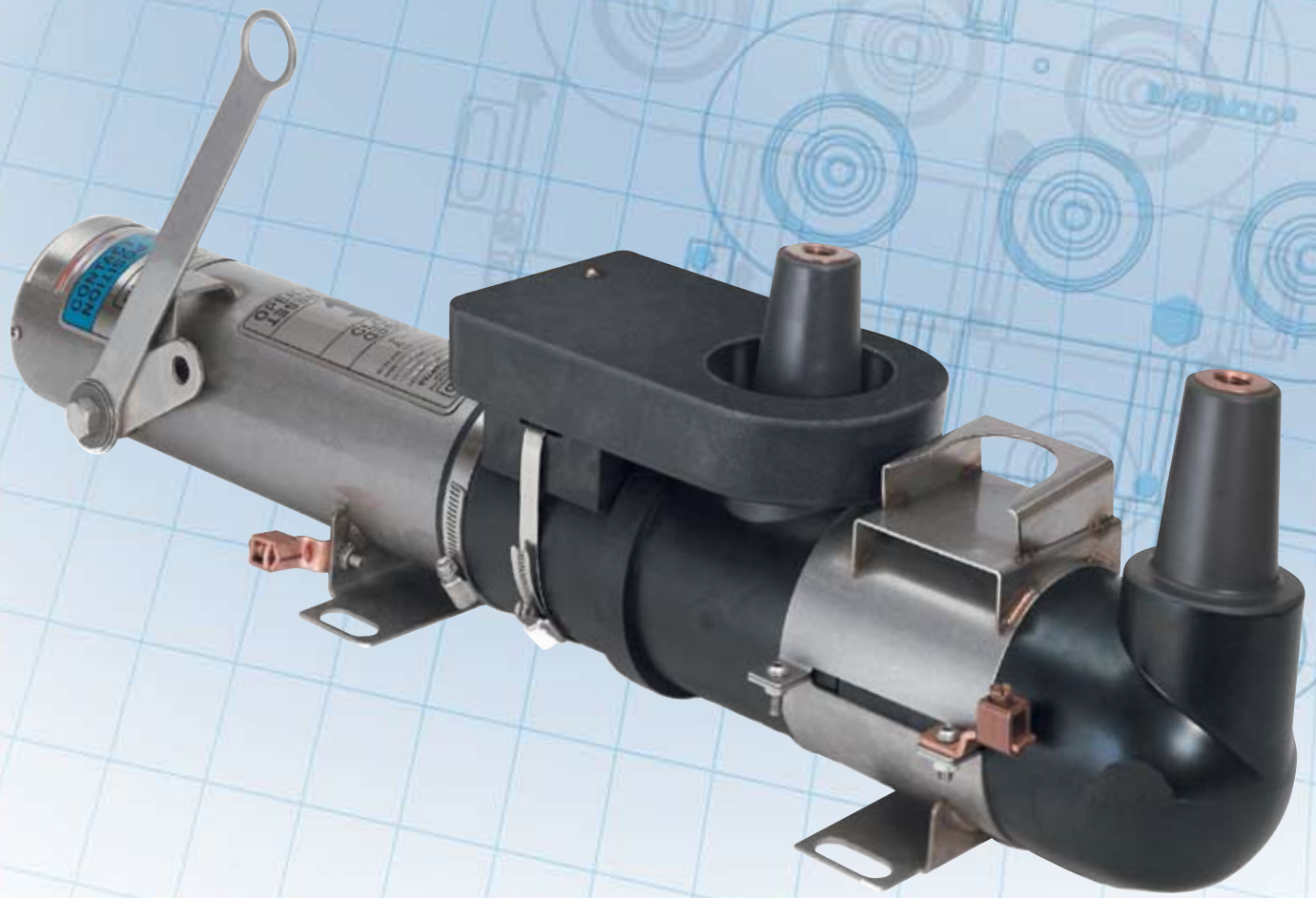
elastimold®

PROTECTION AND CONTROL

PG-PC-0506

Fuses
Fault and Voltage Indicators
Underground Arresters
Underground Distribution Switchgear



POWER DELIVERY

Product Selection Guide

Thomas&Betts

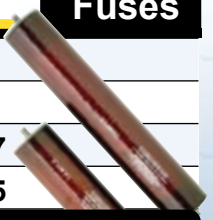
elastimold®

Protection and Control Products

Electric underground distribution systems demand high performance in the form of improved reliability, improved power quality, reduced operational and maintenance costs, and flexibility of operation. These can be accomplished by sectionalizing feeders, installing equipment with minimal maintenance/installation costs, installing protection equipment, installing automatic source transfer equipment, and/or providing ways to monitor the system and quickly locate a fault.

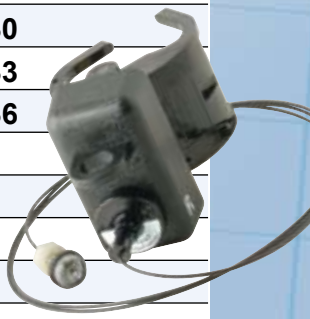
Thomas & Betts' Protection and Control products provide flexible solutions to all of the above challenges. With a wide arrangement of products such as arresters, canister and molded fuses, fault indicators, fused elbows, and switchgear we are able to provide the equipment that you need to fulfill the needs of underground distribution systems up to 35kV.

Fuses



Product Application	Pg.	5-6
Fused Elbow		7-11
Molded Current-Limiting Fuse		12-17
Molded Canister Fuse		18-25

Fault and Voltage Indicators



FAULT INDICATORS		
Product Application	Pg.	26-27
Test Point Mounted		28-30
Underground Clamp Type		31-33
Overhead Line Mounted		34-36
Fault Indicator Accessories		37
VOLTAGE INDICATORS		
V2		38
V1 BIP		39
PD35 Voltage & Phasing Indicator		40
Ordering Information		41

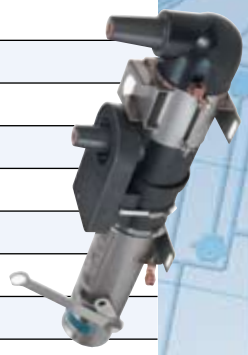
Underground Arresters

Product Application	Pg.	42-44
Ratings		45
Ordering Information		46-47

Contents

Underground Distribution Switchgear

Product Application	Pg.	48-58
Manual Sectionalizing		51
Automatic Sectionalizing		52
Distribution Automation		53-57
Automatic Source Transfer		53
Network Transformer Protection		54-56
Loop Automation		57
Application Summary		58
Molded Vacuum Switches		59-61
Molded Vacuum Interrupters		62-66
Multi-Way Switchgear		67-71
Automatic Source Transfer Packages		72-73
Distribution Automation Packages		74-75



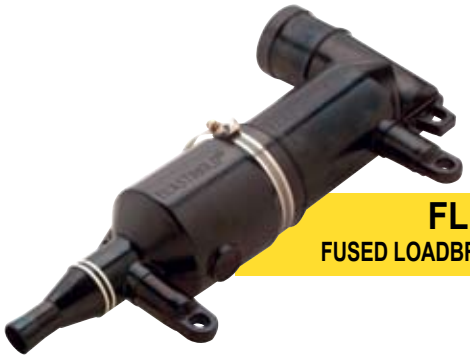
Thomas & Betts' Elastimold® Fuses cover a wide range of applications and ratings. Molded Current-Limiting Fuses (MCLF), Molded Canister Fuses (MCAN), and Fused Elbows (FLR) provide full-range protection through 50 kA. The fuses in these products can easily be replaced with minimal down time. MCAN and 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® fuses, as well as information on how to request a quote/order.

EFX 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. The EFX full-range current-limiting fuses 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).

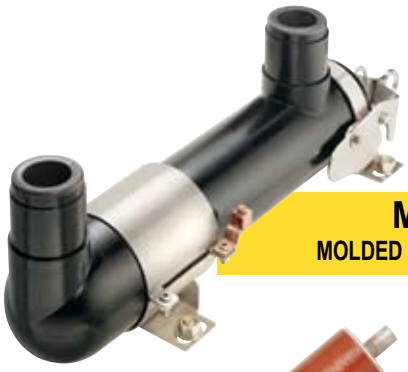
The fuses are capable of interrupting in elevated ambient temperature, and are hermetically sealed (discharge no gasses during operation). EFX Fuse design features include:

- Patented Damage Sensor® designed to significantly reduce the risk of fuse failure should the fuse be subjected to an element damaging current surge.



FLR
FUSED LOADBREAK ELBOW

MCLF
MOLDED CURRENT-LIMITING FUSE



MCAN
MOLDED CANISTER FUSE

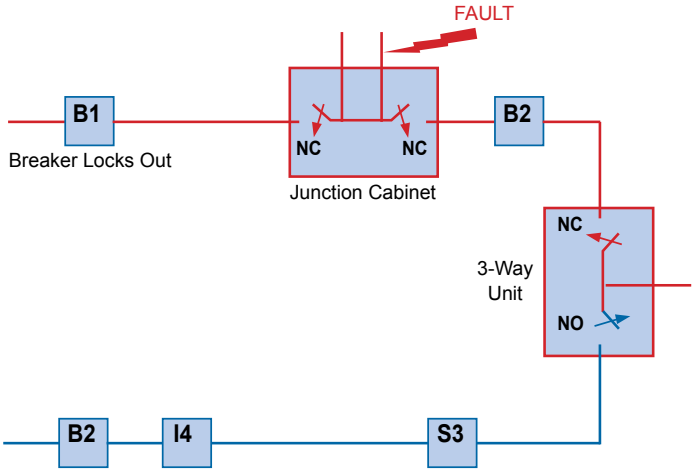
EFX
CURRENT-LIMITING FUSE

- Hermetically sealed construction ensures that no gasses escape from the fuse during current interruption. All EFX fuses are helium mass spectrometer leak tested to ensure sealing system integrity.

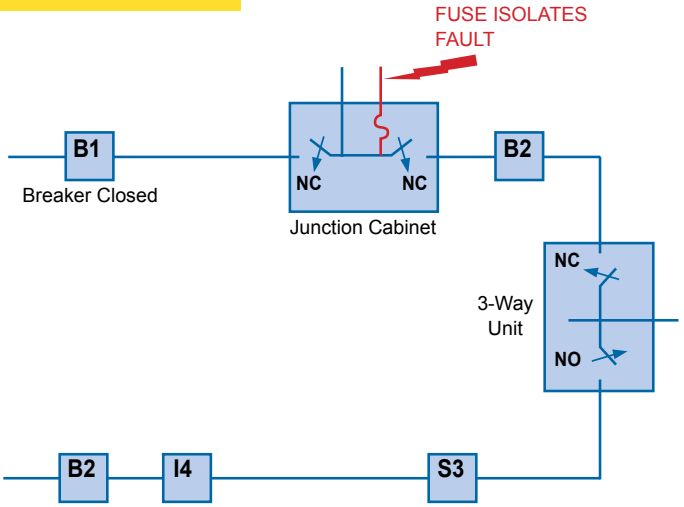
- Rugged machined brass end caps used for greater ferrule strength resulting in less distortion and more secure fuse attachment in dry-well canisters.

Elastimold® FLR, MCAN, and MCLF fuses 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.

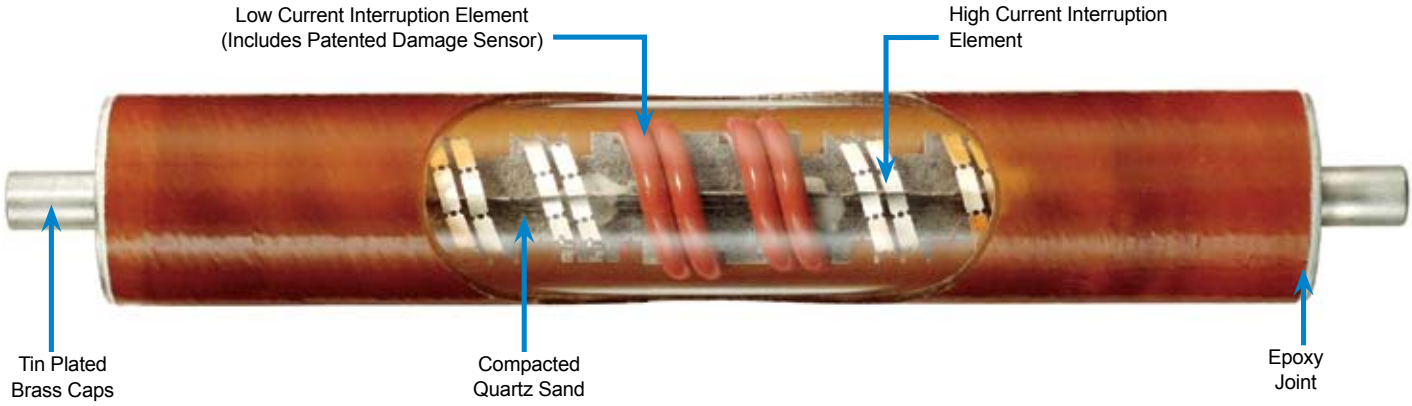


Loop system without tap protection: A fault on the tap will lock out the substation breaker and generate an outage for all customers to the open point.



Loop system with tap protection: A fault on the tap will be isolated by the FUSES. This reduces the number of customers affected by the outage, thus improving the system's System Average Interruption Frequency Index (SAIFI).

EFX Current-Limiting Fuse



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

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

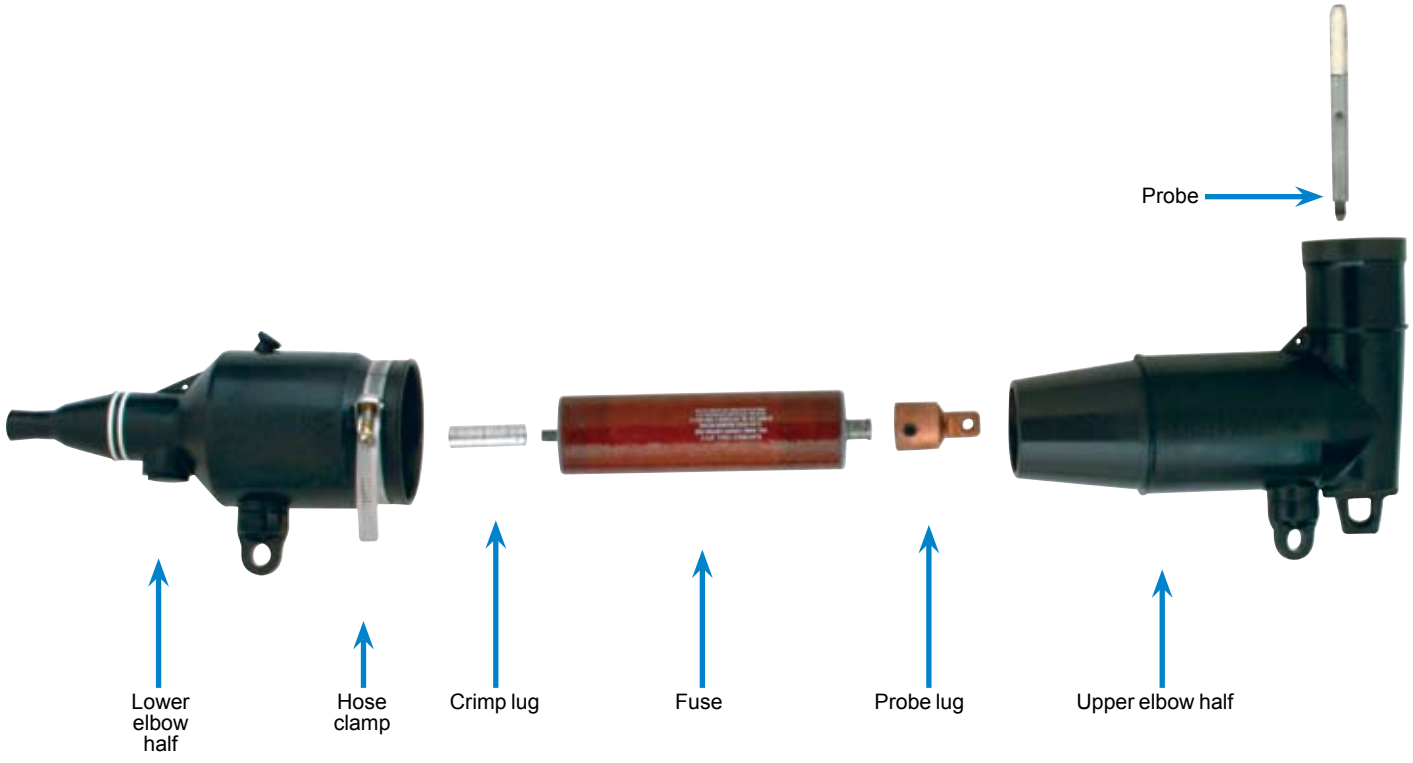
System Voltage Class (kV)	15	25	25/28*
Nominal Fuse Voltage (kV)	8.3	15.5	17.2
Rated Maximum Fuse Voltage (kV)	10	15.5	17.2
Frequency (Hz)	50/60	50/60	50/60
BIL Impulse Withstand (kV)	95	125	140
One Minute AC Withstand (kV)	34	40	45
Fifteen Minute DC Withstand (kV)	53	78	78
Corona Extinction (kV)	11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

APPLICATION INFORMATION

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

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

* The 28kV rated fuse requires at least 75% grounded load.



ELECTRICAL CHARACTERISTICS OF EFX-ELBOW FUSES

System Voltage Class (kV)	Nominal Fuse Voltage Rating (kV)	Current Rating (A)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Maximum Continuous Current (2) (6) 25° C	40°C	65°C	Peak Arc Voltage (kV) (5)	Minimum Melt I^2t (AMP^2-SEC)	Maximum Total I^2t (3) (4) (AMP^2-SEC)
15	8.3	6	EFX083006-E	10.0	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	6	EFX172006-E	17.2	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.
2. Fuses have a Rated Maximum Application Temperature of 65ºC (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 I^2t 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 I^2t values are reduced for currents below 50,000 A. For example, at 10,000 A, maximum total I^2t 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 25º C. For example: At 40º 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 25ºC. 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”.

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**

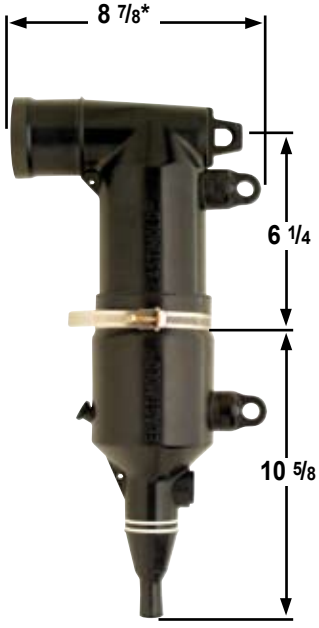
CABLE INSULATION DIAMETER (IN.)

A	0.575 - 0.740
B	0.635 - 0.905
C	0.805 - 1.060
D	0.890 - 1.220

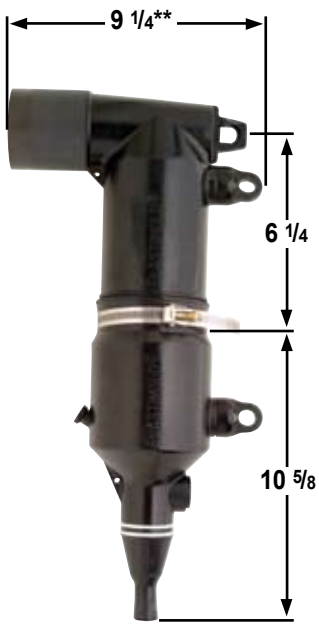
CONDUCTOR SIZE

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

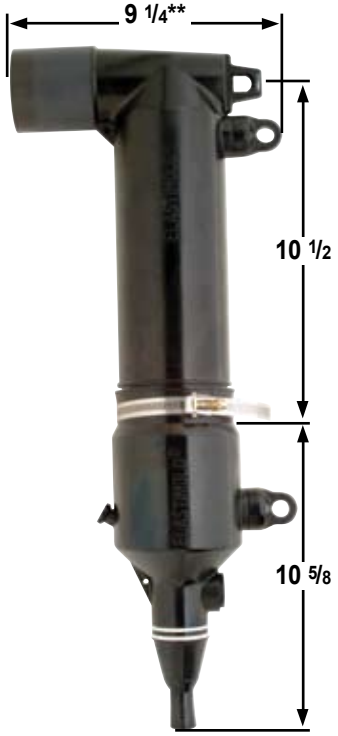
* Small Housing is used with 8.3kV (6-45Amp) and 15.5kV (6-20Amp) rated fuses
** Large Housing is used with 8.3kV (65 and 80Amp) and 17.2kV (6-45Amp) rated fuses



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 or ** 10 5/8
- 168FLR3 uses a large housing with a 15kV, 200 Amp elbow interface

ORDERING INFORMATION FOR FULL-RANGE CURRENT-LIMITING FUSES

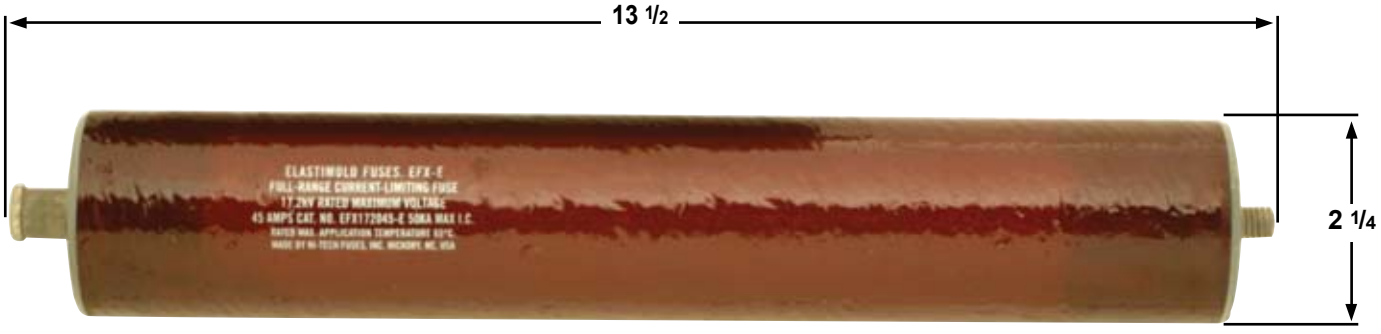
EFX YYY AAA - E

VOLTAGE RATING	
083	8.3kV
155	15.5kV
172	17.2kV

AMPERAGE RATING (A)*	
006	6
008	8
010	10
012	12
018	18
020	20
025	25
030	30
040	40
045	45
065	65
080	80

*8.3kV rated fuses are available in all Amp ratings listed
15.5kV rated fuses are available between 6-20Amps
17.2kV rated fuses are available between 6-45Amps

8.3/15.5 kV Fuse



8.3/17.2kV Fuse

All dimensions rounded up to the nearest eighth inch.

Molded Current-Limiting Fuses provide full-range fault current protection using specially designed fuse elements, rated through 23kV line to ground and 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 (see Table 1)
- 6 thru 115 Amp ratings for applications on 8.7/15kV grounded Wye systems (see Table 1)
- 6 thru 100 Amp ratings for applications on 15/25kV grounded Wye systems (see Table 1)
- 6 thru 50 Amp ratings for applications on 20/35kV grounded Wye systems (see Table 1)

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

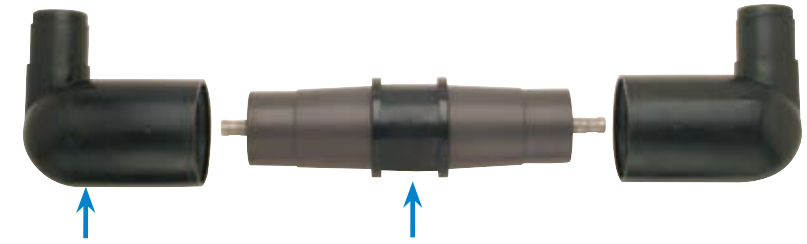
System Voltage Class (kV)	5	15	25/28*	35
Rated Maximum Fuse Voltage (kV)	5.5	10*	17.28*	23
Frequency (Hz)	50/60	50/60	50/60	50/60
BIL Impulse Withstand (kV)	60	95	125/140	150
One Minute AC Withstand (kV)	34	34	40-45	50
Fifteen Minute DC Withstand (kV)	53	53	78	103
Corona Extinction (kV)	11	11	19/21.5	26
Symmetrical Interrupting Capability (Amp)	50,000	50,000	50,000	50,000
Current Rating (Amp)	80-180	6-115	6-100	6-50

APPLICATION INFORMATION

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

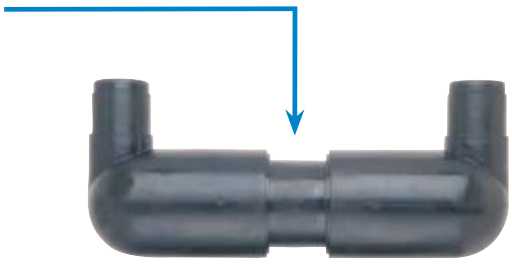
Ambient Temperature Range:– 30 to +65 degrees centigrade for 6-50 Amp fuses;
– 30 to +40 degrees centigrade for >50 Amp fuses.

* 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.



Interchangeable Molded Rubber End Fittings

Replaceable Molded Rubber Current-Limiting Fuse



Assembled Fuse Unit

Assembled Fuse Unit with Optional Wall Mounting Bracket

ELECTRICAL CHARACTERISTICS OF ENCAPSULATED FUSES USED IN MCLF

Fuse Voltage Rating (kV)	Current Rating (A)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Maximum Continuous Current 25°C	Maximum Continuous Current 40°C	Peak Arc Voltage (kV) (3)	Minimum Melt I^2t (AMP^2-SEC)	Maximum Total I^2t (2) (AMP^2-SEC)
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. Maximum total I^2t values are reduced for currents below 50,000A. For example, at 10,000A, I^2t values are approximately 15% less than the published values.
3. 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.

FUSE ORDERING INFORMATION

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

1. Select the Fuse Catalog Number from Table 1 based on the amperage and system voltage class. This table is also used to order spare or replacement fuses.
2. From Table 2 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 4.
3. Select Mounting Options (if required) from Table 3.

