

Construction: Submersible, corrosion resistant, fully shielded.

Ambient Temperature Range: – 30 to +65°

*without fuse

FUSE RATINGS

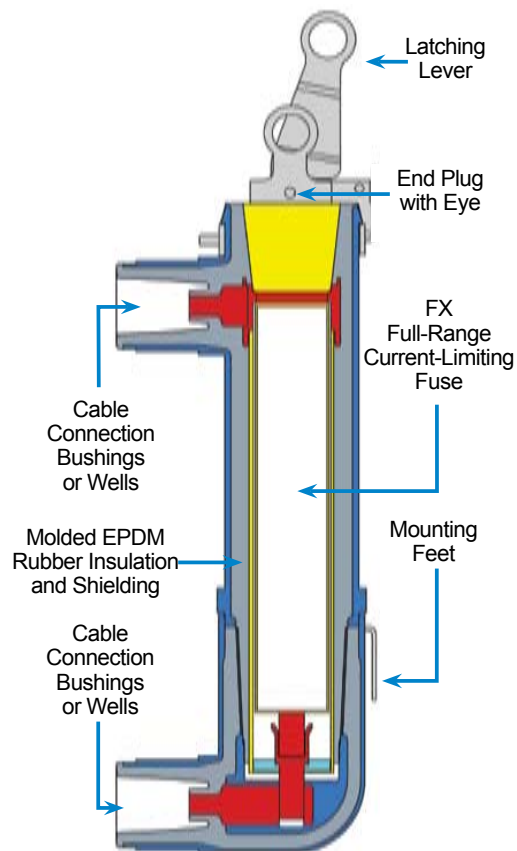
Nominal Voltage Rating (kV)	8.3	15.5	23.0
Rated Maximum Voltage (kV)	8.8/10.0	17.2+	23.0
Frequency (Hz)	50-60	50-60	50-60
Current Rating (Amp)	3-80	3-50	6-50
Rated Maximum Interrupting Current (Sym. Amperes)	50,000	50,000++	50,000

Fuses are only suitable for the system voltage class shown if the recovery voltage across the fuse will not exceed its rated maximum voltage. For three-phase applications, this generally requires that protected transformers be gndy-gndy and have at least 50% grounded load.

+The 17.2 kV L-G rated fuse requires at least 75% grounded load to be applied on a 28kV system.

++3 Amp Fuse was Tested @ 44kA

Fuse replacement requires the MCAN to be de-energized.