EXAMPLE:

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

CATALOG NO. M25CLF50-22
Mounting Options (See Table 3)

TABLE 1 – FUSE CATALOG NUMBERS

Amperage Rating	5kV Catalog No.	8.7/15kV GRD-Y* Catalog No.	15/25kV GRD-Y† Catalog No.	20/35kV GRD-Y Catalog No.
10	–	M15CLF010	M25CLF010	M35CLF010
20	–	M15CLF020	M25CLF020	M35CLF020
30	–	M15CLF030	M25CLF030	M35CLF030
40	–	M15CLF040	M25CLF040	M35CLF040
50	–	M15CLF050	M25CLF050	M35CLF050
65	–	M15CLF065	M25CLF065	–
80	M05CLF080	M15CLF080	M25CLF080	–
100	M05CLF100	M15CLF100	M25CLF100	–
125/115	M05CLF125	M15CLF115	–	–
150	M05CLF150	–	–	–
180	M05CLF180	–	–	–

NOTE: Fuses rated 6, 8, 12, 18 and 25 Amps are also available by special request.
Contact Factory for additional information.
Grounded Y systems must have enough grounded load to prevent the recovery voltage from exceeding the fuse's maximum voltage.
* For 65 Amp and higher, the fuses have a rated maximum voltage of 8.3 kV
† For 65 Amp and higher, the fuses have a rated maximum voltage of 15.5 kV

TABLE 2 – FUSE END FITTING ARRANGEMENTS

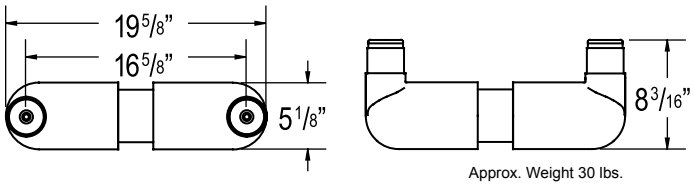
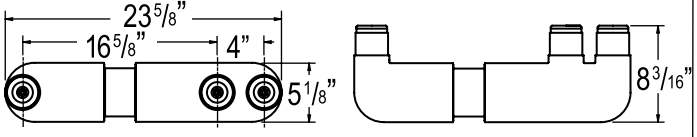
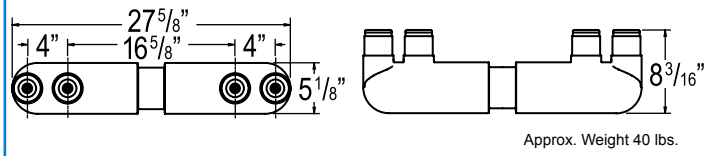
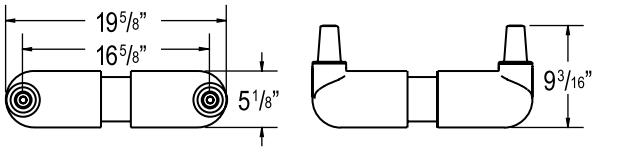
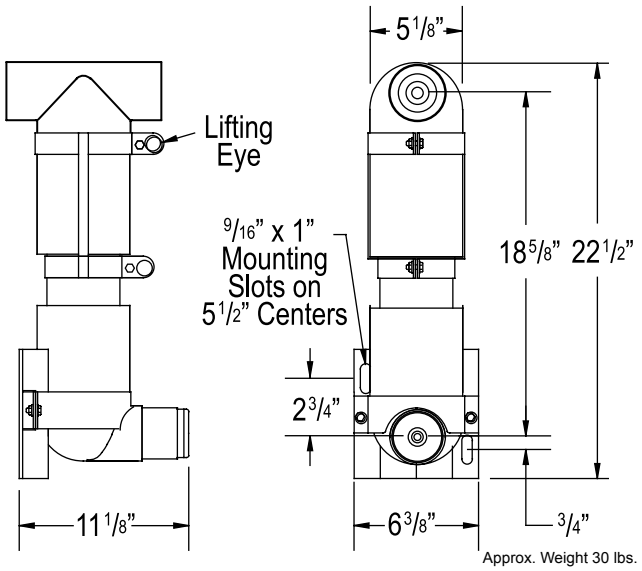
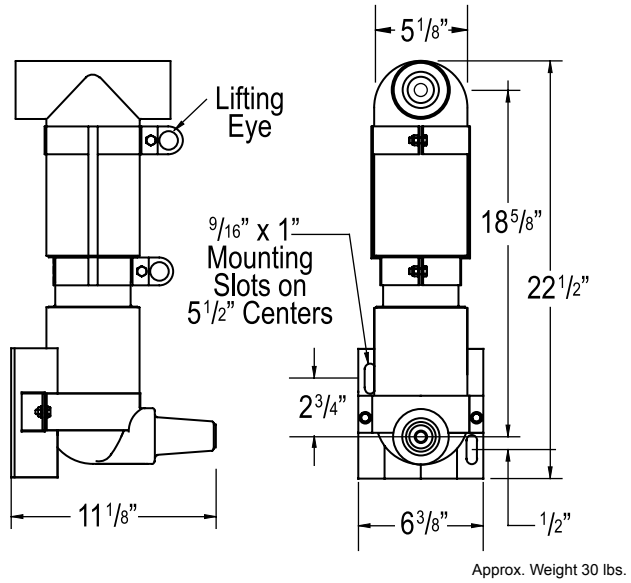
Outline	Model No.	Description
 Approx. Weight 30 lbs.	22	200 Amp Deepwell on both ends.
 Approx. Weight 35 lbs.	222	200 Amp Deepwell on one end and two 200 Amp Deepwells on the other end.

TABLE 2 – FUSE END FITTING ARRANGEMENTS (CONTINUED)

Outline	Model No.	Description
 Approx. Weight 40 lbs.	2222	Two 200 Amp Deepwell on both ends.
 Approx. Weight 30 lbs.	66	600 Amp Bushing on both ends.
 Approx. Weight 30 lbs.	6E2	600 Amp Elbow Connector on one end for attachment to equipment and a 200 Amp Deepwell on the other end. This arrangement is not available at 20/35kV
 Approx. Weight 30 lbs.	6E6	600 Amp Elbow Connector on one end for attachment to equipment and a 600 Amp bushing on the other end. This arrangements is not available at 20/35kV

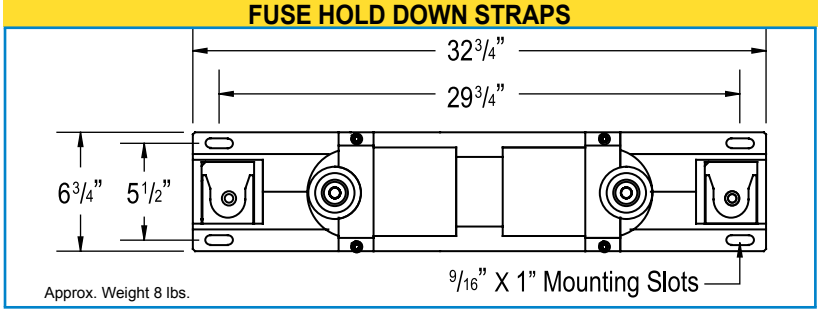
Note: Other models are available such as 26.

TABLE 3 – 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

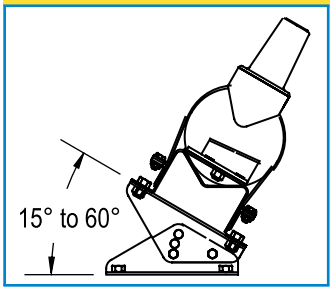


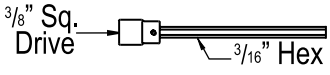
TABLE 4 – END FITTING CATALOG NUMBERS

Use this table only if end fittings are to be ordered and shipped separately from the fuse. Use Table 2 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	Figure 11
EF6E	600 Amp Elbow Connector End Fitting (kV)	5,15 & 25	Figure 11

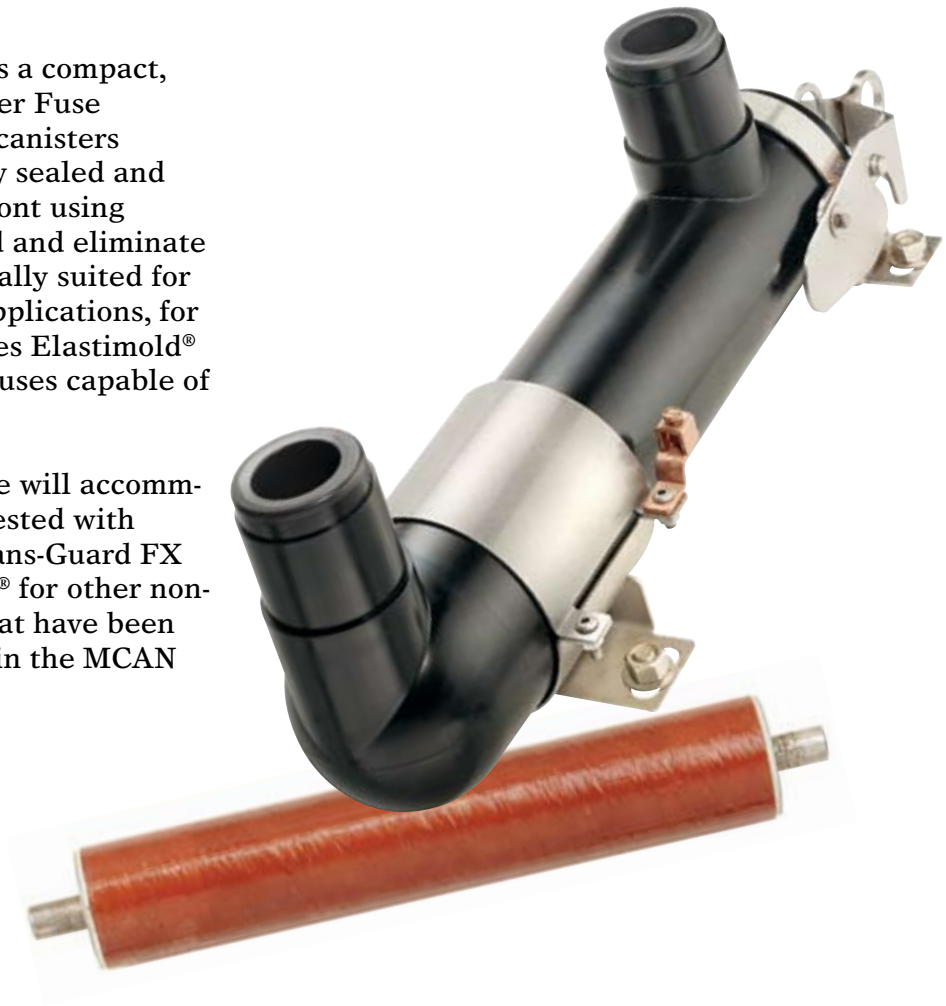
NOTE: EF6E is equipped with a standard thru hole spade lug (Type 03700).

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.

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 25kV. MCAN uses Elastimold® EFX full-range current-limiting fuses capable of interrupting up to 50kA.

The MCAN Molded Canister Fuse will accommodate and has been thoroughly tested with Elastimold® EFX and Hi-Tech Trans-Guard FX fuses. Please contact Elastimold® for other non-gassing, current-limiting fuses that have been qualified by Elastimold® for use in the MCAN Canister.



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 and EFX 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.

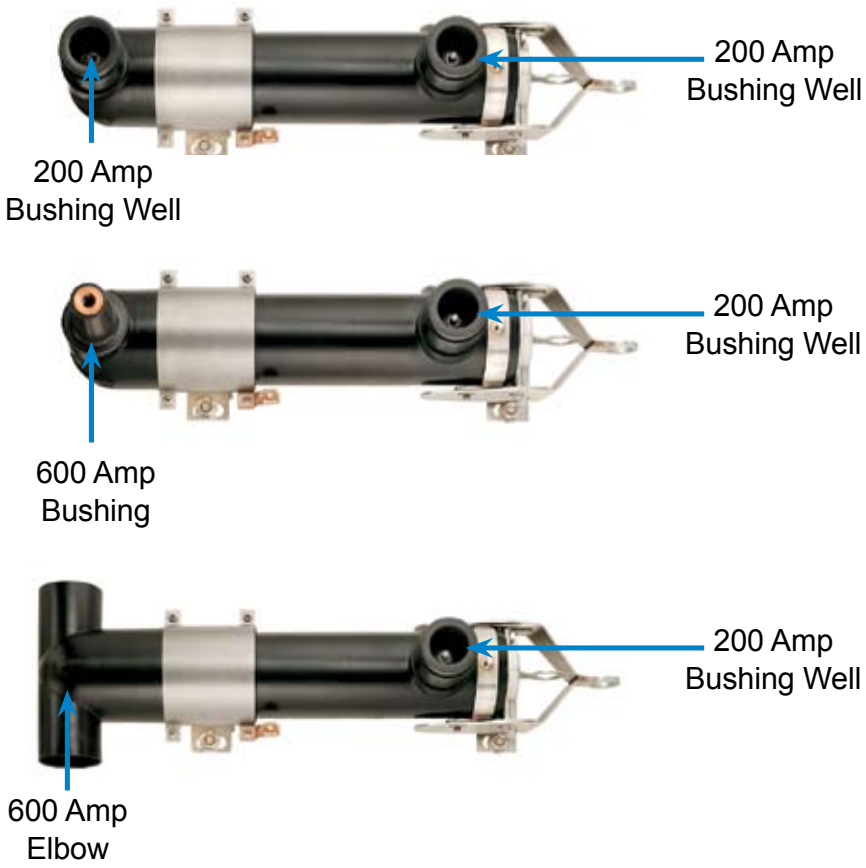
FUSE CANISTER RATINGS

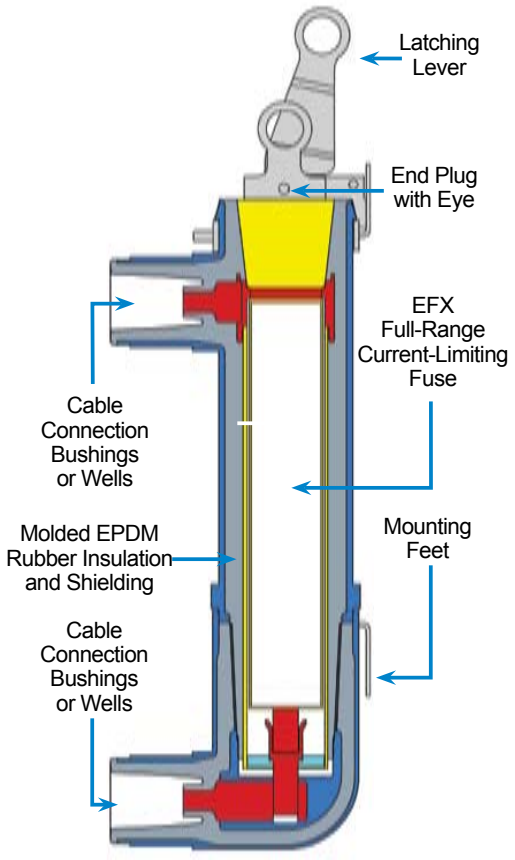
System Voltage Class (kV)	15	25/28	35
Maximum Line to Ground Voltage (kV)	10.0	17.2	23
BIL Impulse Withstand (kV)	95	125-140	150
One Minute AC Withstand (kV)	34	40-45	50
Fifteen Minute DC Withstand (kV)	53	78	103
Corona Extinction (kV)	11	19-21.5	26
Maximum Continuous Current (Amps)	200*	200*	200*
Momentary Current (kA)	10*	10*	10*
Construction: Submersible, corrosion resistant, fully shielded.			
Ambient Temperature Range: – 30 to +65 degrees centigrade			

FUSE RATINGS

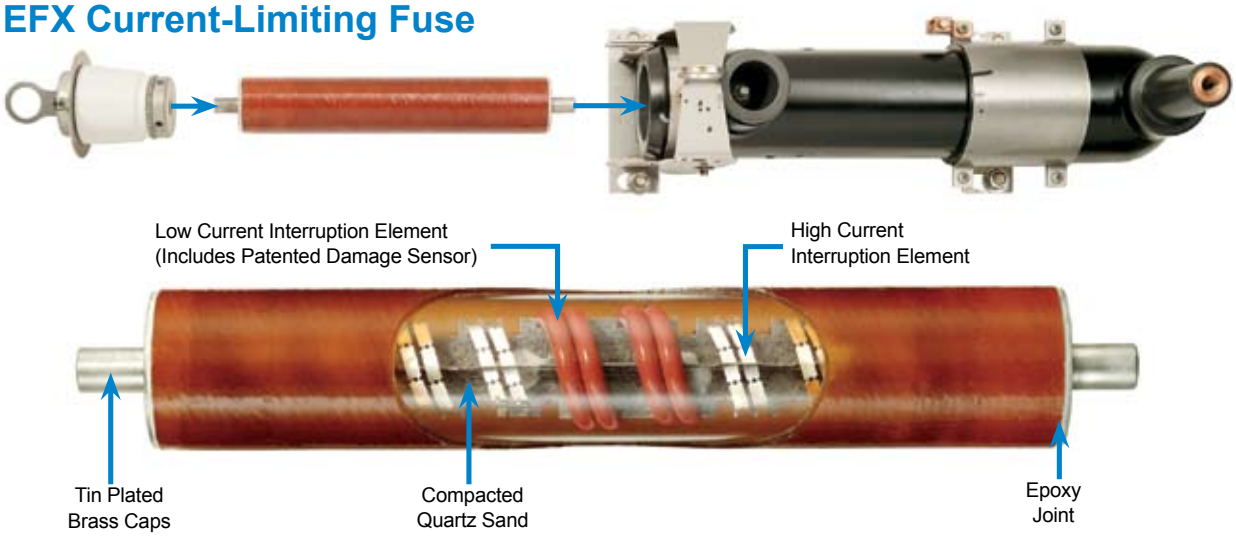
Nominal Voltage Rating (kV)	8.3	15.5	23.0
Rated Maximum Voltage (kV)	10.0	17.2	23.0
Frequency (Hz)	50-60	50-60	50-60
Current Rating (Amp)	3-80	3-50+	6-50+
Rated Maximum Interrupting Current (Sym. Amperes)	50,000	50,000++	50,000
Ambient Temperature Range: – 30 to 140° C for the 2.25" diameter fuse			

* Without Fuse
+ See Table 8
++ 3 Amp Fuse was Tested @ 44kA





EFX Current-Limiting Fuse



RECOMMENDED EFX MOUNTED IN A MCAN EPDM RUBBER INSULATED DRY WELL CANISTER AT 40° C AMBIENT TEMPERATURE

	Recommended Fuse Current Ratings (Amperes)																	
Fuse Voltage	**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		6a		3		3a		3a		3a		3a		3a		6a
15		10		6		6a		3		3		3a		3a		3a		6a
25	12	20	8	10		8		6		6		3		3		3		6a
37.5	20	30	12	18		12		8		8		6a		6a		6a		6a
50	25	50	18	25	12	20	10	12		10		6		6		6a		6a
75	50		25	40	20	30	12	20	12	20		10		8		8		6
100			30		25	50	18	25	18	25		12	10	12		10		8
167							30		30	50	18	25	18	25	12	20		12
250									50		25	50	25	40	20	30	18	25
333											50		30		25	50	20	30
500															50		40	

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

RECOMMENDED EFX MOUNTED IN A MCAN EPDM RUBBER INSULATED DRY WELL CANISTER AT 40° C AMBIENT TEMPERATURE

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

NOTE: 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. 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.

ELECTRICAL CHARACTERISTICS OF ELASTIMOLD® EFX FUSES

Nominal Fuse Voltage Rating (kV)	Current Rating (A)	Fuse Catalog Number	Rated Maximum Voltage (kV)	Maximum Continuous Current (in MCAN)			Peak Arc Voltage (kV) (5)	Minimum Melt I^2t (AMP^2-SEC)	Maximum Total I^2t (3) (4) (AMP^2-SEC)
				25°C	40°C	65°C			
8.3	3	EFX083003	10.0	4.3	4.2	3.9	30	100	350
	6	EFX083006		9.5	9.0	8.5	32	620	2,700
	8	EFX083008		11.5	11.0	10.5	28	800	4,000
	10	EFX083010		13.5	13.0	12.5	28	800	4,000
	12	EFX083012		17.5	17.0	16.0	26	920	8,000
	18	EFX083018		19.5	19.0	18.0	26	1,310	9,500
	20	EFX083020		24.0	23.0	21.5	26	1,620	11,000
	25	EFX083025		29.5	28.5	27.0	26	3,660	22,000
	30	EFX083030		34.0	33.0	31.0	26	5,250	30,000
	40	EFX083040		40.0	39.0	36.5	26	8,700	50,000
	50	EFX083050		45.5	44.0	42.0	26	12,800	70,000
	65	EFX083065	8.8	70.0	68.0	64.5	23	34,000	200,000
	80	EFX083080		80.0	77.5	73.5	22	51,200	280,000
15.5	3	EFX155003	17.2	4.3	4.2	3.9	51	100	510
	6	EFX155006		9.5	9.0	8.5	54	620	2,600
	8	EFX155008		11.5	11.0	10.5	46	800	3,700
	10	EFX155010		13.5	13.0	12.5	46	800	3,700
	12	EFX155012		17.5	17.0	16.0	43	920	6,500
	18	EFX155018		19.5	19.0	18.0	45	1,310	8,000
	20	EFX155020		24.0	23.0	21.5	45	1,620	10,000
	25	EFX155025		29.5	28.5	27.0	45	3,660	22,000
	30	EFX155030		34.0	33.0	31.0	45	5,250	30,000
23.0	40	EFX155040	23.0	40.0	39.0	36.5	45	8,700	50,000
	50	EFX155050		44.5	43.0	40.0	45	12,800	70,000
	6	EFX230006		9.5	9.0	8.5	67	620	3,100
	8	EFX230008		11.5	11.0	10.5	61	800	4,800
	10	EFX230010		13.5	13.0	12.5	61	800	4,800
	12	EFX230012		17.5	17.0	16.0	60	920	8,300
	18	EFX230018		19.5	19.0	18.0	60	1,310	11,200
	20	EFX230020		24.0	23.0	21.5	60	1,620	13,000
	25	EFX230025		29.5	28.5	27.0	60	3,660	28,000
	30	EFX230030		34.0	33.0	31.0	60	5,250	38,000
	40	EFX230040		38.5	37.0	35.0	60	8,700	61,000
	50	EFX230050		44.5	43.0	40.0	60	12,800	82,000

NOTES:

1. Designs have a 50,000 Amps rms. Symmetrical Rating (except 3A 17.2 kV which was tested at 44 kA maximum).
2. Tabulated Maximum Total I^2t 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 I^2t let-through when applied at voltages up to these higher values. For example, Maximum Total I^2t 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.
3. Maximum total I^2t values are reduced for currents below 50,000 A. For example, at 10,000 A, maximum total I^2t 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 currents and voltages will reduce the peak arc voltage. Consult the factory for further information.
5. 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 41 x .92 = 38 A (in air) or 34 x .92 = 31 (in MCAN).
6. 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 EFX fuse and an MCAN fuse canister:

1. Select the Fuse Catalog Number from Table 5 based on the amperage and "Rated Max Voltage (kV)" column. Note the fuses current carrying ability is reduced when used in a canister.

2. Based on selected fuse, select canister from the "Canister Catalog Number" column of Table 5. See Table 6 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 7.

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. EFX155050 AND MCAN-5B25-22

MCAN FUSE CODING SYSTEM

Mounting Code	Maximum Fuse Overall Length	Diameter Code	Maximum Fuse Overall Diameter
4	10"	B	2.25"
5	14.31"	B	2.25"
6	17.12"	B	2.25"

Note: Lower Mounting Codes (shorter) fuses may be applied in canisters of higher Mounting Codes by using an adapter. See Mounting Code Adapters table 7.

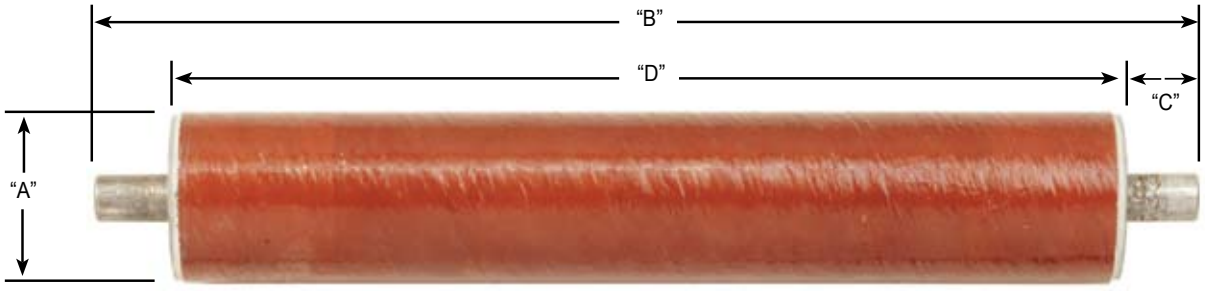


TABLE 5 ORDERING INFORMATION FOR EFX FUSES USED WITH MCAN

Current Rating (Amps)	Nominal Fuse Voltage Rating (kV)	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 (lbs)
3	8.3	EFX083003	10.0	4	B	2.25	10.0	1.02	7.96	MCAN-4B15-22 MCAN-4B15-66 MCAN-4B15-6E2 MCAN-4B15-6E6	3.00
6		EFX083006									
8		EFX083008									
10		EFX083010									
12		EFX083012									
18		EFX083018									
20		EFX083020									
25		EFX083025									
30		EFX083030									
40		EFX083040									
50		EFX083050									
65		EFX083065	8.8	5	B	2.25	14.31	1.02	12.27	MCAN-5B15-22 MCAN-5B15-66 MCAN-5B15-6E2 MCAN-5B15-6E6	4.25
80		EFX083080									
3	15.5	EFX155003	17.2	5	B	2.25	14.31	1.02	12.27	MCAN-5B25-22 MCAN-5B25-66 MCAN-5B25-6E2 MCAN-5B25-6E6	4.25
6		EFX155006									
8		EFX155008									
10		EFX155010									
12		EFX155012									
18		EFX155018									
20		EFX155020									
25		EFX155025									
30		EFX155030									
40		EFX155040									
50		EFX155050									
6	23.0	EFX230006	23.0	6	B	2.25	17.12	1.02	15.09	MCAN-6B25-66	4.75
8		EFX230008									
10		EFX230010									
12		EFX230012									
18		EFX230018									
20		EFX230020									
25		EFX230025									
30		EFX230030									
40		EFX230040									
50		EFX230050									

All dimensions are in inches
For 5kV systems, use the 8.3 kV rated fuses

TABLE 6 – WEIGHTS (LBS.) AND DIMENSIONS (IN.)

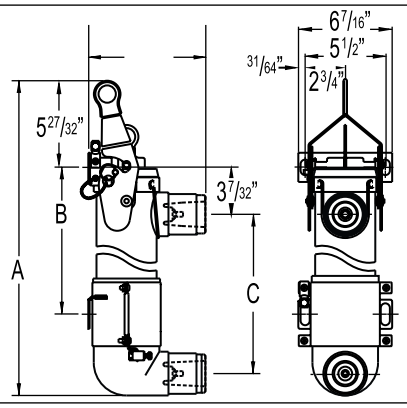
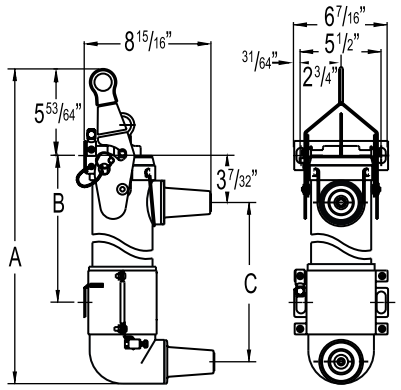
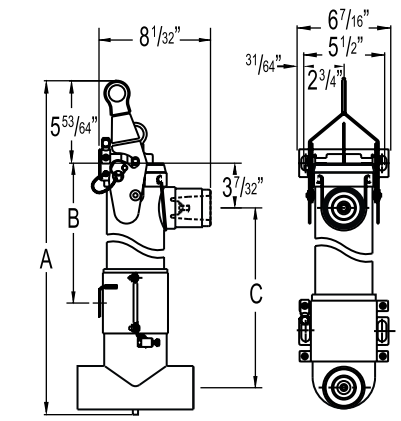
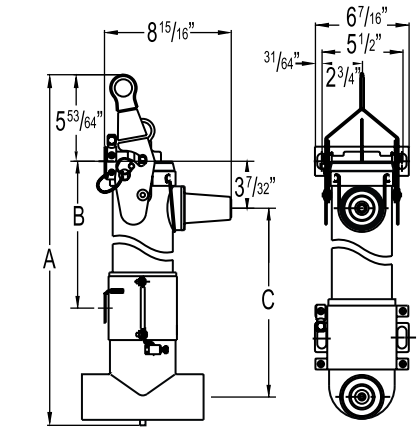
Outline	Catalog Number	(A)	(B)	(C)	Approx. Weight (lbs)	End Bushing*	Main Bushing*
	MCAN-4B15-22 MCAN-5B25-22	21.49 25.80	10.06 14.37	10.91 15.22	19 21	200 Amp Bushing Well	200 Amp Bushing Well
	MCAN-4B15-66 MCAN-5B25-66 MCAN-6B25-66	21.49 25.80 28.68	10.06 14.37 17.25	10.91 15.22 18.10	21 23 24	600 Amp Bushing	600 Amp Bushing
	MCAN-4B15-6E2 MCAN-5B25-6E2	23.90 28.21	10.06 14.37	12.91 17.22	20 22	600 Amp Elbow Connector	200 Amp Bushing Well
	MCAN-4B15-6E6 MCAN-5B25-6E6	23.90 28.21	10.06 14.37	12.91 17.22	20 22	600 Amp Elbow Connector	600 Amp Bushing

TABLE 7 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.