FX Current-Limiting Fuse

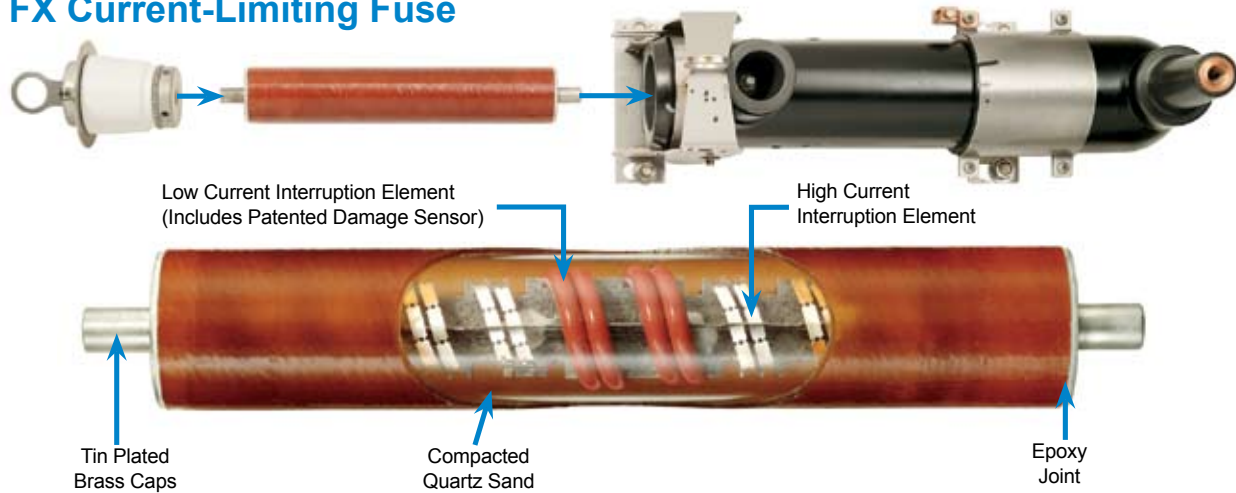


TABLE 40 – RECOMMENDED FX: IN MCAN AT 40°C AMBIENT TEMPERATURE

	Recommended Fuse Current Ratings (Amperes)																	
FuseVoltage	8.3kV										15.5kV						23kV	
1-Phase Transformer kVA	Transformer 1-Phase Voltage Rating (kV) Phase-to-Ground																	
	2.4		4.16		4.8		7.2		7.62		12		14.4		16		19.9	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
10		6		6 ^a		3		3 ^a		3 ^a		3 ^a		3 ^a		3 ^a		6 ^a
15		10		6		6 ^a		3		3		3 ^a		3 ^a		3 ^a		6 ^a
25	12	20	8	10		8		6		6		3		3		3		6 ^a
37.5	20	30	12	18		12		8		8		6 ^a		6 ^a		6 ^a		6 ^a
50	25	50	18	25	12	20	10	12		10		6		6		6 ^a		6 ^a
75	50	65	25	40	20	30	12	20	12	20		10		8		8		6
100	65	80	30	50	25	50	18	25	18	25		12	10	12		10		8
167			65	80	65	80	30	50	30	50	18	25	18	25	12	20		12
250					80		65	80	50	65	25	50	25	40	20	30	18	25
333							80		65		50		30		25	50	20	30
500															50		40	

TABLE 41 – RECOMMENDED FX: IN MCAN AT 40°C AMBIENT TEMPERATURE

	Recommended Fuse Current Ratings (Amperes)																			
FuseVoltage	8.3kV										15.5kV						23kV			
3-Phase Transformer kVA	Transformer 3-Phase Voltage Rating (kV) Phase-to-Phase																			
	2.4		4.16		4.8		7.2-7.96		8.32		12.47		13.2-14.4		22.9-24.9 ^b		20.8		34.5 ^b	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
15		6		3		3		3 ^a		3 ^a		3 ^a		3 ^a		3 ^a		6 ^a		6 ^a
22.5		8		6 ^a		6 ^a		3		3		3 ^a		3 ^a		3 ^a		6 ^a		6 ^a
30	10	12		6		6		6 ^a		3		3 ^a		3 ^a		3 ^a		6 ^a		6 ^a
45	12	20		10		8		6		6 ^a		3		3		3 ^a		6 ^a		6 ^a
75	25	40	12	20	12	18		8		8		6		6		3		6 ^a		6 ^a
100	30	50	18	25	18	25		12		10		8		8		6 ^a		6 ^a		6 ^a
112.5	40	65	20	30	18	25	12	18		12		8		8		6 ^a		6 ^a		6 ^a
150	65	80	25	50	25	40	18	25	12	18		10		10		6		6		6 ^a
200	80		40	65	30	50	20	30	18	25	12	18		12		8		8		6
225			50	65	40	65	25	40	20	30	12	20	12	20		8		10		6
300			65	80	65	80	30	50	25	50	18	25	18	25		12		12		8
500							65	80	65	80	30		30	50	18	25	18	25		12
750									80						25	40	25	50	18	25
1000														40		40			25	30
1500																			40	

NOTES:

Column A = 140-200% of transformer rating and Column B = 200-300% of transformer rating.

- 8.3kV 3-50A fuses are used in mounting code 4 canisters, 8.3kV 65-80A fuses and 15.5kV 3-50A fuses are used in mounting code 5 canisters, and 23kV 6-50A fuses are used in mounting code 6 canisters.
- Recommended fuses meet inrush criteria of 12 times transformer full load current for 0.1 second and 25 times transformer full load current for 0.01 second. Fuses also meet cold load pickup criteria of 6 times transformer full load current for 1 second and 3 times transformer full load current for 10 seconds.

a Fuse allows greater than 300% of transformer rating.

b Recommendations limited to gndY-gndY transformers with no more than 50% delta connected secondary load. Phase-to-ground rated fuses are frequently recommended for gndY-gndY three phase transformers.