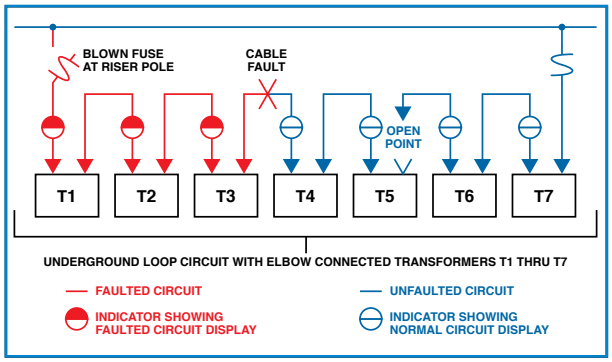
SUFFIX NUMBER	DESCRIPTION
-PS	Parking Stand between bushings

CATALOG NUMBER	DESCRIPTION
160WMPS	Wall Mount Parking Stand

Switchgear Assemblies

Elastimold® multi-point junctions shown in catalog PG-CA-0506 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.

Thomas & Betts' Elastimold® Fault Indicators aid in the location and isolation of the faulted cable or equipment in overhead and underground distribution systems through 35kV. This product guide details the different types of faulted circuit indicators, voltage indicators, and phase indicators. With a complete line of elbow test point mount and cable mount indicators, you will find the best product to meet your system's performance needs.



Fault Indicators reduce outage duration by quickly pinpointing the location of the fault. As shown in the circuit diagram, the fault is located between the last tripped indicator and the first untripped indicator. Once identified, this section is switched to become the new open point, allowing full service restoration to the rest of the customers during repairs.

Backfeed Prevention Using Fault Indicators

One concern, especially on three-phase installations of fault indicators, is causing a false trip or a false reset operation on the indicator due to current flowing through the cable into the fault. This current can be in the opposite direction to the fault current and cause a false trip or reset on indicators.

False tripping occurs when the indicator trips due to high currents that are feeding the fault from a down line location (e.g. from capacitor banks). TPMVOL or OLMVOL indicators won't false trip. After the fault occurs, the indicator located beyond the fault has no voltage running through it, which prevents any operation of the indicator even if the backfed current is above the trip setting.

False resetting occurs when an indicator that has tripped due to a single-phase fault detects voltage from the unfaulted phases (e.g. delta-connected load). This voltage could be enough to reset the indicator. TPMVOL and OLMVOL indicators won't false reset. These indicators reset based on time, so even if backfed voltage is available the indicators will not reset.

FEATURE	BENEFIT/DESCRIPTION
AccQTrip™ "Off The Trip" Logic Circuitry	Prevents false tripping due to transient current surges or system overloading.
AccQClamp™ Self Adjusting Mounting Provision	No need for customer to specify cable O.D. when ordering cable mount FCI's. The AccQClamp™ maintains 10% trip accuracy over the entire clamping range (.4"-2.2"), and is composed of U.V. stable polycarbonate, stainless steel reinforced materials.
Voltage Reset Fault Indicators	Eliminate false resetting and false tripping. Ideal for use on lightly loaded circuits where sufficient current may not be available to reliably energize a current reset type fault indicator. Automatic reset upon restoration of system voltage and/or time reset after 4 hours.
High/Low Trip Setting Selection	Coordinates FCI's with current limiting fuses. No minimum load current requirements and no load surveys needed.
Inrush Restraint Circuitry	Coordinates FCI's with circuit breaker or auto reclosure operation, avoiding misindication due to inrush currents.
Internal Adjacent Phase Shielding	Prevents electro-magnetic interference from adjacent phase conductors.
1 ms Trip Response Time	Coordinates FCI's with current limiting fuses, and other protective devices.
No False Trips Due to Back Feed	Voltage operated time reset indicators will not trip or reset due to current backfeed
Quality Manufacturing Processes	Manufactured using state-of-the-art surface mount technology, and premium quality electronic components, for the highest degree of performance and reliability. All fault indicators meet or exceed ANSI/IEEE Standard 495-1986.

Faulted Circuit Operation

t1 Fault Indicator is connected to the system and powers up. At 5kV, this takes 3 min. in the case of the test point mounted unit, and 6 min. in the case of the overhead type unit. At higher voltages the power up time is shorter.

t2 Fault current is detected. Fault Indicator is Armed after 1ms. Fault Indicator display shows Normal.

t3 Breaker/recloser locks out and voltage drops.

t4 Voltage is lost. (A 30-second time window allows for the protective device to clear the fault, and reclose) Indicator changes state.

Inrush Restraint Operation

t1 Fault Indicator is connected to the system and powers up. At 5kV, this takes 3 min. in the case of the test point mounted unit, and 6 min. in the case of the overhead type unit. At higher voltages the power up time is shorter.

t1 - t2 Upline recloser / breaker operation due to fault on another phase. After 100ms (t2) the Fault Indicator is disabled because there is no fault current detected.

t3 Recloser closes back. Voltage is back to normal. Unfaulted phases see Inrush. No change in the Fault Indicator display.

Overloading Operation

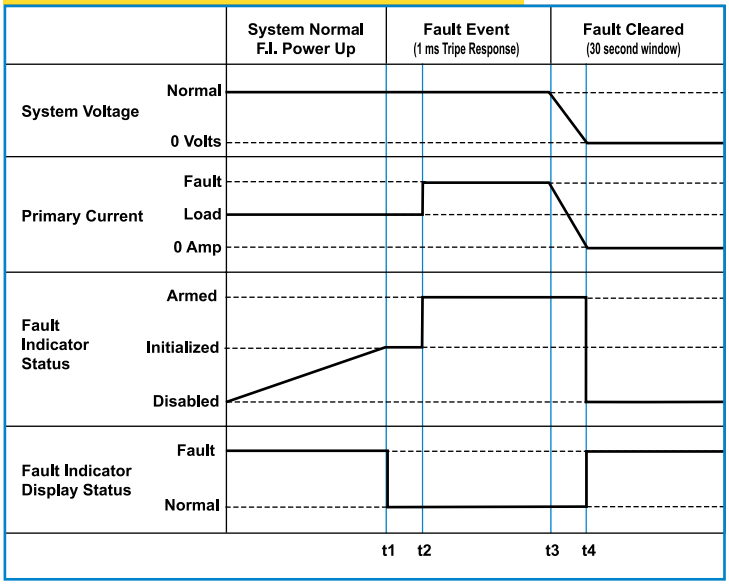
t1 Fault Indicator is connected to the system and powers up. At 5kV, this takes 3 min. in the case of the test point mounted unit, and 6 min. in the case of the overhead type unit. At higher voltages the power up time is shorter.

t2 Device downline from Fault Indicator switches creating an overload. Fault Indicator is Armed after 1ms. Fault Indicator display shows Normal.

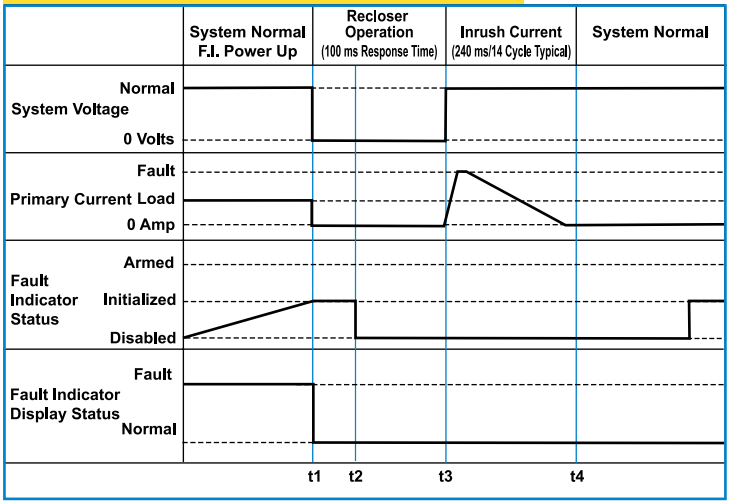
t3 Overload condition over. Fault Indicator does not change state.

t4 After 30 sec. Fault Indicator goes back to initialized state.

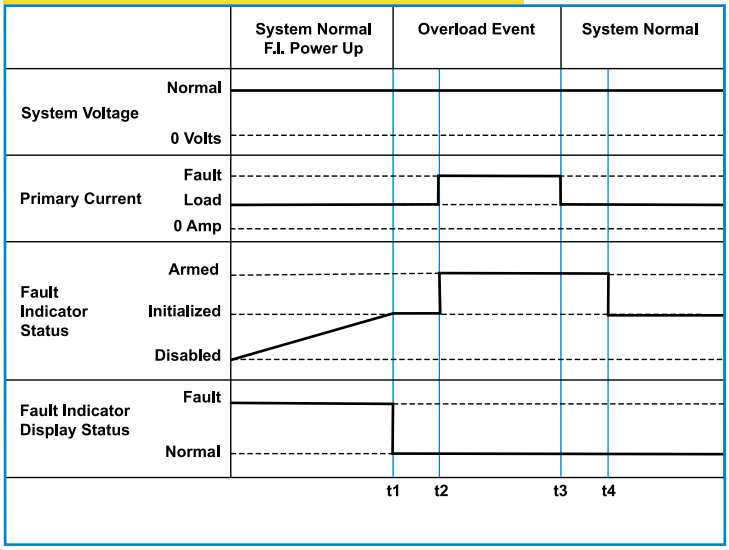
FAULTED CIRCUIT OPERATION



INRUSH RESTRAINT OPERATION



OVERLOADING OPERATION



TPM Series Standard Features

AccQTrip™ Logic Circuitry In voltage reset units prevents false indications due to inrush currents, cold load pickup, and overloading.

High/Low Trip Setting Selection No minimum load current requirement, and no load surveys needed.

Internal Magnetic Shielding Prevents adjacent phase effects

Trip Response .001 Seconds Coordinates with current limiting fuses, as well as other protection devices

Magnetically Latched Flag Indication Flag Indication will not change state due to shock or vibration

Light Weight, Compact and Sealed

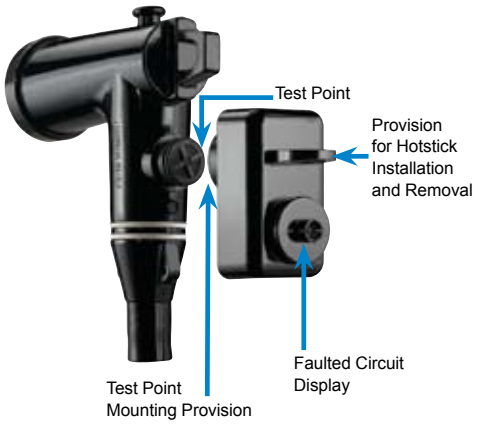
Test Point Mounted Fault Indicators provide a clear, visual means for locating faulted cables and equipment on underground distribution systems. Indicators are self-powered and consist of a solid state current sensor connected to a faulted circuit display. Designs incorporate advanced circuit logic, monitoring system protection operation and preventing indicator tripping unless an overcurrent condition is followed by a loss of system voltage. Trip and reset operations are automatic and the same indicator may be used for 5KV thru 35KV applications.

Units are designed to mount directly to 200 & 600 Amp elbows, splices and other cable accessory components equipped with IEEE 386 Standard capacitive test points. Indicators include a universal mounting provision allowing installation on test point products as manufactured by Elastimold® and others.

Designs feature compact, shielded and sealed, corrosion resistant construction. The indicator is enclosed in a rugged, impact resistant Lexan housing and includes an EPDM molded rubber, test point mounting boot. A built-in pulling eye allows for easy hotstick installation and removal of the indicator from the test point.

TPMVF
Model

TPMVL/TPMVOL
Model



Basic Operation

A faulted circuit produces an associated magnetic field which closes a reed switch in the indicator resulting in a tripped display. Trip response occurs in .001 seconds allowing the fault indicator to properly coordinate with all types of circuit protection schemes including current limiting fuses.

To eliminate confusing false trips, voltage reset indicators are equipped with inrush, backfeed, overload, and cold load pick up restraint circuitry as standard. Current sensors are constructed with internal shielding to prevent inadvertent tripping when located in close proximity to adjacent phases, such as junction mounted applications.

SPECIFICATIONS FOR TPM VOLTAGE OPERATED, TIME RESET, LED DISPLAY: MODEL TPMVOL

Nominal Trip Ratings	Low, 400 Amp; High, 800 Amp
Trip Response Time	1mS
Fault Clearing Time[1]	.001 – 30 Sec. Subsequent To Arming
Maximum Surge Level	25kA 10 Cycles 60 Hz
Effect of Adjacent Phase	Internal Shielding Prevents Adjacent Phase Effects
Inrush/Backfeed Restraint	100mS (Disable Delay)
Load Current Requirements	None
Power Up Requirement	3 Minutes @ 5kV
Display Type	Flashing Super Bright LED
Flash Rate	30 Flashes per Minute
LED Display Time	4 Hour – Standard
Reset Time	4 Hour-Standard (longer times available upon request)
Power Source[3]	3.6 volt Lithium Thyonil Chloride Battery
Battery Capacity	2.4 Ah
Battery Operating Life	1200 Flash Hours Minimum
Battery Storage Life	15-20 Years
Temperature Range	-40ºC To +85ºC
Housing Material	Mounting Boot – EPDM Conductive Rubber Housing Body – UV Stabilized Polycarbonate Polymer
Weight	258 Grams

SPECIFICATIONS FOR TPM VOLTAGE RESET, FLAG DISPLAY: MODEL TPMVF

Nominal Trip Ratings	Low, 400 Amp; High, 800 Amp
Trip Response Time	1mS
Fault Clearing Time[1]	.001 – 30 Sec. Subsequent To Arming
Maximum Surge Level	25kA 10 Cycles 60 Hz
Effect of Adjacent Phase	Internal Shielding Prevents Adjacent Phase Effects
Inrush Restraint Response	100mS (Disable Delay)
Load Current Requirements	None
Display Type	Mechanical Flag
Minimum Reset Voltage	5KV (Beginning Initializing Sequence)
Voltage Reset Time	3 Minutes @ 5KV
Power Source	Volt Test Point Powered
Temperature Range	-40ºC To +85ºC
Housing Material	Mounting Boot – EPDM Conductive Rubber Housing Body – UV Stabilized Polycarbonate Polymer
Weight	258 Grams

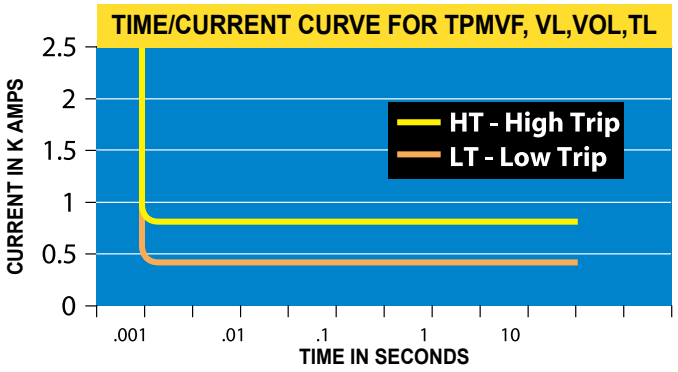
SPECIFICATIONS FOR TPM VOLTAGE RESET, LED DISPLAY: MODEL TPMVL

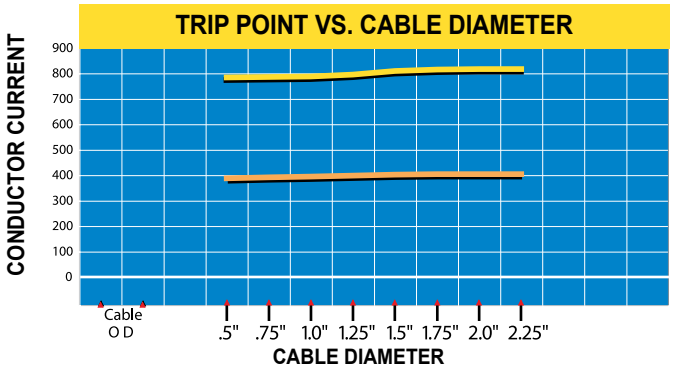
Nominal Trip Ratings	Low, 400 Amp; High, 800 Amp
Trip Response Time	1mS
Fault Clearing Time[1]	.001 – 30 Sec. Subsequent To Arming
Maximum Surge Level	25kA 10 Cycles 60 Hz
Effect of Adjacent Phase	Internal Shielding Prevents Adjacent Phase Effects
Inrush Restraint Response	100mS (Disable Delay)
Load Current Requirements	None
Power Up Requirement	3 Minutes @ 5kV
Display Type	Flashing Super Bright LED
Flash Rate	30 Flashes per Minute
LED Display Time	4 Hour – Standard
Voltage Reset Time	3 Minutes @ 5kV
Power Source[3]	3.6 volt Lithium Thyonil Chloride Battery
Battery Capacity	2.4 Ah
Battery Operating Life	1200 Flash Hours Minimum
Battery Storage Life	15-20 Years
Temperature Range	-40ºC To +85ºC
Housing Material	Mounting Boot – EPDM Conductive Rubber Housing Body – UV Stabilized Polycarbonate Polymer
Weight	258 Grams

SPECIFICATIONS FOR TPM VOLTAGE RESET, LED DISPLAY: MODEL TPMTL[2]

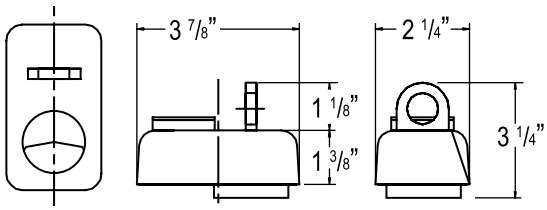
Nominal Trip Ratings	Low, 400 Amp; High, 800 Amp
Trip Response Time	1mS
Maximum Surge Level	25kA 10 Cycles 60 Hz
Effect of Adjacent Phase	Internal Shielding Prevents Adjacent Phase Effects
Power Up Requirement	None
Display Type	Flashing Super Bright LED
Flash Rate	30 Flashes per Minute
Reset Time	4 Hour – Standard
Power Source[3]	3.6 volt Lithium Thyonil Chloride Battery
Battery Capacity	2.4 Ah
Battery Operating Life	1200 Flash Hours Minimum
Battery Storage Life	15-20 Years
Temperature Range	-40ºC To +85ºC
Housing Material	Mounting Boot – EPDM Conductive Rubber Housing Body – UV Stabilized Polycarbonate Polymer
Weight	258 Grams

NOTES:
1) Prevents false trips due to short time interruptions without loss of voltage.
2) Inrush restraint is standard on voltage reset models. It is not available on time reset models.
3) Battery powers LED and it is active only when LED is ON. Lithium Thyonil Chloride batteries provide accurate indication throughout the entire temperature range.





DIMENSIONS



ORDERING INFORMATION

CATALOG PREFIX

Catalog Number	Description	Reset Operation
TPMTL	Time Reset with LED Display	Indicator auto-resets to normal after a four-hour time duration. Indicator may also be manually reset using an FTT test tool.
TPMVF	Voltage Reset with Flag Display	Indicator auto-resets to normal after system voltage restoration. Reset requires 5kV minimum voltage to operate. Reset operation time is proportional to system voltage. Example: at 15kV, reset occurs 30 seconds after system voltage restoration.
TPMVL	Voltage Reset with LED Display	
TPMVOL	Voltage Operated, Time Reset, LED display	Indicator auto-resets after a four-hour time period. Longer time resets are available upon request.

CATALOG SUFFIX

Catalog Number	Description
LT	All fused taps use LOW trips ratings. For 200 Amp. URD applications, use LOW trip rating
HT	For 600 Amp. URD applications, use HIGH trip rating

For overhead bulk feeder applications, use HIGH or LOW trip ratings (whichever is greater than the minimum pickup setting of the related protection device).

UCM Series Standard Features

AccQClamp™ Mounting Provision Universal one-size-fits-all design automatically adjusts

High/Low Trip Setting Selection No minimum load current requirement, and no load surveys needed.

Trip Response .001 Seconds Coordinates with current limiting fuses, as well as other protection devices

Internal Magnetic Shielding Prevents adjacent phase effects

URD Cable Mounted Fault Indicators aid in locating faulted cables and equipment on underground distribution systems. Indicators are self powered and consist of a solid state current sensor connected to faulted circuit display.

Units are designed for direct installation to an underground power cable using a spring loaded, over center toggle clamp mounting provision. The clamp accommodates cables ranging from .4 to 2.2 inches in diameter and includes retainer pads to prevent slip and twist. The clamp positions the cable conductor at a constant distance from the current sensor, maintaining indicator trip accuracy over the entire range of cable sizes.

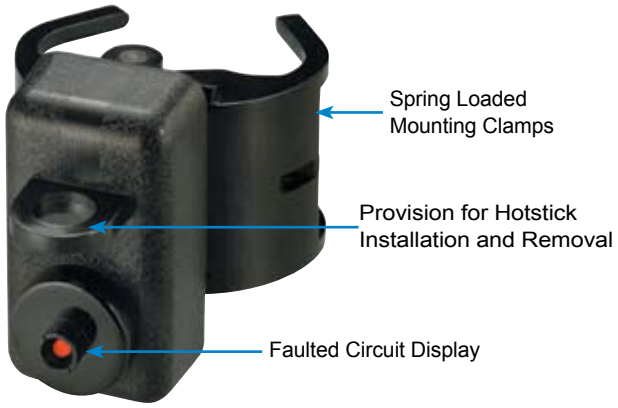
Designs feature compact, shielded and sealed, corrosion resistant construction. The indicator is enclosed in a durable, impact resistant Lexan housing and includes a built-in pulling eye for easy hotstick installation and removal from the cable.

Basic Operation

A faulted circuit produces an associated magnetic field which closes a reed switch in the indicator resulting in a tripped display. Trip response occurs in .001 seconds allowing the fault indicator to properly coordinate with all types of circuit protection schemes including current limiting fuses.

URD Cable Mounted Fault Indicators are constructed with an internally shielded current sensor that prevents inadvertent tripping when located in close proximity to adjacent phases, such as junction mounted applications.

UCMTL
Model



SPECIFICATIONS FOR UCM TIME RESET, LED DISPLAY: MODEL UCMTL

Nominal Trip Ratings	Low, 400 Amp; High, 800 Amp
Trip Response Time	1mS
Maximum Surge Level	25kA 10 Cycles 60 Hz
Effect of Adjacent Phase	Internal Shielding Prevents Adjacent Phase Effects
Display Type	Flashing Super Bright LED
Flash Rate	30 Flashes per Minute
Reset Time	4 Hour - Standard
Power Source[1]	3.6 volt Lithium Thyonil Chloride Battery
Battery Capacity	2.4 Ah
Battery Operating Life	1200 Flash Hours Minimum
Battery Storage Life	15-20 Years
Temperature Range	-40ºC To +85ºC
Housing Material	Mounting Boot – EPDM Conductive Rubber Housing Body – UV Stabilized Polycarbonate Polymer
Weight	258 Grams

Footnotes
1) Battery powers LED and it is active only when LED is ON. Lithium Thyonil Chloride batteries provide accurate indication throughout the entire temperature range.

TYPICAL INSTALLATION

As shown below, proper installation of URD Cable Mounted Fault Indicators requires routing cable neutral wires to prevent the ground return from affecting trip accuracy. Similar procedures should be followed for tape, wire, LC or other types of shielded cable constructions.

INSTALL FAULT INDICATOR IN AREA SHOWN

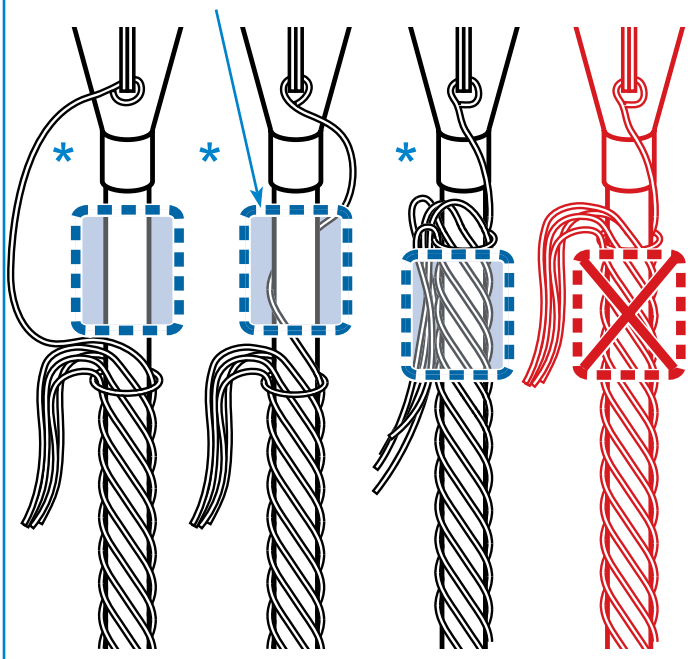
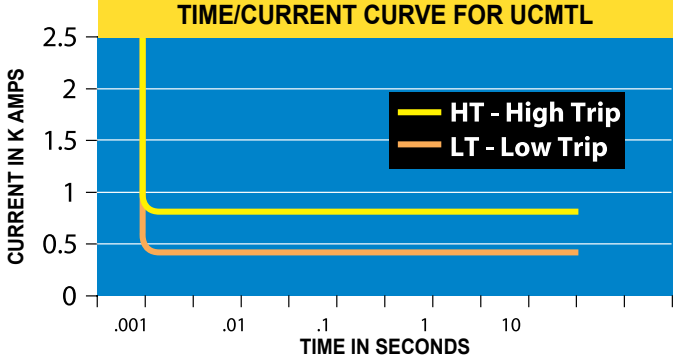


Fig. 1 Fig. 2 Fig. 3 Fig. 4 INCORRECT

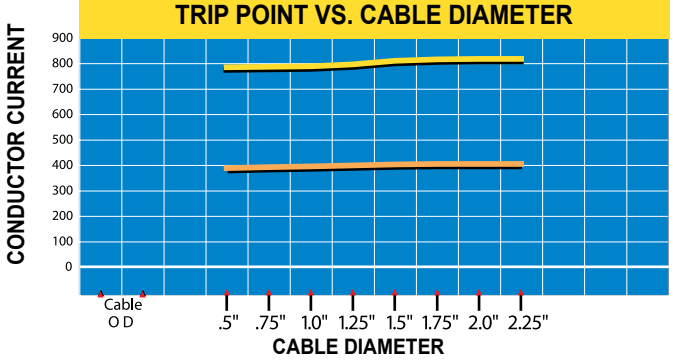
* Recommended

Do not install indicator directly over the concentric neutral to avoid misindication (Fig. 4)

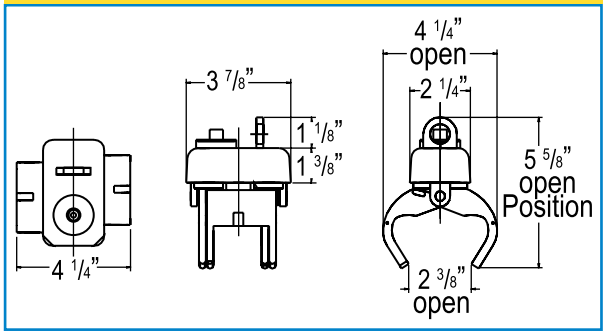
TIME/CURRENT CURVE FOR UCMTL



TRIP POINT VS. CABLE DIAMETER



DIMENSIONS



ORDERING INFORMATION

CATALOG PREFIX

Catalog Number	Description	Reset Operation
UCMTL	Time Reset with LED Display	Indicator auto-resets to normal after a four-hour time duration. Indicator may also be manually reset using an FTT test tool.