TABLE 42 – ELECTRICAL CHARACTERISTICS OF HI-TECH FX FUSES INSIDE MCAN CANISTERS

Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Maximum Continuous Current (2) (6)			Peak Arc Voltage (kV) (5)	Minimum Melt I ² t (AMP ² -SEC)	Maximum Total I ² t (3) (4) (AMP ² -SEC)
				25°C	40°C	65°C			
8.3	3	HTFX230003	10.0	4.3	4.2	3.9	30	100	350
	6	HTFX230006		9.5	9.0	8.5	32	620	2,700
	8	HTFX230008		11.5	11.0	10.5	28	800	4,000
	10	HTFX230010		13.5	13.0	12.5	28	800	4,000
	12	HTFX230012		17.5	17.0	16.0	26	920	8,000
	18	HTFX230018		19.5	19.0	18.0	26	1,310	9,500
	20	HTFX230020		24.0	23.0	21.5	26	1,620	11,000
	25	HTFX230025		29.5	28.5	27.0	26	3,660	22,000
	30	HTFX230030		34.0	33.0	31.0	26	5,250	30,000
	40	HTFX230040		40.0	39.0	36.5	26	8,700	50,000
	50	HTFX230050		45.5	44.0	42.0	26	12,800	70,000
	65	HTFX230065	8.8	70.0	68.0	64.5	23	34,000	200,000
	80	HTFX230080		80.0	77.5	73.5	22	51,200	280,000
15.5	3	HTFX240003	17.2	4.3	4.2	3.9	51	100	510
	6	HTFX240006		9.5	9.0	8.5	54	620	2,600
	8	HTFX240008		11.5	11.0	10.5	46	800	3,700
	10	HTFX240010		13.5	13.0	12.5	46	800	3,700
	12	HTFX240012		17.5	17.0	16.0	43	920	6,500
	18	HTFX240018		19.5	19.0	18.0	45	1,310	8,000
	20	HTFX240020		24.0	23.0	21.5	45	1,620	10,000
	25	HTFX240025		29.5	28.5	27.0	45	3,660	22,000
	30	HTFX240030		34.0	33.0	31.0	45	5,250	30,000
	40	HTFX240040		40.0	39.0	36.5	45	8,700	50,000
	50	HTFX240050		44.5	43.0	40.0	45	12,800	70,000
23.0	6	HTFX250006	23.0	9.5	9.0	8.5	67	620	3,100
	8	HTFX250008		11.5	11.0	10.5	61	800	4,800
	10	HTFX250010		13.5	13.0	12.5	61	800	4,800
	12	HTFX250012		17.5	17.0	16.0	60	920	8,300
	18	HTFX250018		19.5	19.0	18.0	60	1,310	11,200
	20	HTFX250020		24.0	23.0	21.5	60	1,620	13,000
	25	HTFX250025		29.5	28.5	27.0	60	3,660	28,000
	30	HTFX250030		34.0	33.0	31.0	60	5,250	38,000
	40	HTFX250040		38.5	37.0	35.0	60	8,700	61,000
	50	HTFX250050		44.5	43.0	40.0	60	12,800	82,000

NOTES:

1. Designs have a 50,000 Amps rms. Symmetrical Rating (except 3A 15.5 kV which was tested at 44 kA maximum).
2. Fuses have a Rated Maximum Application Temperature of 65°C (RMAT is the maximum temperature of the air, in contact with the MCAN housing, at which they have been shown to be suitable for use).
3. Tabulated Maximum Total I²t values are for currents of 50,000 amperes at the nominal voltage of the fuse. Fuses that have a Rated Maximum Voltage higher than their Nominal Voltage Rating will have a higher I²t let-through when applied at voltages up to these higher values. For example, Maximum Total I²t values are increased by approximately 30% when 8.3 kV fuses are applied at 10 kV and approximately 25% when 15.5 kV fuses are used at 17.2 kV.
4. Maximum total I²t values are reduced for currents below 50,000 A. For example, at 10,000 A, maximum total I²t values are approximately 15% less than the published values.
5. Peak arc voltages quoted are for 50,000 A currents at the rated maximum voltage listed. Reduced currents and voltages will reduce the peak arc voltage. Consult the factory for further information.
6. Maximum continuous currents at higher ambient temperatures may be determined by derating the fuses by 0.2% per degree C over 25°C. For example: At 65°C the derating would be 40 x .2 = 8%, making the maximum continuous current of a 30 A fuse 34 x .92 = 31 A.
7. Reduction in the long time melting current of the fuses (approximately one hour and longer) due to higher ambient temperatures is the same as described above "Maximum continuous currents...". See time-current characteristics for melting characteristics in this time region.

ORDERING INFORMATION

To specify and order an FX fuse and an MCAN fuse canister:

1. Select the Fuse Catalog Number from Table 42 based on the amperage and “Rated Max Voltage (kV)” column.
2. Based on selected fuse, select canister from the “Canister Catalog Number” column of Table 43. See Table 44 for additional MCAN Fuse Canister information (Make sure that the Canister Mounting Code and Diameter Code correspond to the Fuse selected).
3. Select Options and accessories (if required) from Table 45.