CATALOG SUFFIX

Catalog Number	Description
LT	All fused taps use LOW trips ratings. For 200 Amp. URD applications, use LOW trip rating
HT	For 600 Amp. URD applications, use HIGH trip rating

For overhead bulk feeder applications, use HIGH or LOW trip ratings (whichever is greater than the minimum pickup setting of the related protection device).

AccQClamp™ is a trademark of Quality Indications, Inc.

OLM Standard Features

AccQTrip™ Logic Circuitry In voltage reset units prevents false indications due to inrush currents, cold load pickup, and overloading

AccQClamp™ Mounting Provision Universal one-size-fits-all design automatically adjusts

High/Low Trip Setting Selection No minimum load current requirement, and no load surveys needed

Trip Response .001 Seconds Coordinates with current limiting fuses, as well as other protection devices

Internal Magnetic Shielding Prevents adjacent phase effects

Magnetically Latched Flag Indication Flag Indication will not change states due to shock or vibration

Light Weight, Compact and Sealed

OLMVF
Model

OLMVL/OLMVOL
Model

Overhead Line Fault Indicators aid in locating faulted circuits and equipment on overhead distribution systems. Indicators are self powered and consist of a solid state current sensor connected to a faulted circuit display. Designs incorporate advanced circuit logic, monitoring system protection operation and prevent indicator tripping unless an overcurrent condition is followed by a loss of system voltage. Trip and reset operations are automatic and the same indicator may be used for 5kV thru 35kV line-to-ground applications.

Units are designed for direct installation to the overhead line using a spring loaded, over center, toggle clamp mounting provision. The clamp accommodates conductors ranging from .4 to 2.2 inches in diameter and includes retainer pads to prevent slip and twist. The clamp positions the conductor at a constant distance from the current sensor, maintaining indicator trip accuracy over the entire range of conductors. Designs are compact, sealed and corrosion resistant.

Model OLMTL

Basic Operation

A faulted circuit produces an associated magnetic field which closes a reed switch in the indicator resulting in a tripped display. Trip response occurs in .001 seconds allowing the fault indicator to properly coordinate with all types of circuit protection schemes including current limiting fuses.

To eliminate confusing false trips, indicators are equipped with inrush, overload and cold load pick up restraint circuitry as standard. Current sensors are constructed with internal shielding to prevent inadvertent tripping when located in close proximity to adjacent phases.

SPECIFICATIONS FOR OLM VOLTAGE OPERATED, TIME RESET, LED DISPLAY: MODEL OLMVOL

Nominal Trip Ratings	Low, 400 Amp; High, 800 Amp
Trip Response Time	1mS
Fault Clearing Time[1]	.001 – 30 Sec. Subsequent To Arming
Maximum Surge Level	25kA 10 Cycles 60 Hz
Effect of Adjacent Phase	Internal Shielding Prevents Adjacent Phase Effects
Inrush/Backfeed Restraint	100mS (Disable Delay)
Load Current Requirements	None
Power Up Requirement	6 Minutes @ 5kV
Display Type	Flashing Super Bright LED
Flash Rate	30 Flashes per Minute
LED Display Time	4 Hour – Standard
Reset Time	4 Hour-Standard (longer times available upon request)
Power Source[3]	3.6 volt Lithium Thyonil Chloride Battery
Battery Capacity	2.4 Ah
Battery Operating Life	1200 Flash Hours Minimum
Battery Storage Life	15-20 Years
Temperature Range	-40ºC To +85ºC
Housing Material	Mounting Boot – EPDM Conductive Rubber Housing Body – UV Stabilized Polycarbonate Polymer
Weight	258 Grams

SPECIFICATIONS FOR OLM VOLTAGE RESET, FLAG DISPLAY: MODEL OLMVF

Nominal Trip Ratings	Low, 400 Amp; High, 800 Amp
Trip Response Time	1mS
Fault Clearing Time[1]	.001 – 30 Sec. Subsequent To Arming
Maximum Surge Level	25kA 10 Cycles 60 Hz
Effect of Adjacent Phase	Internal Shielding Prevents Adjacent Phase Effects
Inrush Restraint Response	100mS (Disable Delay)
Load Current Requirements	None
Display Type	Mechanical Flag
Minimum Reset Voltage	5KV (Beginning Initializing Sequence)
Voltage Reset Time	6 Minutes @ 5KV
Power Source	Volt Test Point Powered
Temperature Range	-40ºC To +85ºC
Housing Material	Mounting Boot – EPDM Conductive Rubber Housing Body – UV Stabilized Polycarbonate Polymer
Weight	258 Grams

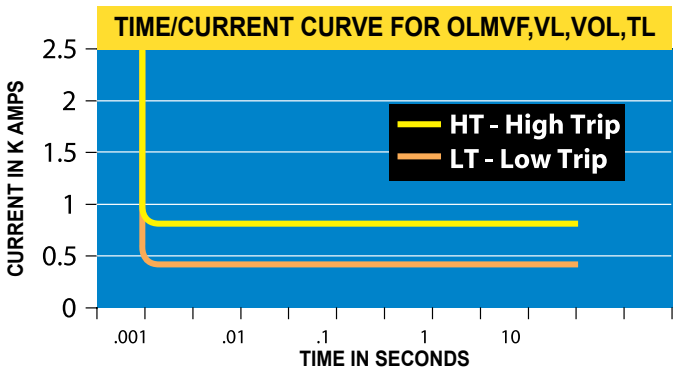
SPECIFICATIONS FOR OLM VOLTAGE RESET, LED DISPLAY: MODEL OLMVL

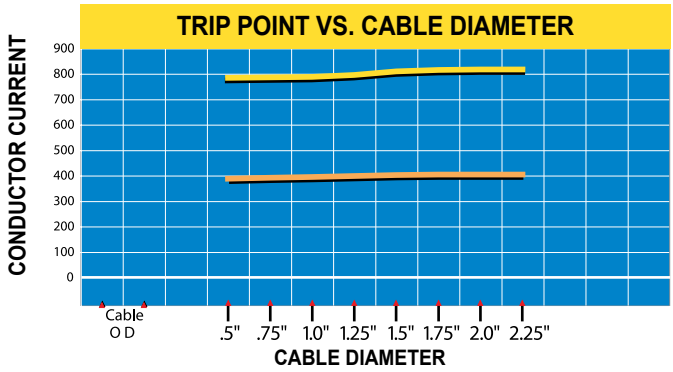
Nominal Trip Ratings	Low, 400 Amp; High, 800 Amp
Trip Response Time	1mS
Fault Clearing Time[1]	.001 – 30 Sec. Subsequent To Arming
Maximum Surge Level	25kA 10 Cycles 60 Hz
Effect of Adjacent Phase	Internal Shielding Prevents Adjacent Phase Effects
Inrush Restraint Response	100mS (Disable Delay)
Load Current Requirements	None
Power Up Requirement	6 Minutes @ 5kV
Display Type	Flashing Super Bright LED
Flash Rate	30 Flashes per Minute
LED Display Time	4 Hour – Standard
Voltage Reset Time	6 Minutes @ 5kV
Power Source[3]	3.6 volt Lithium Thyonil Chloride Battery
Battery Capacity	2.4 Ah
Battery Operating Life	1200 Flash Hours Minimum
Battery Storage Life	15-20 Years
Temperature Range	-40ºC To +85ºC
Housing Material	Mounting Boot – EPDM Conductive Rubber Housing Body – UV Stabilized Polycarbonate Polymer
Weight	258 Grams

SPECIFICATIONS FOR OLM VOLTAGE RESET, LED DISPLAY: MODEL OLMTL[2]

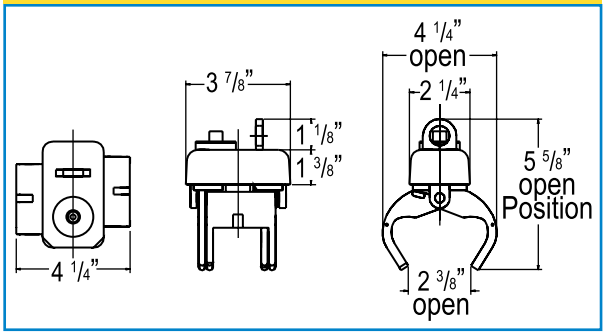
Nominal Trip Ratings	Low, 400 Amp; High, 800 Amp
Trip Response Time	1mS
Maximum Surge Level	25kA 10 Cycles 60 Hz
Effect of Adjacent Phase	Internal Shielding Prevents Adjacent Phase Effects
Power Up Requirement	None
Display Type	Flashing Super Bright LED
Flash Rate	30 Flashes per Minute
Reset Time	4 Hour – Standard
Power Source[3]	3.6 volt Lithium Thyonil Chloride Battery
Battery Capacity	2.4 Ah
Battery Operating Life	1200 Flash Hours Minimum
Battery Storage Life	15-20 Years
Temperature Range	-40ºC To +85ºC
Housing Material	Mounting Boot – EPDM Conductive Rubber Housing Body – UV Stabilized Polycarbonate Polymer
Weight	258 Grams

NOTES:
1) Prevents false trips due to short time interruptions without loss of voltage.
2) Inrush restraint is standard on voltage reset models. It is not available on time reset models.
3) Battery powers LED and it is active only when LED is ON. Lithium Thyonil Chloride batteries provide accurate indication throughout the entire temperature range.





DIMENSIONS



ORDERING INFORMATION

CATALOG PREFIX

Catalog Number	Description	Reset Operation
OLMTL	Time Reset with LED Display	Indicator auto-resets to normal after a four-hour time duration. Indicator may also be manually reset using an FTT test tool.
OLMVF	Voltage Reset with Flag Display	Indicator auto-resets to normal after system voltage restoration. Reset requires 5kV minimum voltage to operate. Reset operation time is proportional to system voltage. Example: at 15kV, reset occurs 30 seconds after system voltage restoration.
OLMVL	Voltage Reset with LED Display	
OLMVOL	Voltage Operated, Time Reset, LED Display	Indicator auto-resets after a four-hour time duration. Longer time resets are available upon request.

CATALOG SUFFIX

Catalog Number	Description
LT	All fused taps use LOW trips ratings. For 200 Amp. URD applications, use LOW trip rating
HT	For 600 Amp. URD applications, use HIGH trip rating

For overhead bulk feeder applications, use HIGH or LOW trip ratings (whichever is greater than the minimum pickup setting of the related protection device).

Field Test Tool permits field testing and reset of fault indicators and provides assurance that the indicator is properly functioning. The test tool is light weight, portable and incorporates a built-in magnet which operates the indicator trip and reset functions. The unit is equipped with provisions for hotstick handling and operation.

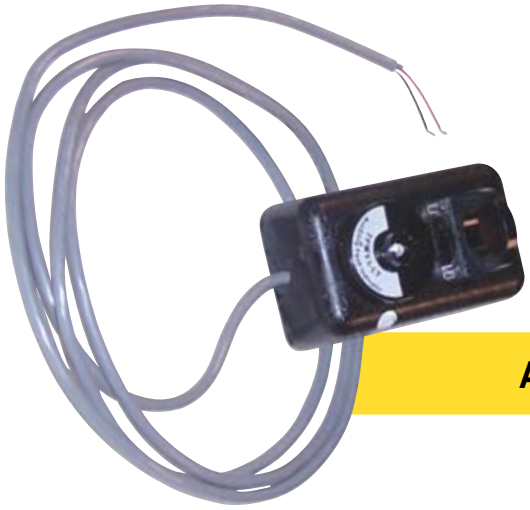
FTT

FO-CABLE06

Remote Fiber Optic Indicator for Underground Fault Indicators with LED Display can be extended to the outside of enclosures and/or vaults for ease of access and fault location.

All the hardware for mounting the remote end of the cable to the enclosure is included. The display has a large reflective bolt to enhance visibility.

Auxiliary Contacts for Underground Fault Indicators makes possible to determine the status of fault indicators in the field from the SCADA master station. Auxiliary contacts in the fault indicators can be fed to an RTU.



AC

CATALOG NUMBER	DESCRIPTION
FTT	Field Test Tool, overall dimensions 2” wide x 3” high x 5/8” deep
FO-CABLE06	Remote Fiber Optic Indicator for UFI

CATALOG SUFFIX	DESCRIPTION
AC	Auxiliary Contacts available for Test Point Mounted Voltage Reset Underground Fault Indicator units. Add Suffix to Fault Indicator’s catalog number. Example: TPMVLAC-HT

V2 Standard Features

Test Point Mounted Neon Voltage Indicators provide a convenient, visual method for determining the energized status of underground distribution circuits. The indicator consists of a self-powered voltage sensor connected to a neon light that flashes when energized. Flash rate is proportional to the system voltage and the same indicator may be used for 5KV thru 35KV applications.

Units are designed to mount directly to 200 & 600 Amp elbows, splices and other cable accessory components equipped with IEEE 386 Standard capacitive test points. Indicators include a universal mounting provision allowing installation on test point products as manufactured by Elastimold® and others.

Designs feature compact, shielded and sealed, corrosion resistant construction. The indicator is enclosed in a durable EPDM molded rubber housing and includes a built-in pulling eye for easy hotstick installation and removal of the indicator from the test point.

Self Powered Flashing Neon Display

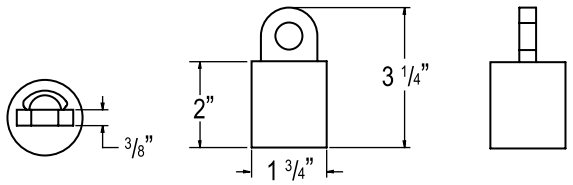
Elastimold® Voltage Indicators are self powered from the test point and are provided with a 20-year, long life neon bulb. A reflective background surrounds the bulb to provide increased brightness. Flash rate per minute is proportional to the phase to phase system voltage with output as follows:

VOLTAGE & FLASH RATE

5kV voltage	20 flash rate	25kV voltage	140 flash rate
10kV voltage	40 flash rate	30kV voltage	160 flash rate
15kV voltage	70 flash rate	35kV voltage	180 flash rate
20kV voltage	100 flash rate		

Voltage Indicator Test Box permits field testing of V2 Voltage Indicators and provides assurance that the indicator is properly functioning. The test box is lightweight, portable and self powered by replaceable C-Size batteries. The unit includes a standard Elastimold® test point, a push to test button, a green LED operation indicating light and a rugged, impact resistant plastic housing.

DIMENSIONS



V2-TB

Basic Operation

1. Mount the Neon Voltage Indicator to the test point provision on the test box.
2. Push and hold the test button to energize the test point. The green LED light will flash indicating that battery voltage is sufficient and that the test box is operating properly.
3. Continue holding the test button until the Neon Voltage Indicator begins to flash. If flashing does not occur after approximately 30 seconds then the Neon Voltage Indicator is defective and should be discarded.

V1 BIP Standard Features

Elbow BIP Mounted Neon Voltage Indicators

provide a convenient, visual method for determining the energized status of underground distribution circuits. The indicator consists of a self-powered voltage sensor connected to a neon light that flashes when energized. Flash rate is proportional to the system voltage and the same indicator may be used for 5KV thru 35KV applications.

Units are designed to mount directly to 600 Amp T elbows equipped with IEEE 386 Standard BIP Interface.

Design features compact, shielded and sealed, corrosion resistant construction. The indicator includes a built-in pulling eye for easy hotstick installation and removal of the indicator from the test point.

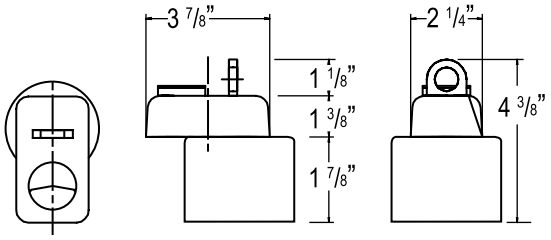
Self Powered Flashing Neon Display

Elastimold® Voltage Indicators are self powered from the test point and are provided with a 20-year, long life neon bulb. A reflective background surrounds the bulb to provide increased brightness. Flash rate per minute is proportional to the phase to phase system voltage with output as follows:

VOLTAGE & FLASH RATE

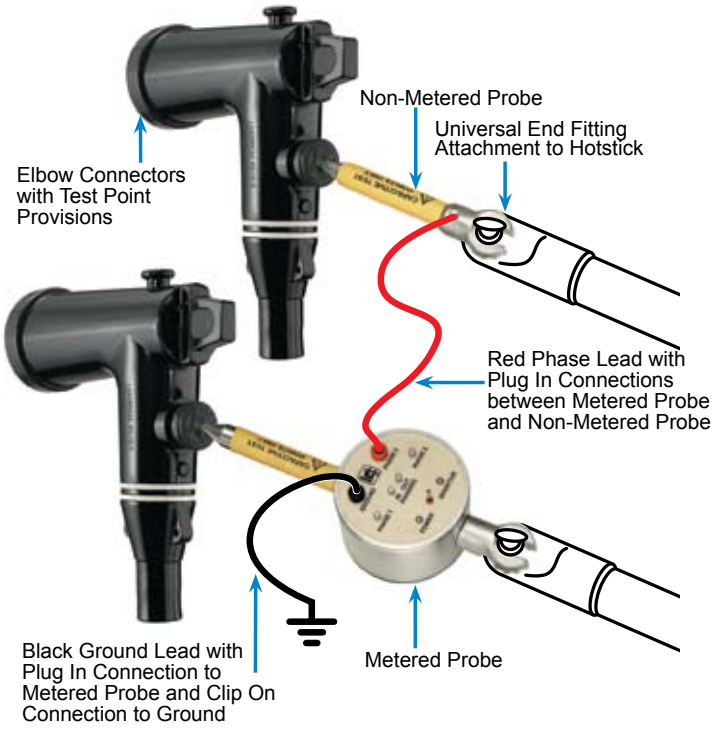
5kV voltage	30 flash rate	25kV voltage	200 flash rate
10kV voltage	60 flash rate	30kV voltage	230 flash rate
15kV voltage	100 flash rate	35kV voltage	260 flash rate
20kV voltage	140 flash rate		

DIMENSIONS



PD35 Standard Features used for determining the correct phasing and energized status of single and three phase underground distribution circuits, rated 5kV thru 35kV. The unit has been specifically designed for use on 200 & 600 Amp elbows, splices and other cable accessory components equipped with IEEE 386 Standard capacitive test points. The tool eliminates direct exposure to high voltage while using established indirect test methods for capacitance-coupled, cable connection test points.

The Phase & Voltage Indicator is designed for hotstick operation and includes universal end fittings for convenient mounting to existing hotsticks. The unit is lightweight, portable and self-powered by a built-in, replaceable, standard 9-volt battery. The tool features rugged, impact resistant construction and easily readable LED indicator lights. Advanced low impedance, solid state circuitry provides accurate and reliable readings with sensitivity as low as 1.5KV phase to ground.



1. Attach the metered probe to a hotstick and connect the BLACK ground lead.
2. Switch the meter to the ON position. The red LED power light will illuminate indicating that battery voltage is sufficient. All other LED indicators will momentarily light up showing that the meter is operating properly.
3. To test for voltage:
   - Touch the metered probe to the test point on the cable connection.
   - The amber PHASE 1 LED indicator light will illuminate showing that the high voltage circuit is energized.
4. To test for proper phasing:
   - Attach the non-metered probe to an additional hotstick and connect the RED phase lead from the metered probe to the non-metered probe.
   - Touch one probe to the test point on one of the cable connections. Touch the other probe to the test point on the other cable connection.
   - The amber PHASE 1 and PHASE 2 LED indicator lights will illuminate showing that each of the high voltage circuits are energized.
   - If the circuits are IN PHASE the green LED will illuminate.
     If the circuits are OUT of PHASE the red LED will illuminate.

ORDERING INFORMATION

Catalog Number	Description
V2	Voltage Indicator with Neon Display
V1 BIP	Elbow BIP Mounted Neon Voltage Indicators
V2TB	Voltage Indicator Test Box
PD35	Voltage & Phasing Indicator

V2

PD-35

V1 BIP

Voltage surges that exceed the BIL rating of the distribution system components will cause damage to the installed equipment. To protect against these surges overhead surge arresters are widely used and their application is understood since overhead lines and equipment are directly affected by voltage surges (e.g. lightning). However, the use of overhead arresters alone will not guarantee proper protection of the insulation in the underground portion of an electrical distribution system. The let-through surge from the riser pole arresters into the underground systems could be enough to cause damage to the equipment insulation.

Elastimold® MOV Surge Arresters provide high voltage lightning and switching surge protection of transformers, cable, equipment and other components typically located on underground power distribution systems. Proper placement, voltage selection and coordination with riser pole arresters minimizes damaging surge voltages by improving protective margins.

Typical applications include installing an arrester at the end of a radial system, or at both ends of an open point on a loop system. Additional arresters can be added at strategic locations upstream from the endpoint for optimum protection.

Thomas & Betts' Elastimold® Metal Oxide Varistor (MOV) Surge Arresters are fully sheilded, fully submersible and are equipped with IEEE 386 interfaces for convenient energized connection with other 200 Amp loadbreak or deadbreak components up to 35kV. Arresters are available in three styles: Elbow (ESA), Parking Stand (PSA) and Bushing (BSA). The PSA and BSA arresters permit direct connection, eliminating the need for additional accessories.

ESA Elbow Arresters are also available with a 200 Amp Deadbreak interface for mating with other Deadbreak Accessories.

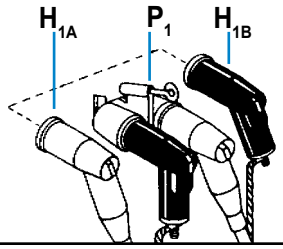
The following tables highlight the different installation options using Bushing and Parking Stand Arresters where Elbow Arresters are normally used. Using BSAs and PSAs will contribute to save space inside transformers and improve operability

FEATURE	BENEFIT/DESCRIPTION
IEEE 386 Interfaces	Convenient energized connection with other 200 Amp loadbreak or deadbreak components
EPDM Molded Rubber Construction	Fully shielded, fully submersible
Compact	Allow installation in existing cabinetry
Elbow (ESA), Parking Stand (PSA), and Bushing (BSA) styles available	Ease of application and installation
Direct connection on PSA and BSA	Eliminates the need for additional accessories
No. 4AWG Ground Lead Tethered to the Jacket	Withstands 10,000 amp for 10 cycles without fusing Controls end plug when ejected, preventing uncontrolled trajectory Maintains the housing shield ground connection after failure

LOOP-FEED CIRCUIT (TYPE 2 TRANSFORMER)

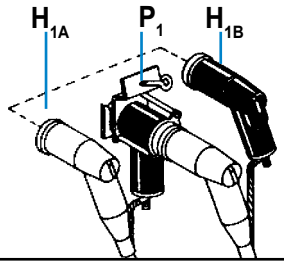
TWO ELBOW ARRESTERS AND A FEED-THRU

This is one approach using elbow arresters only.
(One of the elbow arresters could be mounted on the H_{1A} bushing if allowable by operating procedures.)



ELBOW ARRESTER AND PARKING STAND ARRESTER

This approach can reduce overcrowding (by eliminating the feed-thru device). This desirable in a mini-pad transformer.

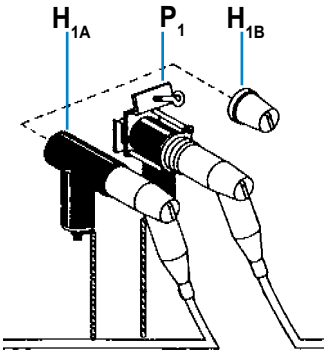


BUSHING ARRESTER AND PARKING STAND ARRESTER*

This approach is best for increasing operability and reducing transformer overcrowding

- The bushing arrester allows the source cable to be positioned on H_{1A} which conforms with some operating practices.
- Potential interference between an elbow arrester on H_{1B} and a cable parked on P_1 is eliminated. A bushing arrester mounted on H_{1A} can be directed downward without interference.
- The bushing arrester requires significantly less space than an elbow arrester used with a feed-thru insert.
- Operability is enhanced because the open point can be closed by moving the parked cable to H_{1B} without removing an arrester.

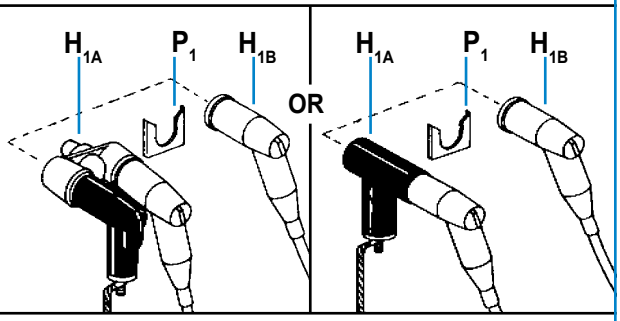
*Transformers must be specified with bushing wells.



ADDITIONAL MARGIN OF PROTECTION

An additional margin of protection may be gained by adding an arrester at the next transformer upstream on each side of the open point. This application is dependent on the system voltage and condition of the cable.

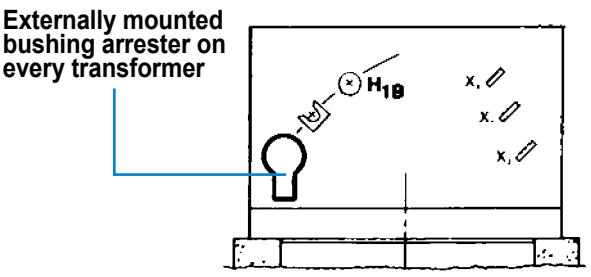
If an additional arrester is added in the circuit, it can be an elbow arrester in combination with a feed-thru insert or it can be a bushing arrester. Use of bushing arrester will reduce tranformer faceplate overcrowding.



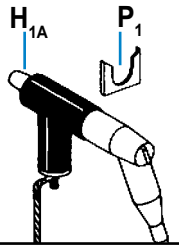
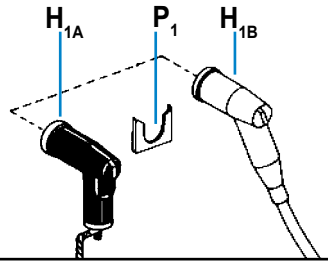
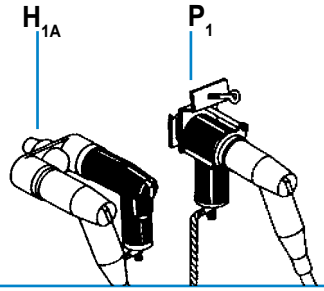
OTHER CONFIGURATIONS

Other configurations are possible such as specifying a bushing arrester on every transformer. This will allow the open point to be quickly and easily moved to any point in the circuit while maintaining the surge protection (without moving all of the portable surge arresters).

The externally mounted bushing arrester provides the surge protection benefits without the negative factors of a under oil arrester.



RADIAL-FEED CIRCUIT (END POINT)

SINGLE-BUSHING TRANSFORMER To add surge protection to a single-bushing transformer, utilize a bushing arrester or an elbow arrester with a feed-thru insert.	
TWO-BUSHING TRANSFORMER To add surge protection to a two-bushing transformer at the end point of a radial-feed circuit, add an elbow arrester to the unoccupied bushing or utilize a bushing arrester.	
CONVERSION OF A RADIAL-FEED TRANSFORMER TO A LOOP-FEED, OPEN POINT TRANSFORMER To convert a single-bushing transformer to a loop-feed, open-point transformer, add a parking stand arrester and an elbow arrester in combination with a feed-thru insert.	

RATINGS

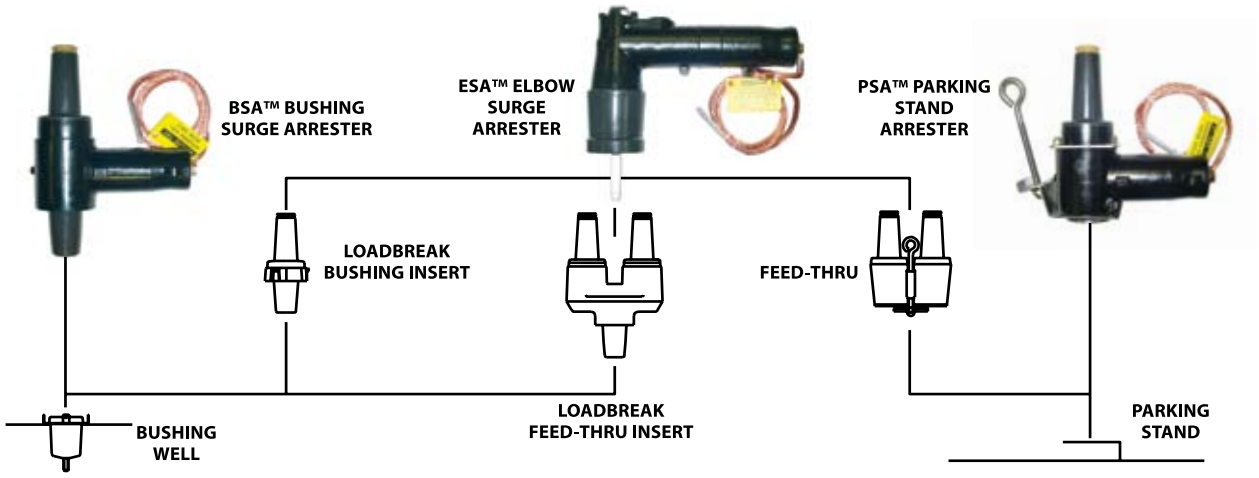
High Current Short Duration	All MOV Arresters withstand two discharges of 40kA crest.
Low Current Long Duration	All MOV Arresters withstand 20 surges of 75 amperes/2000 microsecond duration
Duty Cycle Test	All MOV Arresters withstand 22 operations of 5kA crest at 8 x 20 microsecond duration while energized at rated voltage for the initial 20 operations and at maximum continuous operating voltage (MCOV) for the final two operations.
Following each of the preceding tests, MOV Arresters demonstrate thermal recovery at MCOV.	

PROTECTIVE CHARACTERISTICS

	MCOV (kVrms) Note 1	Duty Cycle Rating (kVrms)	Maximum Discharge Voltage (kV crest) 8x20 microsecond current wave				
			1.5kA	3kA	5kA	10kA	20kA
1.5kA CLASS	2.55	3	10.5	11.0	11.5	13.0	14.5
	5.1	6	20.5	21.5	23.0	25.5	30.0
	8.4	10	30.5	32.5	34.5	38.5	43.5
	10.2	12	40.0	42.5	45.0	50.0	56.5
	12.7	15	48.0	51.0	54.0	60.0	68.0
	15.3	18	56.5	60.0	64.0	71.0	80.5
25kV CLASS	8.4	10	30.5	32.5	34.5	38.5	43.5
	10.2	12	40.0	42.5	45.0	50.0	56.5
	12.7	15	48.0	51.0	54.0	60.0	68.0
	15.3	18	56.5	60.0	64.0	71.0	80.5
	17.0	21	65.5	69.5	74.0	82.5	93.0
35kV CLASS	19.5	24	78.5	83.5	89.0	99.0	112.0
	22.0	27	87.5	93.0	99.0	110.0	124.5
	24.4	30	95.5	101.5	108.0	120.0	136.0

NOTE:
MCOV = Maximum Continuous Operating Voltage

INSTALLATION OPTIONS



ORDERING INFORMATION

To specify and order an MOV Surge Arrester:

1. Determine the appropriate Maximum Continuous Operating Voltage (MCOV) for your system voltage by using the Elastimold® ARRESTER APPLICATION TABLE.
2. Specify the appropriate Elastimold® part number from the SELECTION CHART.

ARRESTER APPLICATION TABLE

	System Line-to-line Voltage kV rms		MCOV (Max. Continuous Voltage Operating Voltage)	
	Nominal	Max.	Solidly Grounded Neutral Circuits	3-Wire Ungrounded Circuits
15kV CLASS	2.40	2.54	2.55	2.55
	4.16	4.40	2.55	5.10
	4.80	5.08	5.10	5.10
	6.90	7.26	5.10	8.40
	8.32	8.80	5.10	8.40
	12.47	13.20	8.40	15.30
	13.20	13.97	8.40	15.30
	13.80	14.50	8.40*	15.30
	13.80	14.50	10.20	15.30
25kV CLASS	6.90	7.26	5.10	8.40
	8.32	8.80	5.10	8.40
	12.47	13.20	8.40	15.30
	13.20	13.97	8.40	15.30
	13.80	14.50	8.40*	15.30
	13.80	14.50	10.20	15.30
	20.78	22.00	12.70	-
	20.78	22.00	15.30*	-
	23.00	24.34	15.30	-
	24.94	26.40	15.30	-
	24.94	26.40	17.00*	-
	28.00	29.80	17.00	-

* Preferred arrester MCOV for this system voltage.

SELECTION CHART

Picture	Description	Voltage Class	Elastimold® Part Number	MCOV kVrms
	BSA Bushing Surge Arrester (includes assembly tool) See Notes N1, 2, 3, 4	15kV	167BSA-3	2.55
		15kV	167BSA-6	5.10
		15kV	167BSA-10	8.40
		15kV	167BSA-12	10.20
		15kV	167BSA-15	12.70
		25kV	273BSA-10	8.40
		25kV	273BSA-12	10.20
		25kV	273BSA-15	12.70
		25kV	273BSA-18	15.30
	ESA Elbow Surge Arrester See Notes N2, 3, 5	15kV	167ESA-3	2.55
		15kV	167ESA-6	5.10
		15kV	167ESA-10	8.40
		15kV	167ESA-12	10.20
		25kV	273ESA-10	8.40
		25kV	273ESA-12	10.20
		25kV	273ESA-15	12.70
		25kV	273ESA-18	15.30
	PSA Parking Stand Arrester See Notes N1, 2, 3	15kV	167PSA-3	2.55
		15kV	167PSA-6	5.10
		15kV	167PSA-10	8.40
		15kV	167PSA-12	10.20
		25kV	273PSA-10	8.4
		25kV	273PSA-12	10.20
		25kV	273PSA-15	12.70
		25kV	273PSA-18	15.30

SELECTION CHART NOTES

N1 Elastimold® PSA and BSA Arresters are equipped with a fully rated 200A switching and fault close loadbreak bushing.

N2 Elastimold® Arresters use high-strength silver epoxy bonded MOV blocks and shunted spring connections for the best circuit connection.

N3 A 36 inch #4 AWG ground lead provided with each unit.

N4 BSA installed by turning internal hex bolt (accessed through the 200 Amp Bushing Interface) with 5/16" hex wrench supplied with each unit.

N5 For 15kV and 25kV Class DEADBREAK system Elbow Arresters, use part number 156ESA with the appropriate Duty Cycle rating.

ORDERING INFORMATION

ARRESTER APPLICATION TABLE

35kV CLASS	System Line-to-line Voltage kV rms		MCOV (Max. Continuous Voltage Operating Voltage)	
	Nominal	Max.	Solidly Grounded Neutral Circuits	3-Wire Ungrounded Circuits
	23.00	24.34	-	22.00
	34.50	36.51	22.00*	-
	34.50	36.51	24.40	-

* Preferred arrester MCOV for this system voltage.

SELECTION CHART

Picture	Description	Voltage Class	Elastimold® Part Number	MCOV kVrms
	1.BSA Bushing Surge Arrester See Notes N 1, 2, 3, 4	35kV CLASS	375BSA-24	19.50
			375BSA-27	22.00
			375BSA-30	24.40
	2. ESA Elbow Surge Arrester See Notes N 2, 3		375ESA-24	19.50
			375ESA-27	22.00
			375ESA-30	24.40
	3. PSA Parking Stand Arrester See Notes N 1, 2, 3		375PSA-24	19.50
			375PSA-27	22.00
			375PSA-30	24.40

SELECTION CHART NOTES

N1 Elastimold® PSA and BSA Arresters are equipped with a fully rated 200A switching and fault close loadbreak bushing.

N2 Elastimold® Arresters use high-strength silver epoxy bonded MOV blocks and shunted spring connections for the best circuit connection.

N3 A 36 inch #4 AWG ground lead provided with each unit.

N4 BSA installed by turning internal hex bolt (accessed through the 200 Amp Bushing Interface) with 5/16" hex wrench supplied with each unit.

N5 For 15kV and 25kV Class DEADBREAK system Elbow Arresters, use part number 156ESA with the appropriate Duty Cycle rating.

Elastimold® Switchgear is the result of extensive field experience in underground distribution systems combined with state of the art know-how, and top-notch customer support. The result? Equipment that fits multiple application needs and contributes to improve the reliability and operating performance of underground distribution systems up to 35kV. Elastimold® Switchgear is fully submersible and features deadfront construction for increased safety of operation. Solid EPDM insulation and vacuum switching/interruption translate into small footprint, no maintenance products. With a wide range of configurations suitable for feeder sectionalizing/ protection, loop sectionalizing/protection, riser pole installations, and automatic source transfer, Thomas & Betts is able to provide the right solutions to overcome your underground distribution system performance challenges.

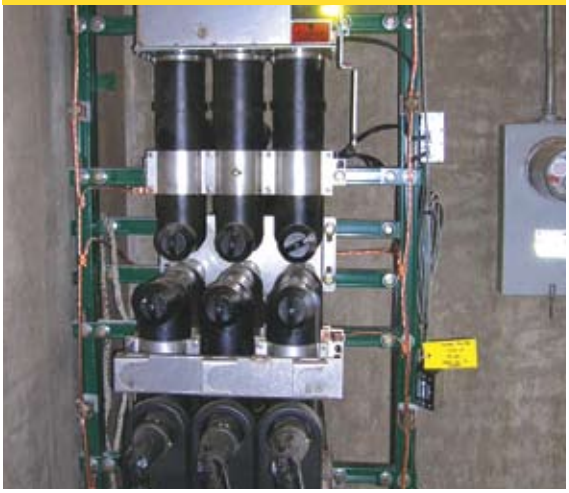
FEATURE	BENEFIT/DESCRIPTION
EPDM Molded Rubber Construction withStainless Steel Hardware and Mechanism Boxes	• Fully sealed • Fully submersible
Vacuum Switching and Vacuum Interruption	• Maintenance-free • Small foot print • Lightweight • NO gas, NO oil, NO hassle
Deadfront Construction	• Insulates, shields and eliminates exposed live parts
Compact and Light Weight	• Fits in tight spaces • Suitable for padmount, subsurface, vault or riser pole installations • Smaller foootprint compared to other switchgear
Non-position sensitive	• Can be installed almost anywhere and in any position (e.g. hanging from ceilings, wall-mounted, mounted at an angle, riser pole mounted)
Modular construction	• Allows any combination of fused, switched and interrupter ways on one piece of switchgear up to 35kV • The knowledge and training acquired can be applied to multiple installations.
Electronic controls for protection and automatic source transfer applications	• Flexibility of settings and operation in different locations throughout the distribution system • Self powered controls • Customized protection curves
Motor operators for remote/local open/close operation of three-phase switched or interrupter ways	• Allow remote reconfiguration of loops and sectionalizing of feeders • Allow automatic or manual source transfer • Can be used with a wide variety of RTUs and communication devices

PADMOUNT

SUBSURFACE

RISER POLE

VAULT



Switchgear Building Blocks

Whether it is a standard or a custom application, Thomas & Betts has the right combination of components and expertise to fit your needs. The modularity and flexibility of Elastimold® Switchgear allows the user to combine the different individual components into products that satisfactorily improve the reliability and performance of distribution systems. Three basic components form the basis for Elastimold® Switchgear:

Single-phase And Three-phase Molded Vacuum Switches (MVS)
Single-phase And Three-phase Molded Vacuum Interrupters (MVI)
Canister Fuses (MCAN)

These combined with electronic controls, motor operators, and SCADA ready controls make the building blocks of Elastimold® Switchgear.

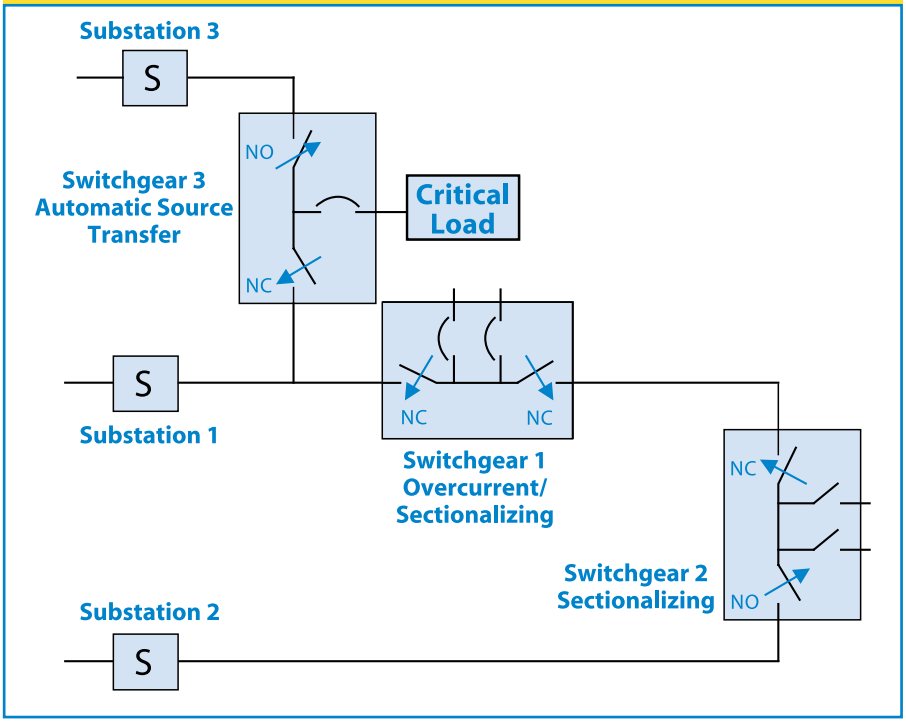
Elastimold® Switchgear building blocks as described on the previous section can be combined into a wide arrangement of configurations, and applied to solve different system challenges in the distribution system. Elastimold® Switchgear products can be classified in three categories according to the function they perform:

- Switching and Sectionalizing Equipment
- Overcurrent Protection Equipment
- Automatic Source Transfer Equipment

These products can be applied in different types of installations:

- Padmount
- Subsurface / Wet or Dry Vaults

UNDERGROUND DISTRIBUTION SWITCHGEAR APPLICATIONS



The switching or manually sectionalizing of loads can be accomplished with the use of Molded Vacuum Switch (MVS) modules. The simplest manual sectionalizer is a single MVS switch, which can be installed in a vault, pole, or inside a padmount enclosure. One of the most popular applications of this sectionalizer is as a replacement of existing oil fuse cutouts. Two, three and four-way units are also available in vault and padmount styles. Switches also aid in the manual reconfiguration of distribution loops by installing them at the open point in the circuit.

Overcurrent protection is accomplished using Molded Canister Fuse (MCAN) or Molded Vaccum Interrupter (MVI) modules. These can be used in combination with MVS modules. The simplest product is a single MVI unit, which can be installed in a vault, pole, or inside a padmount enclosure. One of the most popular applications of this configuration is as a replacement of existing oil fuse cutouts. Two, three, and four-way units are also available in any combination of MVI, MCAN and MVS modules, and in vault and padmount styles. Fuses and interrupters are applied in underground loops to aid in the sectionalizing of the main feeder and by providing protection to the loads along the loop. For more information on canister fuses, please refer to the Fuses section of this Product Selection Guide.

Load switching is required when:

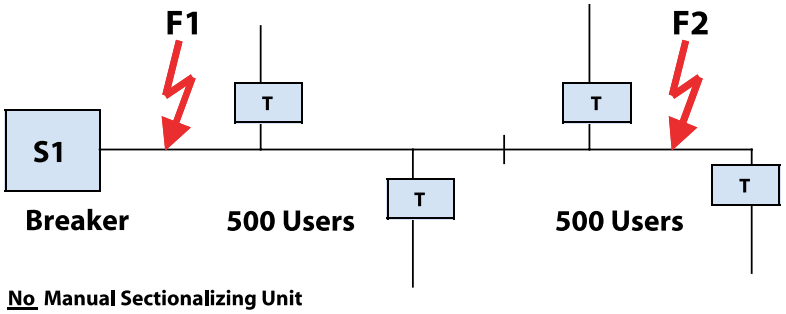
1. A load needs to be isolated to perform maintenance
2. A load needs to be isolated to repair a fault
3. A loop needs to be reconfigured to feed certain load from a different substation and isolate the faulted portion of the loop

In any case, the use of a manual sectionalizer contributes to reduce the length of time that unfaulted or unaffected portions of the system are exposed to an outage. This results in improved reliability of the system as the duration of outages is reduced (i.e. the SAIDI and CAIDI reliability indices).

Switching products can be applied as replacement for existing Oil Fuse Cutouts or as Manual Sectionalizers for loops or radial feeders. Depending on the application these sectionalizers may be installed in a vault, or inside a padmount enclosure. Pole installations are also available.

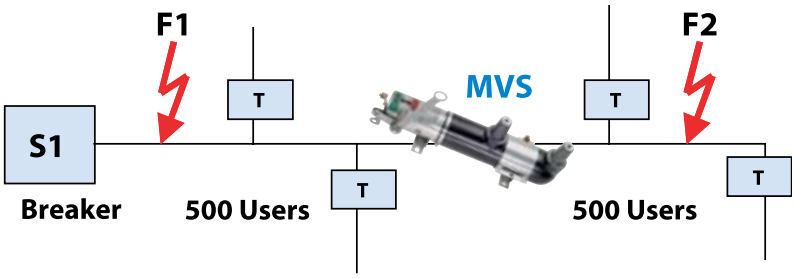
MANUAL SECTIONALIZING IMPROVES RELIABILITY

In the example to the right, a radial feeder is exposed to two failures in one year. Without any manual sectionalizing, all customers are subject to both failures and are out of power until failures are restored. Assuming that the duration of outage one (F1) is one hour, and outage two (F2) is two hours, the calculation of SAIDI shows 3 hours of interruption duration per year.



No Manual Sectionalizing Unit
Permanent Faults F1 and F2
Interruption Duration: F1 = 1hr; F2 = 2hr.
Evaluation Period = 1yr.

SAIDI = [(1hr)*(1000) + (2hr)*(1000)] / 1000 = 3 hr/yr
SAIFI = [1000 + 1000] / 1000 = 2 Interruptions / yr



MVS Manual Sectionalizing Unit = Shorter restoration time for 500 customers
Permanent Faults F1 and F2
Interruption Duration: F1 = 1hr; F2 = 2hr for 500 users; F2 = 1hr for 500 users
Evaluation Period = 1yr.

SAIDI = [(1hr)*(1000) + (1hr)*(500) + (2hr)*(500)] / 1000 = 2.5 hr/yr
SAIFI = [1000 + 1000] / 1000 = 2 Interruptions / yr

With the use of an MVS at the mid-point of the feeder, the restoration time is reduced. Once the fault is located the MVS is open to isolate the faulted portion of the feeder. At this point the other half of the feeder can be energized, reducing the outage duration or SAIDI from 3 hours to 2.5 hours per year (16.6%).

Similar application of MVS switches in loop configurations contribute to significantly reduce the outage duration. In these cases single or multi-way switch configurations can be applied.

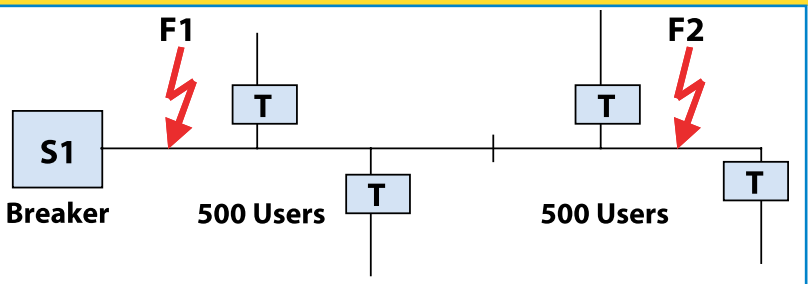
Fault interrupting devices are used on:

1. Feeders to sectionalize, so that if there is a fault only a small section of the load is affected.
2. Radial taps deriving from a main feeder or loop so that a fault on a tap is isolated from the main circuit.
3. Network transformers to isolate the devices in case of overcurrent, excessive pressure/ temperature, etc.

While a switching device contributes to improve the duration of outages, fault interrupters contribute to improve the duration AND frequency of outages (i.e. SAIDI, CAIDI, SAIFI, CAIFI reliability indices).

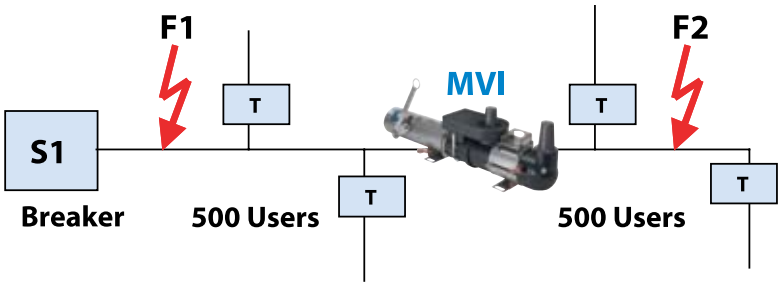
AUTOMATIC SECTIONALIZING IMPROVES RELIABILITY

In the example to the right, a radial feeder is exposed to two failures in one year. Without any automatic sectionalizing (overcurrent protection), all customers are subject to both failures and are out of power until failures are restored. Assuming that the duration of outage one (F1) is one hour, and outage two (F2) is two hours, the calculation of SAIDI shows 3 hours of interruption duration per year. The calculation of the frequency of interruptions (SAIFI) shows two interruptions per year.



No Automatic Sectionalizing Unit
Permanent Faults F1 and F2
Interruption Duration: F1 = 1hr; F2 = 2hr.
Evaluation Period = 1yr.

SAIDI = [(1hr)*(1000) + (2hr)*(1000)] / 1000 = 3 hr/yr
SAIFI = [1000 + 1000] / 1000 = 2 Interruptions / yr



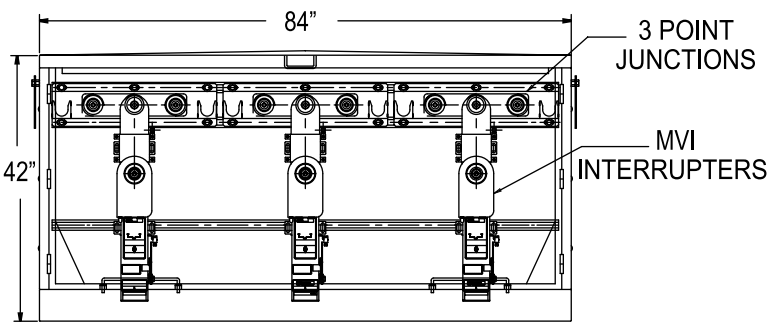
MVI Sectionalizing Unit = Eliminate one Interruption for 500 users
Permanent Faults F1 and F2
Interruption Duration: F1 = 1hr; F2 = 2hr for 500 users
Evaluation Period = 1yr.

SAIDI = [(1hr)*(1000) + (2hr)*(500)] / 1000 = 2.0 hr/yr
SAIFI = [1000 + 500] / 1000 = 1.5 Interruptions / yr

With the use of an MVI overcurrent fault interrupting device at the mid-point of the feeder, failure F2 only affects half of the load. Proper protection coordination, between the MVI and the substation breaker, allows the MVI to clear the fault before any customers between the MVI and the breaker are affected. Frequency and duration of interruption are significantly reduced. SAIDI is reduced from 3 to 2 hours of interruption per year (33%), and SAIFI is reduced from 2 to 1.5 interruptions per year (25%).

Similar improvements can be accomplished with the use of MVIs in loop systems. A typical example of the use of radial protection to improve reliability is the use of single-phase MVIs in sectionalizing cabinets. These cabinets can be installed with no tap protection at the beginning of a construction project, and MVIs can be added as the loads come online.

ESP313-BJB-XXX



Distribution Automation

Elastimold® distribution automation products are designed for interoperability and rapid automation implementation. These products can provide Supervisory Control and Data Acquisition System (SCADA) interface and enable feeder automation with or without communications. Elastimold® distribution automation products will help to strengthen existing distribution systems and provide a strong foundation for building a fully implemented scheme in the future.