EXAMPLE:

To order a 15.5kV, 50 Amp fuse, a fuse canister for this fuse with 200 Amp bushing well and no options or accessories specify:

CATALOG NO. HTFX240050 AND MCAN-5B25-22

MCAN FUSE CODING SYSTEM

Mounting Code	Maximum Fuse Overall Length	Diameter Code	Maximum Fuse Overall Diameter
4	10" 254 mm	B	2.25" 57 mm
5	14.31" 363 mm	B	2.25" 57 mm
6	17.12" 435 mm	B	2.25" 57 mm

NOTE Lower Mounting Codes (shorter) fuses may be applied in canisters of higher Mounting Codes by using an adapter. See Mounting Code Adapters table 45.

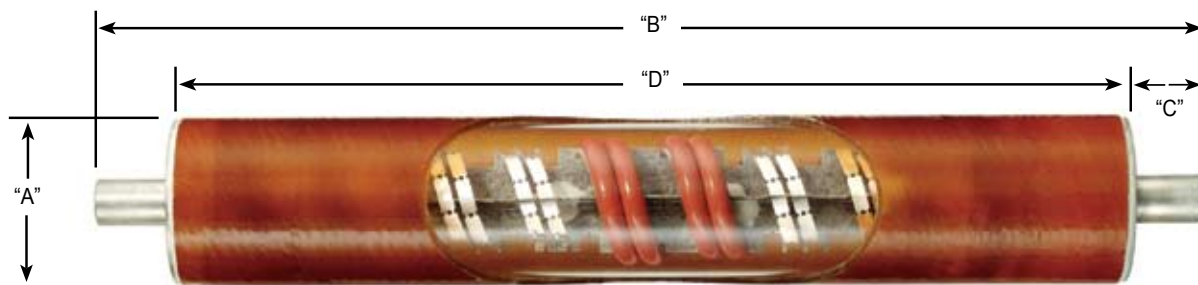


TABLE 43 – ORDERING INFORMATION FOR FX FUSES USED WITH MCAN

Nominal Fuse Voltage Rating (kV)	Current Rating (Amps)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Mounting Code	Diameter Code	Overall Diameter (A)	Overall Length (B)	Contact Length (C)	Body Length (D)	Canister Catalog Number	Fuse Weight
8.3	3	HTFX230003	10.0	4	B	2.25" 57mm	10.0" 254mm	1.02" 26mm	7.96" 202mm	MCAN-4B15-22 MCAN-4B15-66 MCAN-4B15-6E2 MCAN-4B15-6E6	3.00lb. 1.3kg
	6	HTFX230006									
	8	HTFX230008									
	10	HTFX230010									
	12	HTFX230012									
	18	HTFX230018									
	20	HTFX230020									
	25	HTFX230025									
	30	HTFX230030									
	40	HTFX230040									
	50	HTFX230050									
	65	HTFX230065	8.8	5	B	2.25" 57mm	14.31" 363mm	1.02" 26mm	12.27" 312mm	MCAN-5B15-22 MCAN-5B15-66 MCAN-5B15-6E2 MCAN-5B15-6E6	4.25lb. 1.9kg
	80	HTFX230080									
15.5	3	HTFX240003	17.2	5	B	2.25" 57mm	14.31" 363mm	1.02" 26mm	12.27" 312mm	MCAN-5B25-22 MCAN-5B25-66 MCAN-5B25-6E2 MCAN-5B25-6E6	4.25lb 1.9kg
	6	HTFX240006									
	8	HTFX240008									
	10	HTFX240010									
	12	HTFX240012									
	18	HTFX240018									
	20	HTFX240020									
	25	HTFX240025									
	30	HTFX240030									
	40	HTFX240040									
23.0	6	HTFX250006	23.0	6	B	2.25" 57mm	17.12" 435mm	1.02" 26mm	15.09" 383mm	MCAN-6B35-66	4.75lb 2.2kg
	8	HTFX250008									
	10	HTFX250010									
	12	HTFX250012									
	18	HTFX250018									
	20	HTFX250020									
	25	HTFX250025									
	30	HTFX250030									
	40	HTFX250040									
	50	HTFX250050									