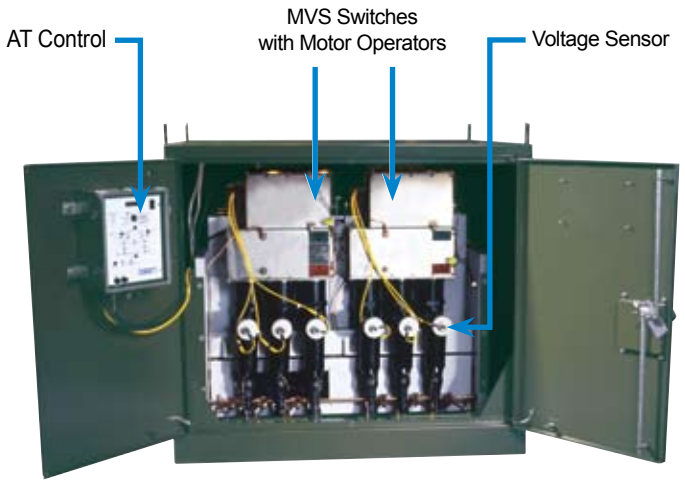
Here are some of the benefits of distribution automation implementation:

- Early detection and correction of abnormal line conditions
- Reduced frequency and duration of outages
- Remote control and automatic restoration
- Improved dispatcher decision-making and field manpower savings
- Automation packages can be added-on or upgraded as the system requirements change

Some of the automation packages available are discussed in the following pages:

- Automatic source transfer
- Transformer network protection
- Loop Automation

PADMOUNT AUTOMATIC SOURCE TRANSFER



Automatic Source Transfer

The main application of source transfer packages is to transfer a load from one power source to another. In some cases, when the load is not critical, this is done manually using a switching device (see switching section). In the case of critical loads such as hospitals, financial institutions, manufacturing facilities, and any other load that would have computer-related equipment, a fast transfer is required between the main (preferred) source and the backup (alternate) source. It is important for the automatic source transfer not to affect the operation of the load because any interruption of the business process translates into costly lost production and setup time. The preferred and backup sources are normally utility feeders, but in some cases the backup source may be a generator.

Elastimold® Switchgear offers automatic transfer (AT) packages capable of performing a full transfer in less than 2 seconds. The system monitors the voltage on the preferred source, and initiates a transfer when the voltage is below the acceptable level for the customer. At this point the preferred source is disconnected and the alternate source connected. AT packages include:

Two three-phase MVS switches with motor operators (one for the preferred source, and one for the alternate source)

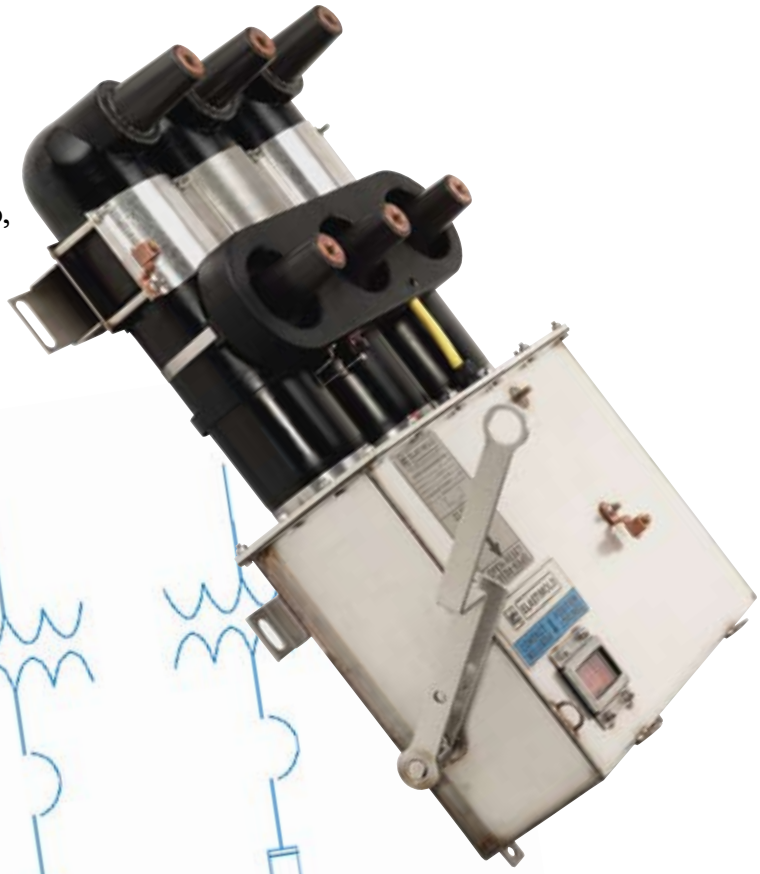
Six Voltage sensors (one for each phase of the MVS switches). These sensors monitor voltage on every phase and feed their output to the AT control.

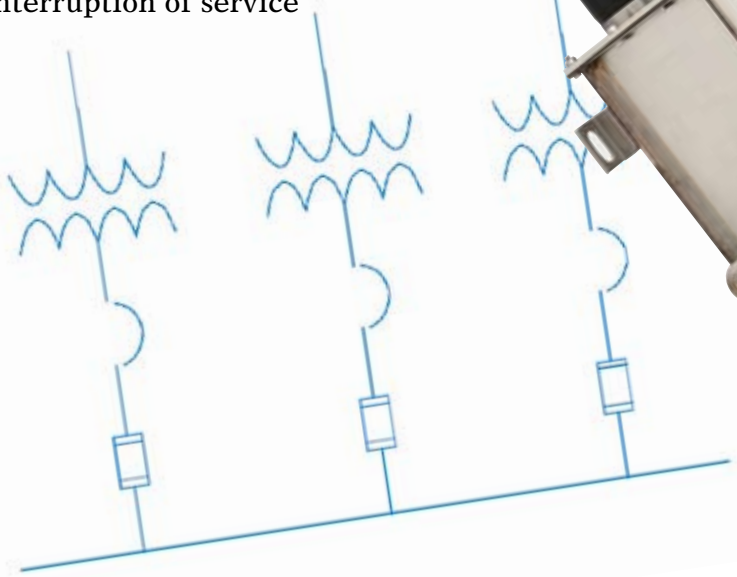
AT control which receives the output from the voltage sensors, and determines if there is a loss of voltage. If there is a loss of voltage, the AT control sends an OPEN signal to the preferred source MVS, and a CLOSE signal to the alternate source MVS. When the voltage is restored the system transfers back to its normal state, either automatically or at a set time.

One or two protected taps. These can be MCAN or MVI modules, which protect the critical load against overcurrent. Solid taps are also available.

Network Transformer Protection the reliability of conventional radial or looped underground distribution circuits is measured in terms of the number and/or frequency of interruptions. These measurements cannot be directly applied to a network system. A typical network system has built-in redundancy. During most events the continuity of power supply to the end user is not affected by fault conditions on the high side of the network transformers. So, from the point of view of customer interruptions network systems are "reliable".

However, transformer failures have been known to result in catastrophic fires, explosions, and even loss of lives. The failure or overload of multiple transformers within a network may ultimately result in the interruption of service to the end user.





LOSS OF REDUNDANCY

Loss of redundancy is a method that highlights the increased vulnerability of the system every time a network transformer is lost. Loss of redundancy indices, are calculated as follows:

$$\text{Duration of Loss of Redundancy (hours/yr)} = \frac{S\ (\text{No. Hours a Transformer is Disconnected} * \text{No. of Transformers in the Circuit})}{\text{No. of Transformers in the Circuit}}$$

$$\text{Frequency of Loss of Redundancy (times/yr)} = \frac{\text{Total No. Transformer De-energizations}}{\text{No. of Transformers in the Circuit}}$$

Where the number of transformers in the circuit is the number of transformers energized by the same feeder.

The Loss of Redundancy indices are calculated in the following example.

EXAMPLE 1: NO HIGH-SIDE TRANSFORMER PROTECTION

One Substation Breaker and one exclusive feeder out to the network
Five transformers are energized by the same feeder
Assume one permanent fault on one transformer in one year
Assume the faulted transformer is de-energized for 6 hours

Because there is only one breaker for five transformers, a failure in one transformer translates in the interruption of power to 5 transformers for 6 hours.

$$\text{Duration of Loss of Redundancy (hours/yr)} = \frac{(6 * 5)}{5} = 6 \text{ hours/year}$$

$$\text{Frequency of Loss of Redundancy (times/yr)} = \frac{5}{5} = 1 \text{ time/year}$$

Loss of redundancy can occur as a consequence of:

- Transformer Fire
- Transformer Overheating
- Transformer Pressure Build-up
- Overcurrent Condition

While the substation breaker may detect most overcurrent faults, faults caused by excessive pressure/heat or fires, cannot be detected by the breaker. One method that allows the automatic isolation of a network transformer from the primary side, regardless of the type or failure, is the installation of an MVI fault interrupter on the high side of the transformer. This MVI can isolate based on overcurrent conditions, but also can be wired to isolate the transformer in case of fire, excessive pressure / heat, emergency signal, etc.

- Benefits of such a setup to the network system and the end users include:
- Minimization of fire damage
- Reduction or elimination of transformer damage due to pressure or temperature build-up
- Longer transformer life

The following example calculates the loss of redundancy of the same system used in Example 1, but adding protection to the primary side of the transformers.

EXAMPLE 2: HIGH-SIDE TRANSFORMER PROTECTION

One Substation Breaker and one exclusive feeder out to the network
Five transformers are energized by the same feeder
Each transformer is equipped with a fault interrupter installed on the high-side
Assume one permanent fault on one transformer in one year
Assume the transformer is de-energized for 6 hours

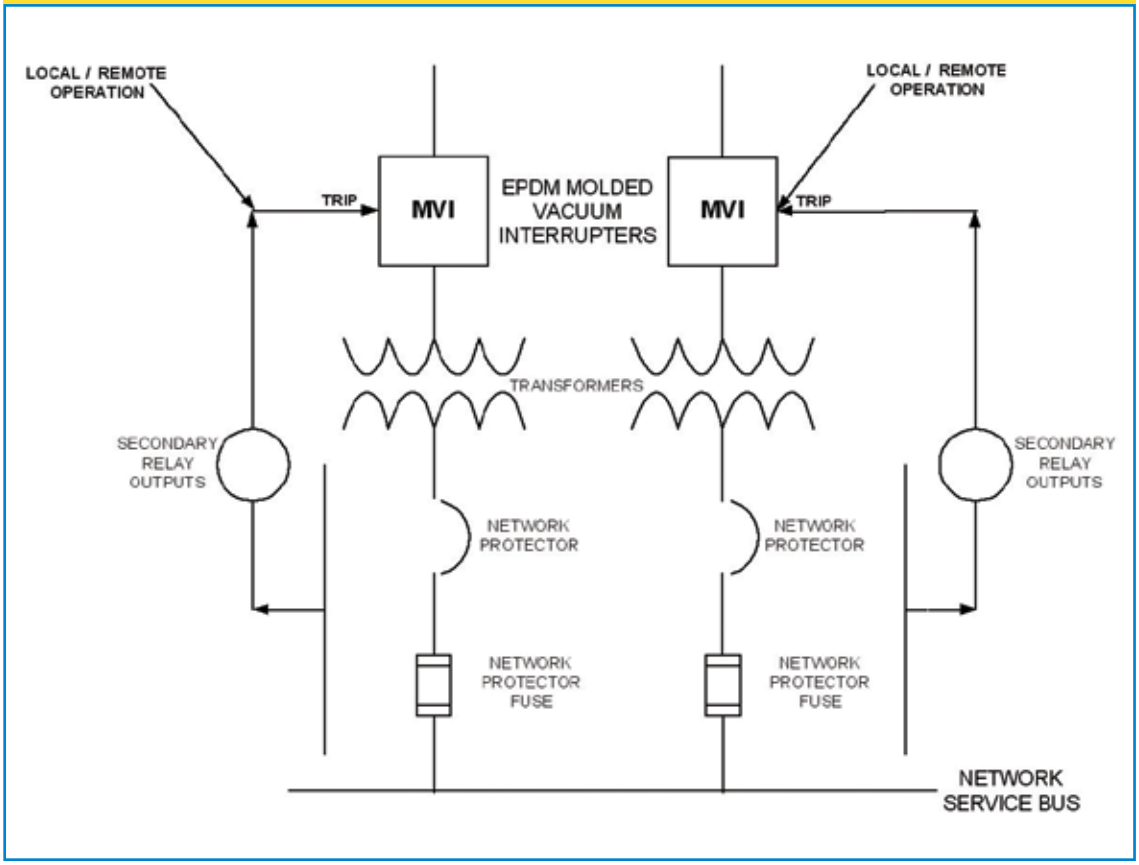
A failure in one transformer translates in the interruption of power to only 1 transformer for 6 hours.

$$\text{Duration of Loss of Redundancy (hours/yr)} = \frac{(6 * 1)}{5} = 1.2 \text{ hours/year}$$

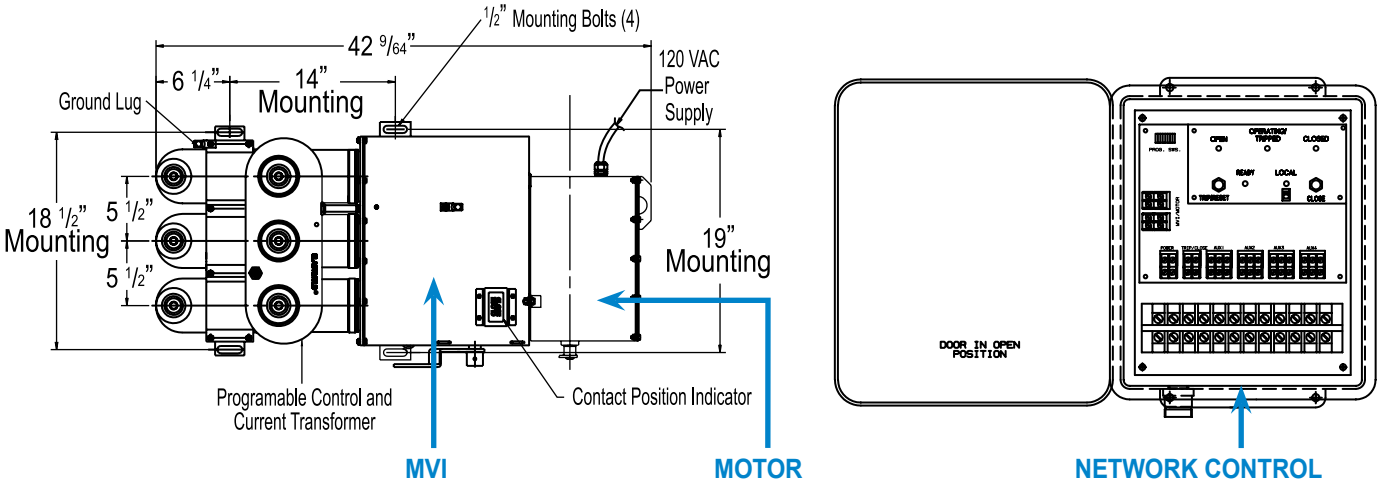
$$\text{Frequency of Loss of Redundancy (times/yr)} = \frac{1}{5} = 0.2 \text{ times/year}$$

Once an MVI is installed, remote operation from the entrance of the vault or via SCADA is possible with the addition of a motor operator and control. Installation of "panic / emergency" push buttons at the entrance of the vault is also possible; pressing this emergency switch will instantaneously trip open one or all of the interrupters in a vault and isolate the transformers.

TRANSFORMER NETWORK WITH PROTECTION ON THE HIGH SIDE OF THE TRANSFORMER



ELASTIMOLD® SWITCHGEAR NETWORK PACKAGE (NMVI3)

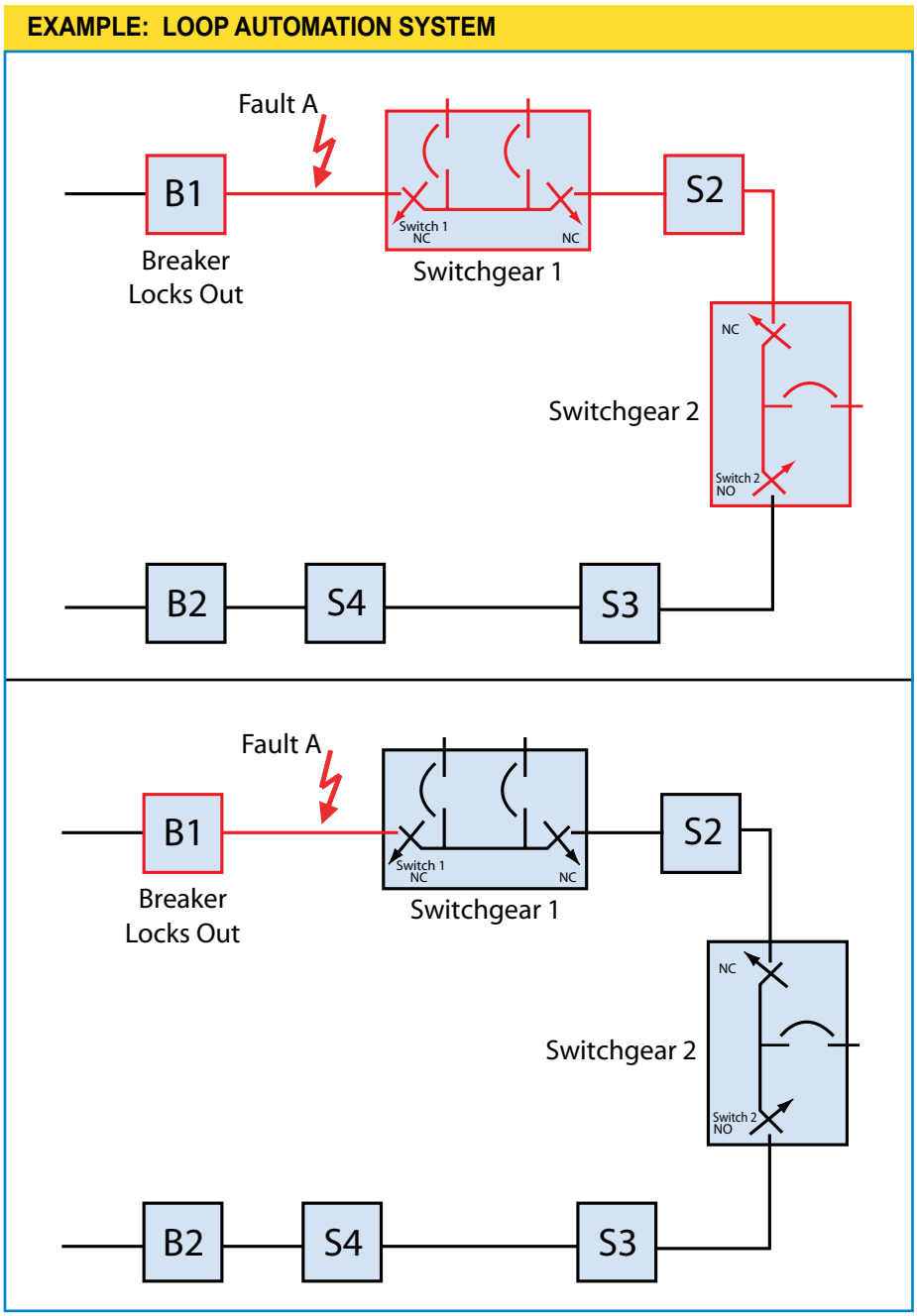


Loop Automation

In the case of underground loops, the switching devices along the loop can be automated to reconfigure the loop. Thus, regardless of the location of the fault, the switches will operate to isolate the faulted portion of the loop and restore service to the remaining customers.

In the following example permanent Fault A will cause the breaker to lock out and all customers up to the open point will be subjected to an outage. The next step is to locate the fault. After the fault is located it is necessary to reconfigure the loop to isolate the faulted portion. This is done by opening Switch 1 and closing Switch 2. Although these operations can be done manually, in order to reduce the outage duration and improve the reliability of the system, the best way to operate the switches on the main loop is via SCADA. The use of motors, motor controls and communications allow remote reconfiguration.

EXAMPLE: LOOP AUTOMATION SYSTEM



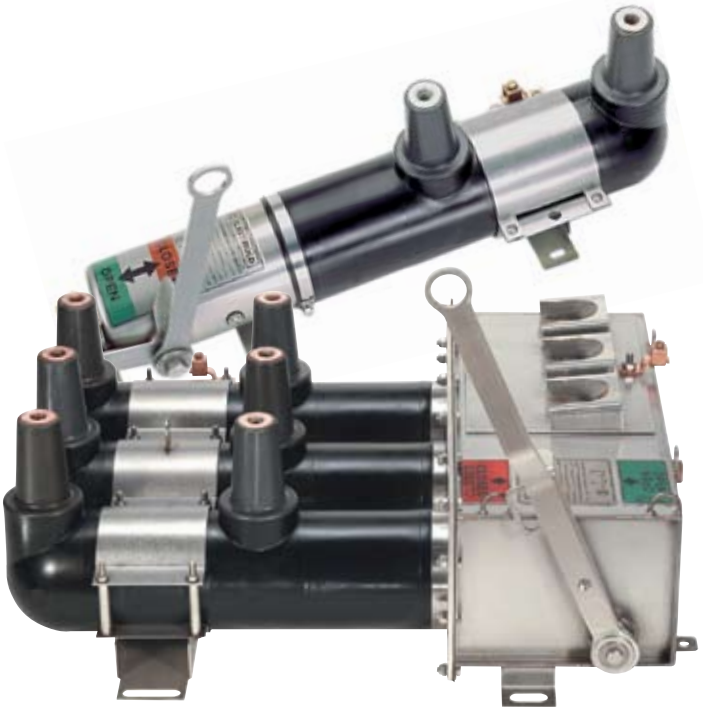
From the following table, select the function and application specific to your system needs. The last column will indicate the product to be used for the specific selection. With this information go to the appropriate section, and finalize the construction of the catalog number that you would need to order.

PRODUCT SELECTION

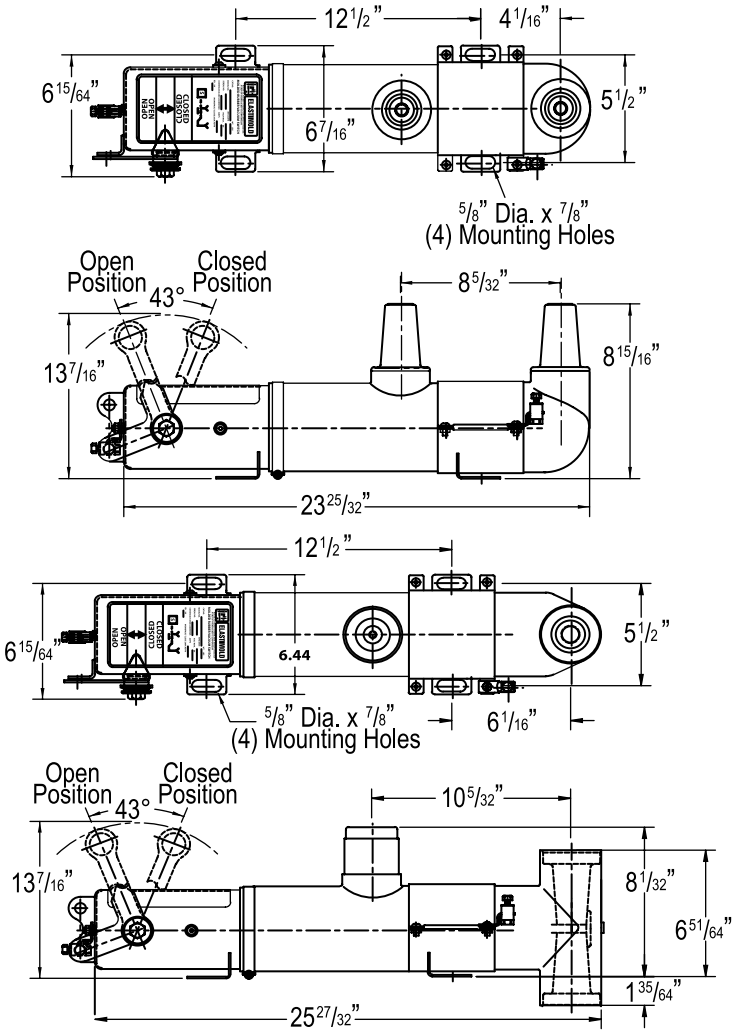
Function	Application	Installation	Nominal Voltage	Continuous Current	Interrupting Current	Product	Page
Switching Sectionalizing	Fuse Cutout Replacement	Subsurface/Vault	15kV 25kV 35kV	600/200A 600/200A 600/200A	12.5/16/20kA	MVS	61
	Manual Underground Feeder or Loop Sectionalizing	Subsurface/Vault Padmount				ESV ESD/PMVS/ ESP	69
Overcurrent Protection	Riser Pole	Pole				RMVI	66
	Network Transformer Protection	Network Transformer Vault				NMVI	*
	Fuse Cutout Replacement	Subsurface/Vault				MVI	66
	Automatic Underground Feeder or Loop Sectionalizing	Subsurface/Vault Padmount				ESV PMVI/ESD/ ESP	70-71
	Underground Feeder or Loop Protection						
Source Transfer	Automatic Source Transfer	Subsurface/Vault Padmount				ATV/ATS ATD/ATP	73

* Consult your local representative on Network Transformer Protection configurations.

MVS Molded Vacuum Switches are spring energy, load switching devices capable of making, carrying and interrupting load currents through 600 amperes on 5-38kV distribution systems. The MVS combines vacuum switching with high dielectric strength EPDM rubber insulation, providing compact, light-weight submersible switching. Units include molded-in elbow connection interfaces, spring energy mechanism and are available in both single and three phase models. Units are manually operated with a hot-stick, and motor operator, SCADA and Auto-Transfer Control options are available.

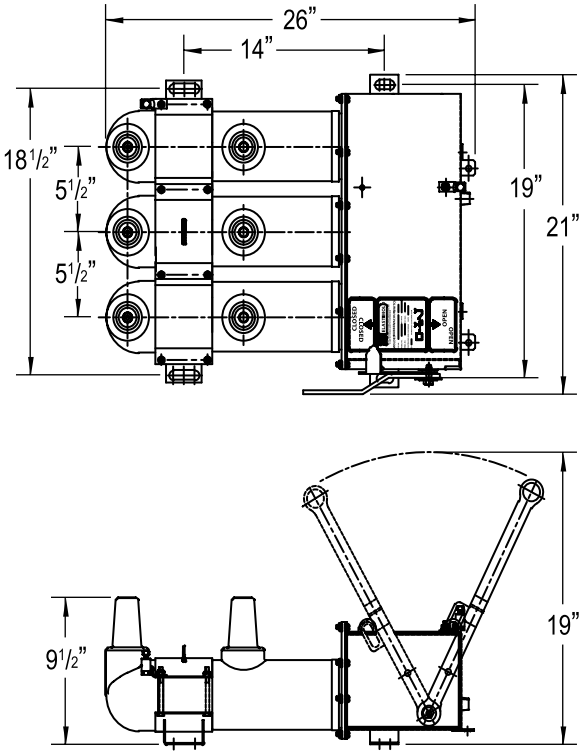


SINGLE PHASE SWITCHES
APPROX. WEIGHT 30 LBS.



Available with 600 amp one-piece bushings or 200 amp wells on either/both terminals

THREE PHASE SWITCHES
APPROX. WEIGHT 135 LBS.