For 5kV systems, use the 8.3 kV rated fuses

TABLE 44 – WEIGHTS AND DIMENSIONS

Outline	Catalog Number	(A)	(B)	(C)	Approx. Weight	End Bushing*	Main Bushing*
<p>Technical drawing showing side and front views of three fuse models. Dimensions include: Side view (A) 148 mm, (B) 82 mm, (C) 82 mm; Top view (A) 204 mm, (B) 25 mm, (C) 70 mm; Front view (A) 164 mm, (B) 140 mm, (C) 70 mm.</p>	MCAN-4B15-22	21.49" 546mm	10.06" 256mm	10.91" 277mm	19lb. 8.6kg	200 Amp Bushing Well	200 Amp Bushing Well
	MCAN-5B25-22	25.80"	14.37"	15.22"	21lb.		
	MCAN-5B15-22	655mm	365mm	387mm	9.5kg		
<p>Technical drawing showing side and front views of three fuse models. Dimensions include: Side view (A) 152 mm, (B) 82 mm, (C) 82 mm; Top view (A) 227 mm, (B) 25 mm, (C) 70 mm; Front view (A) 164 mm, (B) 140 mm, (C) 70 mm.</p>	MCAN-4B15-66	21.49" 546mm	10.06" 256mm	10.91" 277mm	21lb. 9.5kg	600 Amp Bushing	600 Amp Bushing
	MCAN-5B25-66	25.80"	14.37"	15.22"	23lb.		
	MCAN-5B15-66	655mm	365mm	387mm	10.4kg		
<p>Technical drawing showing side and front views of three fuse models. Dimensions include: Side view (A) 152 mm, (B) 82 mm, (C) 82 mm; Top view (A) 204 mm, (B) 25 mm, (C) 70 mm; Front view (A) 164 mm, (B) 140 mm, (C) 70 mm.</p>	MCAN-4B15-6E2	23.90" 607mm	10.06" 256mm	12.91" 328mm	20lb. 9kg	600 Amp Elbow Connector	200 Amp Bushing Well
	MCAN-5B25-6E2	28.21"	14.37"	17.22"	22lb.		
	MCAN-5B15-6E2	717mm	365mm	437mm	10kg		
<p>Technical drawing showing side and front views of three fuse models. Dimensions include: Side view (A) 152 mm, (B) 82 mm, (C) 82 mm; Top view (A) 227 mm, (B) 25 mm, (C) 70 mm; Front view (A) 164 mm, (B) 140 mm, (C) 70 mm.</p>	MCAN-4B15-6E6	23.90" 607mm	10.06" 256mm	12.91" 328mm	20lb. 9kg	600 Amp Elbow Connector	600 Amp Bushing
	MCAN-5B25-6E6	28.21"	14.37"	17.22"	22lb.		
	MCAN-5B15-6E6	717mm	365mm	437mm	10kg		

TABLE 45 – MCAN MOLDED CANISTER FUSE OPTIONS AND ACCESSORIES

Voltage Indicators

Neon voltage indicators mounted to the test point provision on the MCAN elbow connectors provide quick and convenient indication of an energized circuit. The voltage indicator will illuminate with a flashing neon light when the elbow connector is energized. If the fuse opens/clears the neon lights on the load side elbows will stop flashing, indicating that the fuse has blown. Refer to operation instructions for additional detail.



CATALOG NUMBER	DESCRIPTION
V2	Capacitive test point, voltage indicator

Mounting Code Adapters

A mounting code adapter is used to extend the fuse end cap ferrule so that a shorter fuse may be used in a longer code canister. Example: A code 4B size fuse can be used in a code 5B Canister with an MCAN-4-5 adapter.

CATALOG NUMBER	DESCRIPTION
MCAN-4-5	Code 4B size fuse to a code 5B canister
MCAN-4-6	Code 4B size fuse to a code 6B canister
MCAN-5-6	Code 5B size fuse to a code 6B canister



Parking Stands

Parking stands can be mounted adjacent to MCAN Fuse Canister allowing attachment of additional accessories to ground, isolate and test the elbow cable connectors.

SUFFIX NUMBER	DESCRIPTION
-PS	Parking Stand between bushings

CATALOG NUMBER	DESCRIPTION
160WMPS	Wall Mount Parking Stand



Switchgear Assemblies

Elastimold® multi-point junctions shown in catalog PG-CA can be utilized to create custom switchgear lineups consisting of MVS switches, MVI fault interrupters, MCLF current-limiting fuses, MCAN fuse canisters, fused elbows, elbow arresters and other molded products. The junction allows easy assembly and interconnection of components into fully shielded, submersible, compact arrangements.



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