Available with 600 amp one-piece bushings or 200 amp wells on either/both terminals

CERTIFIED TESTS & PERFORMANCE

MVS loadbreak switches have been designed and tested per applicable portions of IEEE, ANSI, NEMA and other industry standards including:

IEEE C37.74 Standard for Subsurface, Vault, and Padmounted Load Interrupting Switches

IEEE 386 Standard for Separable Connectors and Bushing Interfaces

IEC 265 International Standards for Load Interrupting Switches

ANSI C57.12.28 Standard for Padmount Enclosures

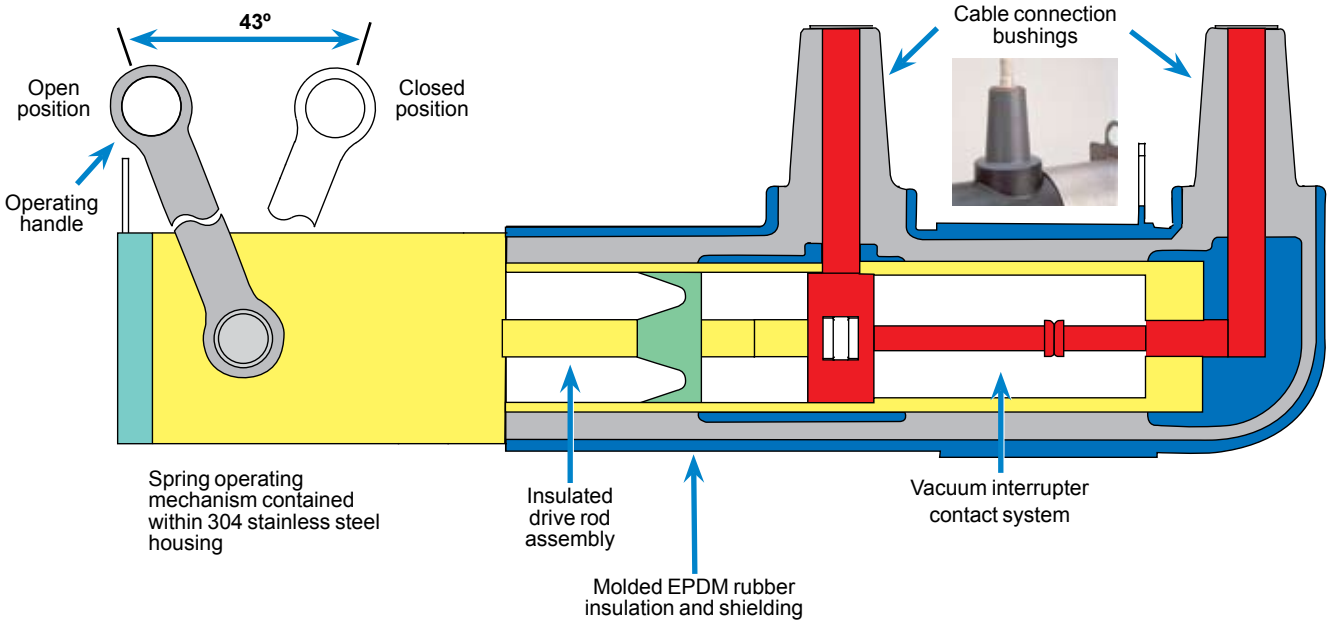
RATINGS

Maximum Design Voltage	15.5 kV	27 kV	38 kV
Frequency	50/60 Hz	50/60 Hz	50/60 Hz
BIL Impulse Withstand	95 kV	125 kV	150 kV
One Minute AC Withstand	35 kV	60 kV	70 kV
Five Minute DC Withstand	53 kV	78 kV	103 kv
Load Interrupting & Loop Switching	600 A	600 A	600 A
Transformer Magnetizing Interrupting	21 A	21 A	21 A
Capacitor or Cable Charging Interrupting	40 A	40 A	40 A
Asymmetrical Momentary and 3 Operation Fault Close	20,000 A	20,000 A	20,000 A
Symmetrical One Second Rating	12,500 A	12,500 A	12,500 A
Continuous Current	600 A	600 A	600 A
8 Hour Overload Current	900 A	900 A	900 A

APPLICATION INFORMATION

Construction: Submersible, corrosion resistant, fully shielded

Ambient Temperature Range: -30 to +40 degrees centigrade



ORDERING INFORMATION FOR MOLDED VACUUM SWITCHES

Diagram	Catalog Number	Description	W	H	D	Wt.
Single-phase Vacuum Switches						
 *	MVS1-21-15-XX	15kV 2-way 1-phase Switch	6	24	14	30
	MVS1-21-15-6EX	15kV 2-way 1-phase Switch - Elbow Interface	6	26	15	30
	MVS1-21-27-XX	25kV 2-way 1-phase Switch	6	24	14	30
	MVS1-21-27-6EX	25kV 2-way 1-phase Switch - Elbow Interface	6	26	15	30
	MVS1-21-38-XX	35kV 2-way 1-phase Switch	6	24	14	30
Three-phase Vacuum Switches						
 *	MVS3-21-15-XX	15kV 2-way 3-phase Switch	21	26	19	135
	MVS3-21-27-XX	25kV 2-way 3-phase Switch	21	26	19	135
	MVS3-21-38-XX	35kV 2-way 3-phase Switch	21	26	19	135

* Height includes handle

ACCESSORIES (ADD THE CATALOG NUMBER AS A SUFFIX TO SINGLE- AND THREE-PHASE UNITS)

Catalog Number	Description
MO120A	120 Vac Motor Operator for 3-phase Units. For Multi-Way Units, Replace T with V for a Motor Operated Switch.
MO12D	12 Vdc Motor Operator for 3-phase Units. For Multi-Way Units, Replace T with U for a Motor Operated Switch.
UAD	2 Vdc Cleaveland Price Motor Operator. For Multi-Way Units, Replace T with Q for a Motor Operated Switch.
MR	Motor Ready - Provisions for Future Installation of Motor
PS	Parking Stand for MVS units
PS3	Parking Stands for MVI3, MVS3 or RMVI3 between Bushings
PS6	Double Parking Stand for MVS3 units
MPS	Parking Stand for MVS3 units on Mechanism Cover

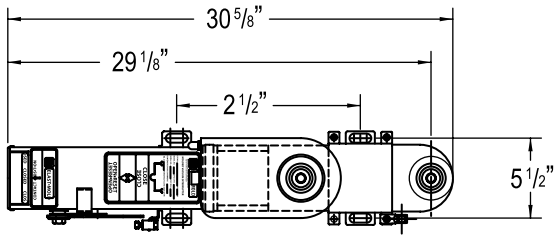
MVI Molded Vacuum Fault Interrupters

are devices capable of making, carrying and automatically interrupting currents through 12,500 amperes symmetrical on 5-38kV distribution systems. The MVI combines vacuum interrupters, programmable electronic self powered controls and high dielectric strength EPDM rubber insulation, to provide compact, light-weight submersible over-current protection. Units include molded-in elbow connection interfaces, trip free mechanism, and are available in single phase and three phase models.

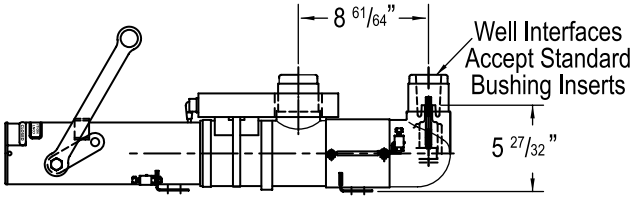
Units are self powered and include current sensing and electronic control. The control is field programmable with a wide range of Time-Current Characteristic (TCC) curves and trip settings. The TCC curves provide predictable tripping for ease of coordination with up-stream and/or down-stream protective devices. The control monitors the circuit condition and sends a signal to the tripping mechanism if the programmed parameters are exceeded.

Motor operators and controls are available, and allow reconfiguration of radial feeders or loops, manually or via SCADA.

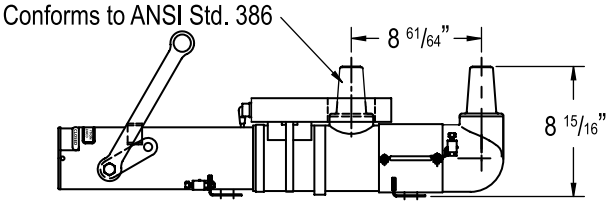
FRONT VIEW SINGLE-PHASE



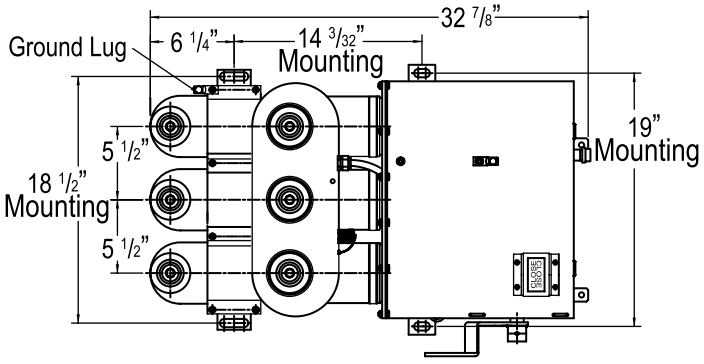
200 AMP WELLS



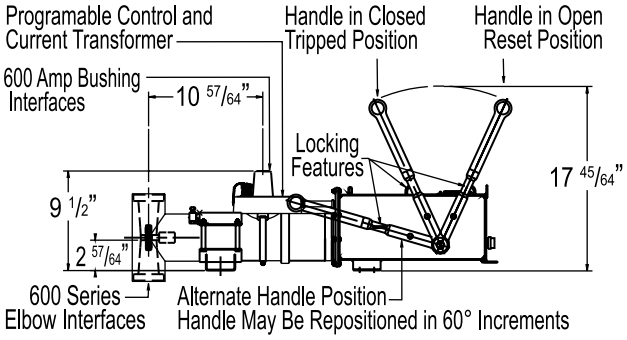
600 AMP BUSHINGS



FRONT VIEW THREE-PHASE



600 AMP T ELBOW INTERFACE



CERTIFIED TESTS & PERFORMANCE

MVI Molded Vacuum Fault Interrupters have been designed and tested per applicable portions of IEEE, ANSI, NEMA and other industry standards including:

ANSI C37.60 Standard for Fault Interrupters

IEEE C37.74 Standard for Subsurface, Vault, and Padmount Load Interrupting Switches

IEEE 386 Standard for Separable Connectors and Bushing Interfaces

IEC 265 International Standards for Load Interrupting Switches

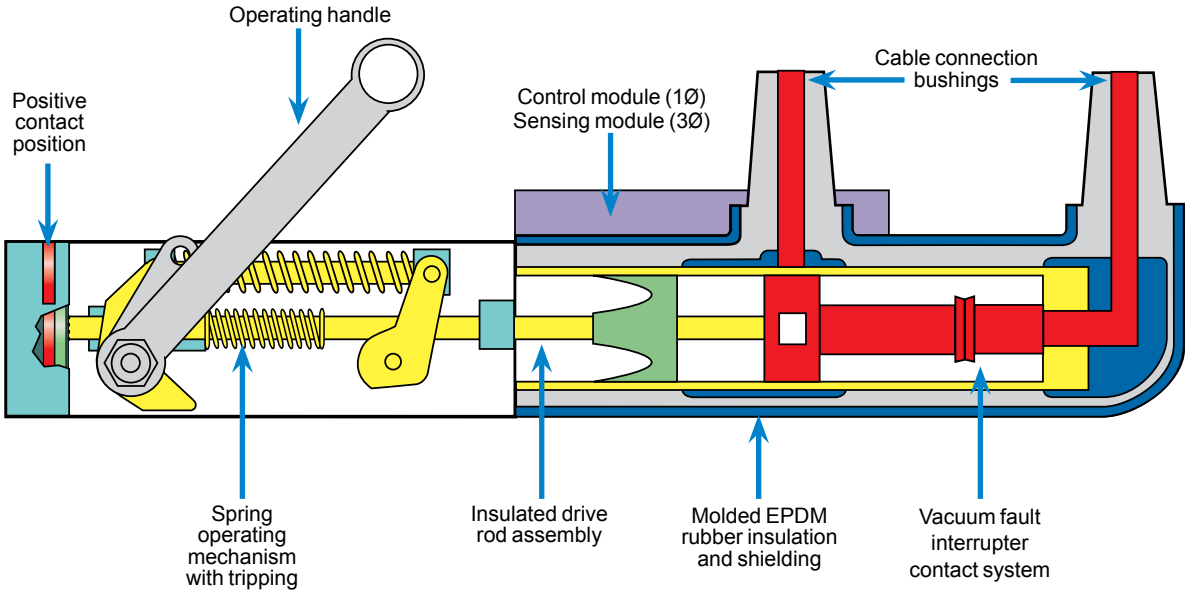
ANSI C57.12.28 Standard for Padmounted Enclosures

RATINGS

Voltage Class	15.5 kV	15.5 kV	27 kV	35kV
Maximum Design Voltage	17 kV	15.5 kV	29 kV	38 kV
Frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz
BIL Impulse Withstand	95 kV	95 kV	125 kV	150 kV
One Minute AC Withstand	35 kV	35 kV	60 kV	70 kV
Five Minute DC Withstand	53 kV	53 kV	78 kV	103 kv
Load Interrupting & Loop Switching	600 A	600 A	600 A	600 A
Transformer Magnetizing Interrupting	21 A	21 A	21 A	21 A
Capacitor or Cable Charging Interrupting	40 A	40 A	40 A	40 A
Symmetrical/Asymmetrical Momentary and Fault Close	12.5/20 kA or 16/32 kA	20/ 25.6 kA	12.5/ 20 kA	12.5/ 20 kA
Symmetrical One Second Rating Continuous Current	630 A	630 A	630 A	
Symmetrical/Asymmetrical Interrupting Capability	12.5/20 kA or 16/32 kA	20/ 25.6 kA	12.5/ 20 kA	12.5/ 20 kA
Current Sensor Ratio	1000:1	1000:1	1000:1	1000:1

APPLICATION INFORMATION

Meets ANSI C37.60 requirement
Construction: Submersible, corrosion resistant, fully Shielded
Ambient Temperature Range: -30 to +40 degrees centigrade



The **Molded Vacuum Interrupters** are provided with self-powered electronic control packages, requiring no batteries or external power. Field-selectable Fuse or Relay Curves and Trip Settings are available. The controls monitor current through the interrupter, and if an overcurrent condition is detected, send a signal to the vacuum interrupters to trip open and interrupt the fault. Depending on the application, four electronic control options are available for the MVI:

INTERNAL CONTROL

This control is integral to the unit (no separate control box). It is accessible via computer connection to view or modify settings. This control is used on ganged three-phase or single-phase MVI interrupters. Phase and Ground trip, as well as Inrush restraint are available. The E-Set software allows the user to connect to the internal control either in the shop or the field to program or change settings. MVI-STP programming connector is required to connect between the PC and the MVI. With a computer connected to the MVI control the user can view real-time currents, the number of overcurrent protection operations, current magnitude of the last trip, and the phase/ground fault targets. This is the standard control option.

Note: E-set can be downloaded from www.elastimoldswitchgear.com

EXTERNAL CONTROL WITH SINGLE/THREE-PHASE TRIP SELECTION (STYLE 10)

This control is mounted external to the mechanism and provides the ability to select TCCs by setting dip switches on the front panel. Each phase can be assigned a different minimum trip setting by means of manual rotary switches. This control is used on one, two or three single-phase MVI mechanisms.

EXTERNAL CONTROL WITH PHASE AND GROUND TRIP (STYLE 20)

This control is mounted external to the mechanism and provides the ability to select phase minimum trip (one for all three phases), time delay for phase tripping, ground trip as a percent of phase minimum trip, and ground trip delay by means of manual rotary switches. This control may be used on ganged three-phase or three single-phase MVI mechanisms.

EXTERNAL CONTROL WITH THREE-PHASE TRIP ONLY (STYLE 30)

This control is mounted external to the mechanism and provides the ability to select phase minimum trip (one for all three phases) by means of a manual rotary switch. It also has an RS232 port for connection to a PC to view the last trip data. This control is used on ganged three-phase or three single-phase MVI mechanisms.

EXTERNAL CONTROL WITH SELECTABLE SINGLE / THREE-PHASE TRIP FUNCTION (80 CONTROL)

This control is mounted externally to the mechanism of the interrupter and provides the ability to select between single-phase trip and three-phase trip. The 80 Control can be used with one three-phase interrupter or with three single-phase interrupters. For three-phase applications, the ground trip function can be blocked from the front panel. Manual Trip and Reset Target buttons are also located on the front panel. This control uses the E-Set software, which allows programming via computer using the MVI-STP adapter. E-Set features custom TCC curves, and provides access to the last fault event information as well as real-time current per phase.

CURVES

Relay Curves (minimum trip 30-600 Amp)				Fuse Curves (minimum trip 10-200 Amp)		
Curve #	Curve Reference #	Curve Type		Curve #	Curve Reference #	Curve Type
01	MVI-TCC-01	E Slow		54	MVI-TCC-54	E Slow
02	MVI-TCC-02	E Standard		55	MVI-TCC-55	E Standard
03	MVI-TCC-03	Oil Fuse Cutout		56	MVI-TCC-56	Oil Fuse Cutout
04	MVI-TCC-04	K		57	MVI-TCC-57	K
05	MVI-TCC-05	Kearney QA		58	MVI-TCC-58	Kearney QA
06	MVI-TCC-06	Cooper EF		59	MVI-TCC-59	Cooper NX-C
07	MVI-TCC-07	Cooper NX-C		60	MVI-TCC-60	T
08	MVI-TCC-08	CO-11-1				
09	MVI-TCC-09	CO-11-2				
10	MVI-TCC-10	T				
11	MVI-TCC-11	CO-9-1				
12	MVI-TCC-12	CO-9-2				
13	MVI-TCC-13	Cooper 280ARX				
14	MVI-TCC-14	F				
16	MVI-TCC-16	Kearney KS				
17	MVI-TCC-17	GE Relay				

ORDERING INFORMATION FOR MOLDED VACUUM INTERRUPERS

Diagram	Catalog Number	Description	W	H	D	Wt.
RISER POLE (Three-Phase Installations Only)						
	RMVI3-21-15-6ABX-YY	15kV 2-way 3-phase - Interrupter with Air Bushings on Top Terminals	30	45	25	150
	RMVI3-21-27-6ABX-YY	25kV 2-way 3-phase - Interrupter with Air Bushings on Top Terminals	30	45	25	150
	RMVI3-21-38-6ABX-YY	38kV 3-way 2-phase - Interrupter with Air Bushings on Top Terminals	30	45	25	150
	RMVI1-21-15-6ABX-3YY	15kV 2-way 3-phase - Interrupter with Air Bushings on Top Terminals Single-Phase Trip Selectable	30	45	25	150
	RMVI1-21-27-6ABX-3YY	27kV 2-way 3-phase - Interrupter with Air Bushings on Top Terminals Single-Phase Trip Selectable	30	45	25	150
	RMVI1-21-38-6ABX-3YY	38kV 2-way 3-phase - Interrupter with Air Bushings on Top Terminals Single-Phase Trip Selectable	30	45	25	150
SUBSURFACE						
Single-phase Vacuum Interruper						
	MVI1-21-15-XX	15kV 2-way 1-phase Interrupter	6	31	9	45
	MVI1-21-15-6EX	15kV 2-way 1-phase Interrupter - Elbow Interface	6	31	11	45
	MVI1-21-27-XX	27kV 2-way 1-phase Interrupter	6	31	9	45
	MVI1-21-27-6EX	27kV 2-way 1-phase Interrupter - Elbow Interface	6	31	11	45
	MVI1-21-38-XX	38kV 2-way 1-phase Interrupter	6	31	9	45
	MVI1-21-38-6EX	38kV 2-way 1-phase Interrupter - Elbow Interface	6	31	11	45
Three-phase Vacuum Interruper						
	MVI1-21-15-XX-3YY	15kV 2-way 3-phase Interrupter - Single-phase Trip Selectable - Ext. Control	20	31	9	145
	MVI1-21-27-XX-3YY	27kV 2-way 3-phase Interrupter - Single-phase Trip Selectable - Ext. Control	20	31	9	145
	MVI1-21-38-XX-3YY	38kV 2-way 3-phase Interrupter - Single-phase Trip Selectable - Ext. Control	20	31	9	145
	MVI3-21-15-XX-YY	15kV 2-way 3-phase Interrupter	20	33	10	145
	MVI3-21-27-XX-YY	27kV 2-way 3-phase Interrupter	20	33	10	145
	MVI3-21-38-XX-YY	38kV 2-way 3-phase Interrupter	20	33	10	145

ACCESSORIES

Catalog Number	Description
MVI-STP	Adapter for Connection Between MVI Units with Internal Control, and a Computer for Programming/Viewing Settings
MO120A	120 Vac Motor Operator for 3-phase Units
MO12D	12-24Vdc Motor Operator for 3-phase Units
UAD	12 Vdc Cleaveland Price Motor Operator and Control with SCADA Provisions
MR	Motor Ready-Provisions for Future Installation of Motor
PS	Parking Stand for MVI1 or MVS1 Between Bushings
PS3	Parking Stand for MVI3, MVS3 or RMVI3 Between Bushings
PS3M	Parking Stand for MVI3, MVS3 or RMVI3 on Mechanism Cover
PS6	Double Parking Stand for MVI3, RMVI3 or MVS3 (Between Bushings and on Mechanism Cover)
BT	Bail Tab Plate Installed
MV1PMB	Pole Mounting Bracket for Single-Phase Units Only (Order Separately)
MV3PMB	Pole Mounting Bracket for Three-Phase Units Only (Order Separately)
MV3HPMB	Horizontal Pole Mounting Bracket for Three-Phase Units Only (Order Separately)
MV13PMB	Pole Mounting Bracket for Three Single-Phase Units Only (Order Separately)
35AL-11	Connector Bare Wire Type 3/4" - 16 Rod for Riser Pole Units. Qty. of 1 needed Per Phase (Order Separately)
35AL-12	Connector 2-Hole Spade Type 3/4" - 16 Rod for Riser Pole Units. Qty. of 1 needed Per Phase (Order Separately)
MVI-TESTER	Tester for Electric Control Style 80

NOTES:
Weights and Dimensions are Approximate
X = 6 for 600 Amp or 2 for 200 Amp or 6E for 600 Amp T interface
Y = 10, 20, 30, 80 for different electronic controls.
Leave blank for internal (self-contained) control.

Accessories should be added as suffix to the main catalog number unless otherwise noted.
Other Configurations are Available. Please Consult Your Local Representative on Configurations Not Shown Here.

Multi-Way Unit Construction

Multi-way vault and padmount units are built using MVS, MVI, and MCAN modules as required by the application. These are mounted onto the ES Multi-way common bus system and assembled on a freestanding, floor mounted frame. At this stage the product is ready to be used in vault installations

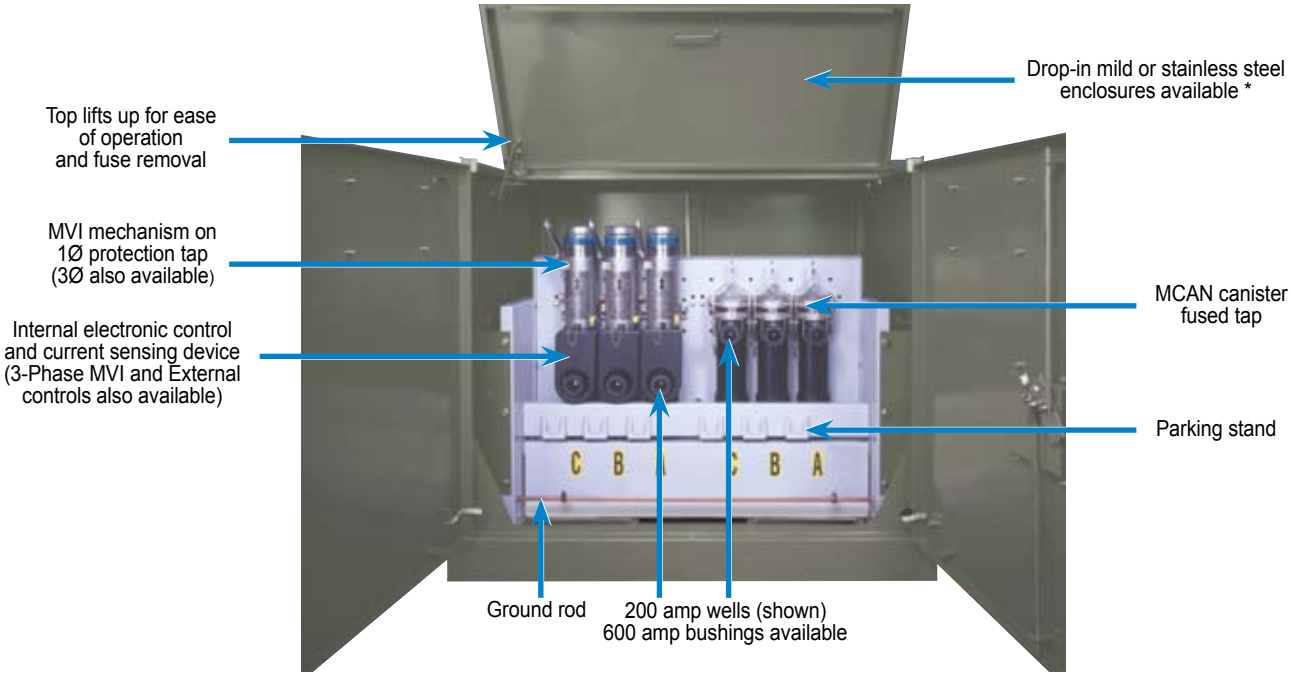
For padmount installations, a double-sided, drop-over, painted, mild-steel enclosure is provided. Munsell Green 7GY 3.29/1.5 is the standard enclosure color. Other colors are available upon request. Painted stainless steel or fiberglass enclosures are available as options.

COMMON BUS ASSEMBLY

PADMOUNT STYLE UNIT

VAULT STYLE UNIT

PADMOUNT UNIT: TAP (LOAD) SIDE



*Consult your local representative for fiberglass enclosure options

ORDERING INFORMATION

The following graph shows how to construct the catalog number for multi-way switchgear or transfer packages. Catalog numbers are shown on Tables 1-3 for the most common configurations:

EXAMPLE: The catalog number for an autotransfer package for padmount installation on a 3-phase, 27kV system, with two MVI protected taps, 600 Amp terminals and standard mild-steel enclosure is: **ATD324-AAPP-6666**

ORDERING INFORMATION FOR MULTI-WAY SWITCHGEAR OR TRANSFER PACKAGE

XX X X X X - XXXX - XXXX X X

"Ways"

SWITCH TYPE

AT	Auto Transfer
ES	Multi-Way Switch

TYPE

V	Vault
S	Sub Surface
D	Double Side Padmount
P	Single Side Padmount

PHASES

1	Single Phase
3	Three Phase

VOLTAGE CLASS

1	15.5kV
2	27.0kV
3	38.0kV

WAYS

2	2 Way
3	3 Way
4	4 Way

ENCLOSURE MATERIAL

Blank	Mild Steel
S	Stainless Steel

CABINET DEPTH PADMOUNT

Blank	54 Inches

INTERFACE BY WAY

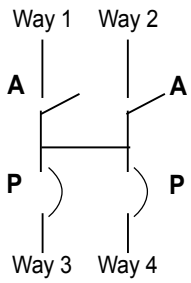
2	200 Amp Bushing Well
6	600 Amp Bushing Well

COMPONENTS BY WAY

A	3 Phase switch motor operator auto transfer
B	Solid tap/direct bus connection (600 or 200A)
C	3 Phase MVI fault interrupter 20 control
D	3 Phase MVI fault interrupter 30 control
E	MCAN 4B CL fuse canister 8.3kV fuses
F	MCAN 5B CL fuse canister 15.5kV fuses
G	MCAN 6B CL fuse canister 23.0kV fuses
I	3 Phase MVS switch with motor provisions
J	1 Phase fault interrupter
K	1 Phase fault interrupter, 10 control
L	1 Phase fault interrupter, 80 control
M	1 Phase fault interrupter, 20 control
N	1 Phase fault interrupter, 30 control
O	3 Phase MVI fault interrupter, 80 control
P	3 Phase MVI fault interrupter
Q	3 Phase MVS switch with UAD control
R	3 Phase MVI fault interrupter motor operator 12-24 Vdc
S	1 Phase MVS switch
T	3 Phase MVS switch
U	3 Phase MVS with 12-24 Vdc motor
V	3 Phase MVS with 120 Vac motor
W	3 Phase MVI fault interrupter motor operator 120 Vac
Y	3 Phase MVI interrupter with motor provisions
Z	3 Phase MVI fault interrupter with UAD control

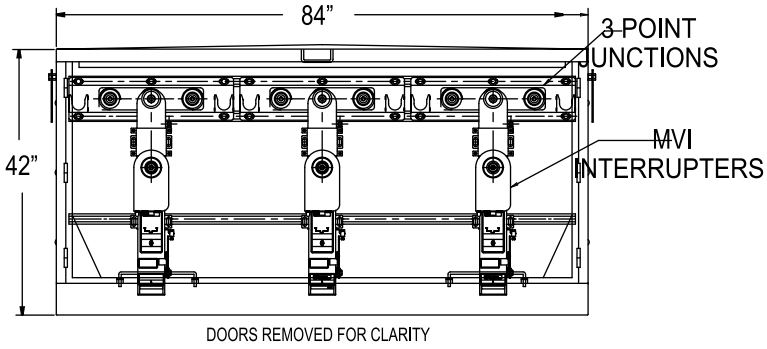
Auto Transfer Ways 1 & 2 are always "A"

EXAMPLE: ATD324-AAPP-6666

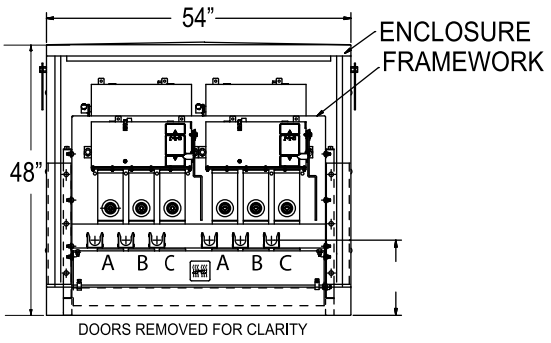


NOTES:
- Custom Padmount enclosure dimensions are available
- Parking Stands are standard on Padmount units
- Consult your local representative on Multi-Way configurations that include 38kV MVI's

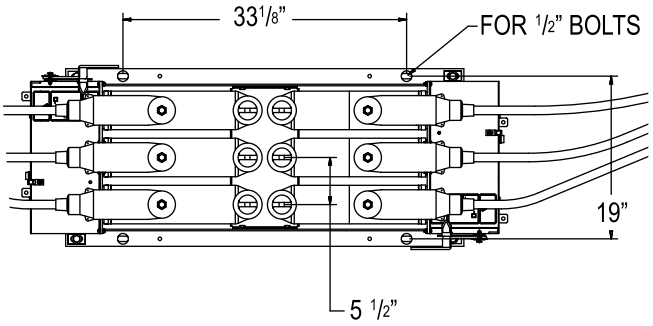
SINGLE SIDE PADMOUNT ESP313-BJB-626



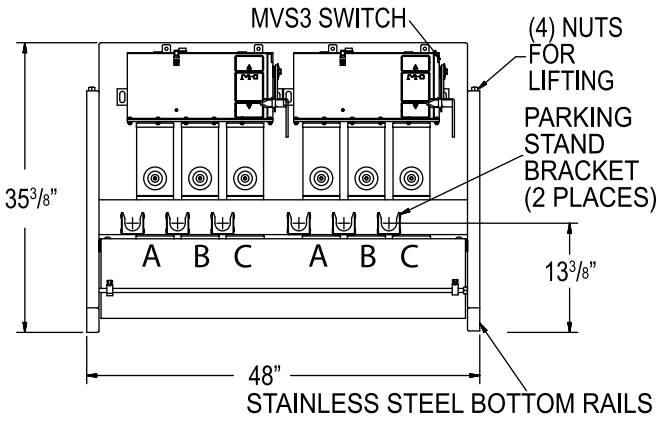
DOUBLE SIDE PADMOUNT ESD3X4-IIPP-6622-S



SUBSURFACE ESS3X2-TT-66



VAULT ESV3X4-TTTT-2222

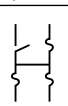


ORDERING INFORMATION FOR SWITCHING AND SECTIONALIZING SWITCHGEAR

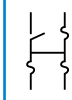
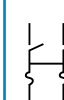
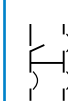
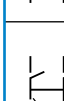
Diagram	Catalog Number	Description	W	H	D	Wt.
VAULT						
	ESV313-TTT-XXX	15kV 3-way 3-phase Switch	48	36	22	750
	ESV323-TTT-XXX	27kV 3-way 3-phase Switch	48	36	22	750
	ESV333-TTT-XXX	38kV 3-way 3-phase Switch	48	36	22	750
	ESV314-TTTT-XXXX	15kV 4-way 3-phase Switch	48	36	22	880
	ESV324-TTTT-XXXX	27kV 4-way 3-phase Switch	48	36	22	880
	ESV334-TTTT-XXXX	38kV 4-way 3-phase Switch	48	36	22	880
PADMOUNT						
	PMVS1-21-15-XX	15kV 2-way 1-phase Switch	36	30	30	310
	PMVS1-21-27-XX	27kV 2-way 1-phase Switch	36	30	30	310
	PMVS1-21-38-XX	38kV 2-way 1-phase Switch	36	30	30	310
	ESD312-T-XX	15kV 2-way 3-phase Switch	36	48	42	680
	ESD322-T-XX	27kV 2-way 3-phase Switch	36	48	42	680
	ESD332-T-XX	38kV 2-way 3-phase Switch	36	48	42	680
	ESD313-TTT-XXX	15kV 3-way 3-phase Switch	54	48	54	1250
	ESD323-TTT-XXX	27kV 3-way 3-phase Switch	54	48	54	1250
	ESD333-TTT-XXX	38kV 3-way 3-phase Switch	54	48	54	1250
	ESD314-TTTT-XXXX	15kV 4-way 3-phase Switch	54	48	54	1380
	ESD324-TTTT-XXXX	27kV 4-way 3-phase Switch	54	48	54	1380
	ESD334-TTTT-XXXX	38kV 4-way 3-phase Switch	54	48	54	1380

NOTE:
Other configurations are available. Consult your local representative on configurations not shown here.

ORDERING INFORMATION FOR OVERCURRENT PROTECTION SWITCHGEAR

Diagram	Catalog Number	Description	W	H	D	Wt.
VAULT						
	ESV312-E-XX	8.3kV 2-way 3-phase - One Fused Tap with Canister Fuses	21	24	11	63
	ESV322-F-XX	15kV 2-way 3-phase - One Fused Tap with Canister Fuses	21	29	11	69
	ESV332-G-XX	23kV 2-way 3-phase - One Fused Tap with Canister Fuses	21	32	11	72
	ESV312-TE-XX	8.3kV 2-way 3-phase - One Source Switch, One Fused Tap	24	36	22	350
	ESV322-TF-XX	15kV 2-way 3-phase - One Source Switch, One Fused Tap	24	36	22	350
	ESV332-TG-XX	23kV 2-way 3-phase - One Source Switch, One Fused Tap	24	39	22	350
	ESV313-TEE-XXX	8.3kV 3-way 3-phase - One Source Switch, Two Fused Taps	36	48	22	560
	ESV323-TFF-XXX	15kV 3-way 3-phase - One Source Switch, Two Fused Taps	36	48	22	560
	ESV333-TGG-XXX	23kV 3-way 3-phase - One Source Switch, Two Fused Taps	39	48	22	560
	ESV313-TTE-XXX	8.3kV 3-way 3-phase - Two Source Switches, One Fused Tap	36	48	22	560
	ESV323-TTF-XXX	15kV 3-way 3-phase - Two Source Switches, One Fused Tap	36	48	22	560
	ESV333-TTG-XXX	23kV 3-way 3-phase - Two Source Switches, One Fused Tap	39	48	22	560
	ESV313-TPP-XXX	15kV 3-way 3-phase - One Source Switch, Two Vacuum Interrupter Taps	40	48	22	660
	ESV323-TPP-XXX	27kV 3-way 3-phase - One Source Switch, Two Vacuum Interrupter Taps	40	48	22	660
	ESV313-TTP-XXX	15kV 3-way 3-phase - Two Source Switches, One Vacuum Interrupter Tap	40	48	22	660
	ESV323-TTP-XXX	27kV 3-way 3-phase - Two Source Switches, One Vacuum Interrupter Tap	40	48	22	660
	ESV314-TEEE-XXXX	8.3kV 4-way 3-phase - One Source Switch, Three Fused Taps	36	48	22	670
	ESV324-TFFF-XXXX	15kV 4-way 3-phase - One Source Switch, Three Fused Taps	36	48	22	670
	ESV334-TGGG-XXXX	23kV 4-way 3-phase - One Source Switch, Three Fused Taps	36	48	22	670
	ESV314-TTEE-XXXX	8.3kV 4-way 3-phase - Two Source Switches, Two Fused Taps	36	48	22	740
	ESV324-TTFF-XXXX	15kV 4-way 3-phase - Two Source Switches, Two Fused Taps	36	48	22	740
	ESV334-TTGG-XXXX	23kV 4-way 3-phase - Two Source Switches, Two Fused Taps	39	48	22	740
	ESV314-TTTE-XXXX	8.3kV 4-way 3-phase - Three Source Switches, One Fused Tap	36	48	22	810
	ESV324-TTTF-XXXX	15kV 4-way 3-phase - Three Source Switches, One Fused Tap	39	48	22	810
	ESV334-TTTG-XXXX	23kV 4-way 3-phase - Three Source Switches, One Fused Tap	39	48	22	810
	ESV314-TPPP-XXXX	15kV 4-way 3-phase - One Source Switch, Three Vacuum Interrupter Taps	40	48	22	880
	ESV324-TPPP-XXXX	27kV 4-way 3-phase - One Source Switch, Three Vacuum Interrupter Taps	40	48	22	880
	ESV314-TTPP-XXXX	15kV 4-way 3-phase - Two Source Switches, Two Vacuum Interrupter Taps	40	48	22	880
	ESV324-TTPP-XXXX	27kV 4-way 3-phase - Two Source Switches, Two Vacuum Interrupter Taps	40	48	22	880
	ESV314-TTTP-XXXX	15kV 4-way 3-phase - Three Source Switches, One Vacuum Interrupter Tap	40	48	22	880
	ESV324-TTTP-XXXX	27kV 4-way 3-phase - Three Source Switches, One Vacuum Interrupter Tap	40	48	22	880
PADMOUNT						
	PMVI1-21-15-XX	15kV 2-way 1-phase Interrupter	36	30	30	310
	PMVI1-21-27-XX	27kV 2-way 1-phase Interrupter	36	30	30	310
	PMVI1-21-38-XX	38kV 2-way 1-phase Interrupter	36	30	30	310
	PMVI1-21-15-XX-3YY	15kV 2-way 3-phase Interrupter - Single-phase Trip Selectable - Ext. Control	48	42	30	680
	PMVI1-21-27-XX-3YY	27kV 2-way 3-phase Interrupter - Single-phase Trip Selectable - Ext. Control	48	42	30	680
	PMVI1-21-38-XX-3YY	38kV 2-way 3-phase Interrupter - Single-phase Trip Selectable - Ext. Control	48	42	30	680
	ESD312-E-XX	8.3kV 2-way 3-phase - One Fused Tap	36	48	42	610
	ESD322-F-XX	15kV 2-way 3-phase One Fused Tap	36	48	42	610
	ESD332-G-XX	23kV 2-way 3-phase One Fused Tap	36	48	42	610

ORDERING INFORMATION FOR OVERCURRENT PROTECTION SWITCHGEAR

Diagram	Catalog Number	Description	W	H	D	Wt.
PADMOUNT (CONTINUED)						
	ESD312-P-XX	15kV 2-way 3-phase - One Vacuum Interrupter Tap	36	48	42	680
	ESD322-P-XX	27kV 2-way 3-phase - One Vacuum Interrupter Tap	36	48	42	680
	ESD332-P-XX	38kV 2-way 3-phase - One Vacuum Interrupter Tap	36	48	42	680
	ESD312-TE-XX	8.3kV 2-way 3-phase - One Source Switch, One Fused Tap	36	48	42	750
	ESD322-TF-XX	15kV 2-way 3-phase - One Source Switch, One Fused Tap	36	48	42	750
	ESD332-TG-XX	23kV 2-way 3-phase - One Source Switch, One Fused Tap	36	48	42	750
	ESD313-TEE-XXX	8.3kV 3-way 3-phase - One Source Switch, Two Fused Taps	54	48	54	1050
	ESD323-TFF-XXX	15kV 3-way 3-phase - One Source Switch, Two Fused Taps	54	48	54	1050
	ESD333-TGG-XXX	23kV 3-way 3-phase - One Source Switch, Two Fused Taps	54	48	54	1050
	ESD313-TTE-XXX	8.3kV 3-way 3-phase - Two Source Switches, One Fused Tap	54	48	54	1050
	ESD323-TTF-XXX	15kV 3-way 3-phase - Two Source Switches, One Fused Tap	54	48	54	1050
	ESD333-TTG-XXX	23kV 3-way 3-phase - Two Source Switches, One Fused Tap	54	48	54	1050
	ESD313-TPP-XXX	15kV 3-way 3-phase - One Source Switch, Two Vacuum Interrupter Taps	54	48	54	1160
	ESD323-TPP-XXX	27kV 3-way 3-phase - One Source Switch, Two Vacuum Interrupter Taps	54	48	54	1160
	ESD333-TPP-XXX	38kV 3-way 3-phase - One Source Switch, Two Vacuum Interrupter Taps	72	54	72	1500
	ESD313-TTP-XXX	15kV 3-way 3-phase - Two Source Switches, One Vacuum Interrupter Tap	54	48	54	1160
	ESD323-TTP-XXX	27kV 3-way 3-phase - Two Source Switches, One Vacuum Interrupter Tap	54	48	54	1160
	ESD333-TTP-XXX	38kV 3-way 3-phase - Two Source Switches, One Vacuum Interrupter Tap	72	54	72	1500
	ESD314-TEEE-XXXX	8.3kV 4-way 3-phase - One Source Switch, Three Fused Taps	54	48	54	1170
	ESD324-TFFF-XXXX	15kV 4-way 3-phase - One Source Switch, Three Fused Taps	54	48	54	1170
	ESD334-TGGG-XXXX	23kV 4-way 3-phase - One Source Switch, Three Fused Taps	54	48	54	1170
	ESD314-TTEE-XXXX	8.3kV 4-way 3-phase - Two Source Switches, Two Fused Taps	54	48	54	1240
	ESD324-TTFF-XXXX	15kV 4-way 3-phase - Two Source Switches, Two Fused Taps	54	48	54	1240
	ESD334-TTGG-XXXX	23kV 4-way 3-phase - Two Source Switches, Two Fused Taps	54	48	54	1240
	ESD314-TTTE-XXXX	8.3kV 4-way 3-phase - Three Source Switches, One Fused Tap	54	48	54	1310
	ESD324-TTTF-XXXX	15kV 4-way 3-phase - Three Source Switches, One Fused Tap	54	48	54	1310
	ESD334-TTTG-XXXX	23kV 4-way 3-phase - Three Source Switches, One Fused Tap	54	48	54	1310
	ESD314-TPPP-XXXX	15kV 4-way 3-phase - One Source Switch, Three Vacuum Interrupter Taps	54	48	54	1380
	ESD324-TPPP-XXXX	27kV 4-way 3-phase - One Source Switch, Three Vacuum Interrupter Taps	54	48	54	1380
	ESD334-TPPP-XXXX	38kV 4-way 3-phase - One Source Switch, Three Vacuum Interrupter Taps	72	54	72	1500
	ESD314-TTPP-XXXX	15kV 4-way 3-phase - Two Source Switches, Two Vacuum Interrupter Taps	54	48	54	1380
	ESD324-TTPP-XXXX	27kV 4-way 3-phase - Two Source Switches, Two Vacuum Interrupter Taps	54	48	54	1380
	ESD334-TTPP-XXXX	38kV 4-way 3-phase - Two Source Switches, Two Vacuum Interrupter Taps	72	54	72	1500
	ESD314-TTTP-XXXX	15kV 4-way 3-phase - Three Source Switches, One Vacuum Interrupter Tap	54	48	54	1380
	ESD324-TTTP-XXXX	27kV 4-way 3-phase - Three Source Switches, One Vacuum Interrupter Tap	54	48	54	1380
	ESD334-TTTP-XXXX	38kV 4-way 3-phase - Three Source Switches, One Vacuum Interrupter Tap	72	54	72	1500

NOTE: Consult your local representative on 38kV Multi-Way configurations.

Automatic Source Transfer

The main application of source transfer packages is to transfer a load from one power source to another. In some cases, when the load is not critical, this is done manually using a switching device (see switching section). In the case of critical loads such as hospitals, financial institutions, manufacturing facilities, and any other load that would have computer-related equipment, a fast transfer is required between the main (preferred) source and the backup (alternate) source. It is important for the automatic source transfer not to affect the operation of the load because any interruption of the business process translates into costly lost production and setup time. The preferred and backup sources are normally utility feeders, but in some cases the backup source may be a generator.

Elastimold® Switchgear offers automatic transfer (AT) packages capable of performing a full transfer in less than 2 seconds. The system monitors the voltage on the preferred source, and initiates a transfer when the voltage is below the acceptable level for the customer. At this point the preferred source is disconnected and the alternate source connected. AT packages include:

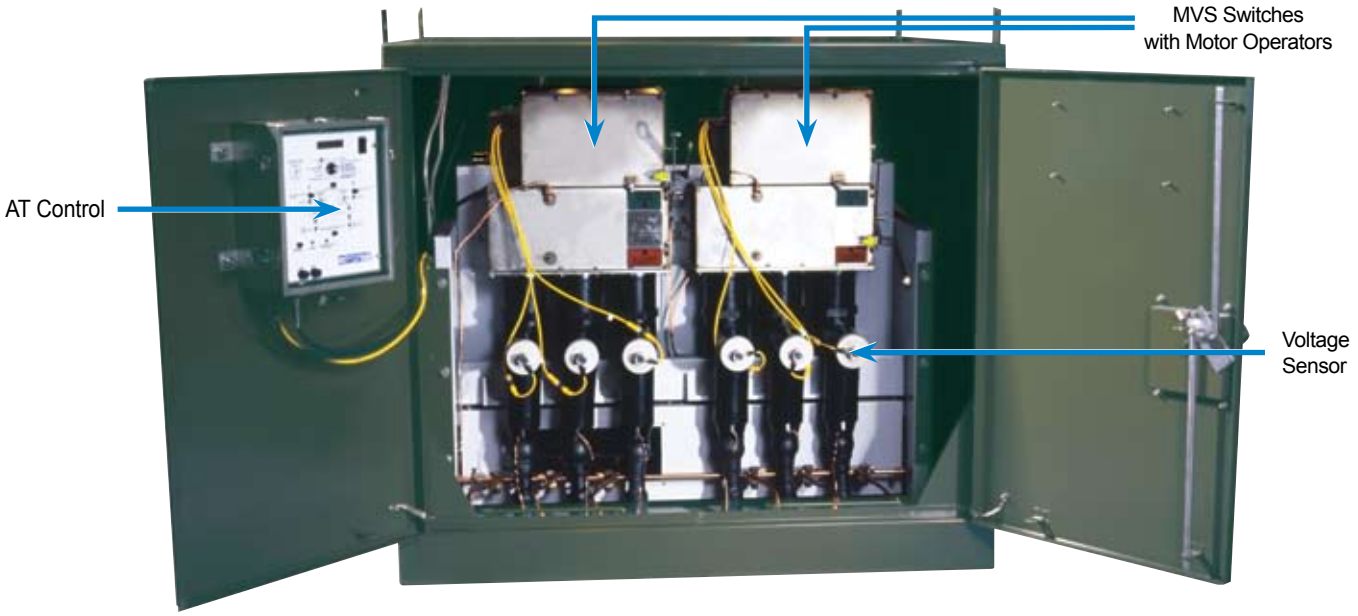
Two three-phase MVS switches with motor operators (one for the preferred source, and one for the alternate source)

Six Voltage sensors (one for each phase of the MVS switches). These sensors monitor voltage on every phase and feed their output to the AT control.

AT control which receives the output from the voltage sensors, and determines if there is a loss of voltage. If there is a loss of voltage, the AT control sends an OPEN signal to the preferred source MVS, and a CLOSE signal to the alternate source MVS. When the voltage is restored the system transfers back to its normal state, either automatically or at a set time.

One or two protected taps. These can be MCAN or MVI modules, which protect the critical load against overcurrent. Solid taps are also available.

PADMOUNT AUTOMATIC SOURCE TRANSFER



*Automatic Source Transfer packages are also available for subsurface/vault installations.

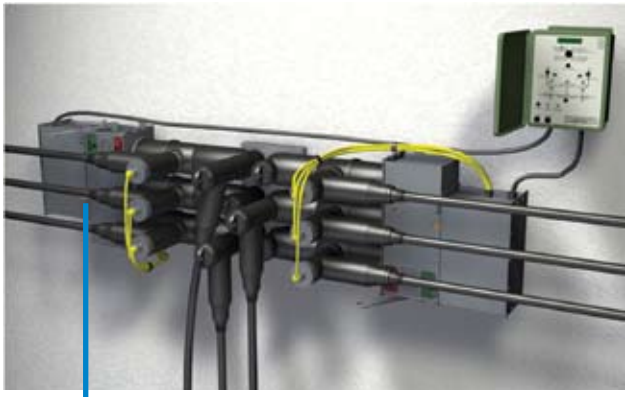
ORDERING INFORMATION FOR AUTOMATIC SOURCE TRANSFER PACKAGES

Diagram	Catalog Number	Description	W	H	D	Wt.
SUBSURFACE (2-MVS3 Interconnected with Multi-point junctions. For wall/floor mounting.)						
 *	ATS312-AA-XX	15kV 2-way 3-phase - Two Source Switches, Customer Connected Tap	21	19	26	60
	ATS322-AA-XX	25kV 2-way 3-phase - Two Source Switches, Customer Connected Tap	21	19	26	60
	ATS313-AAB-XXX	15kV 3-way 3-phase - Two Source Switches, One Solid Tap	22	79	21	300
	ATS323-AAB-XXX	25kV 3-way 3-phase - Two Source Switches, One Solid Tap	22	79	21	300
	ATS314-AABB-XXXX	15kV 4-way 3-phase - Two Source Switches, Two Solid Taps	22	79	21	300
	ATS324-AABB-XXXX	25kV 4-way 3-phase - Two Source Switches, Two Solid Taps	22	79	21	300
 **	ATS313-AAP-XXX	15kV 3-way 3-phase - Two Source Switches, One Vacuum Interrupter Tap	22	79	21	450
	ATS323-AAP-XXX	25kV 3-way 3-phase - Two Source Switches, One Vacuum Interrupter Tap	22	79	21	450
 **	ATS314-AAPP-XXXX	15kV 4-way 3-phase - Two Source Switches, Two Vacuum Interrupter Taps	22	79	21	600
	ATS324-AAPP-XXXX	25kV 4-way 3-phase - Two Source Switches, Two Vacuum Interrupter Taps	22	79	21	600
VAULT (All ways mounted onto a Common Bus and supported by a Free-Standing Frame. For floor mounting.)						
	ATV313-AAB-XXX	15kV 3-way 3-phase - Two Source Switches, One Solid Tap	48	36	22	620
	ATV323-AAB-XXX	25kV 3-way 3-phase - Two Source Switches, One Solid Tap	48	36	22	620
	ATV313-AAP-XXX	15kV 3-way 3-phase - Two Source Switches, One Vacuum Interrupter Tap	48	36	22	750
	ATV323-AAP-XXX	25kV 3-way 3-phase - Two Source Switches, One Vacuum Interrupter Tap	48	36	22	750
	ATV314-AAPP-XXXX	15kV 4-way 3-phase - Two Source Switches, Two Vacuum Interrupter Taps	48	36	22	880
	ATV324-AAPP-XXXX	25kV 4-way 3-phase - Two Source Switches, Two Vacuum Interrupter Taps	48	36	22	880
PADMOUNT						
	ATD313-AAP-XXX	15kV 3-way 3-phase - Two Source Switches, One Vacuum Interrupter Tap	54	48	54	1160
	ATD323-AAP-XXX	25kV 3-way 3-phase - Two Source Switches, One Vacuum Interrupter Tap	54	48	54	1160
	ATD314-AAPP-XXXX	15kV 4-way 3-phase - Two Source Switches, Two Vacuum Interrupter Taps	54	48	54	1380
	ATD324-AAPP-XXXX	25kV 4-way 3-phase - Two Source Switches, Two Vacuum Interrupter Taps	54	48	54	1380

NOTES:
X=6 for 600 Amp or 2 for 200 Amp
Other Configurations are Available. Please Consult Your Local Representative on Configurations Not Shown Here.
* Dimensions for One Switch
** Dimensions for 2-MVS3 Interconnected with Multi-Point Junctions. MVIs are Mounted Elsewhere in the Vault.

Elastimold® Modular Switchgear offers the ability to add automation to existing or new installations. DC or AC motor operators can be added to switches or interrupters in vault, riser pole, or padmount installations. The motors are submersible and the same automation package can be used in all applications.

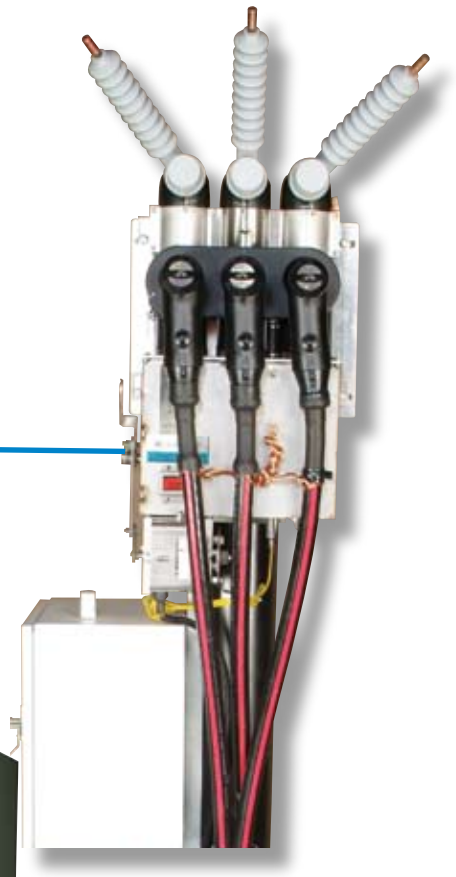
The motors can either be operated from a short distance using a handheld device, as it is the case is some vault installations, or they can be outfitted with fully automated controls containing -Battery-Power supply-Customer-selected RTU-Customer-selected Communications Protocol-Customer-selected Communications Device



Wall Mounted Vault Installation

AUTOMATED UNITS

Floor Mounted Vault Installation



Riser Pole Installation

Padmount Installation

The motors can either be operated from a short distance using a handheld device, as it is the case is some vault installations, or they can be outfitted with fully automated controls containing:

- Battery
- Power Supply
- Customer-Selected RTU
- Customer-Selected Communications Protocol
- Customer-Selected Communications Device

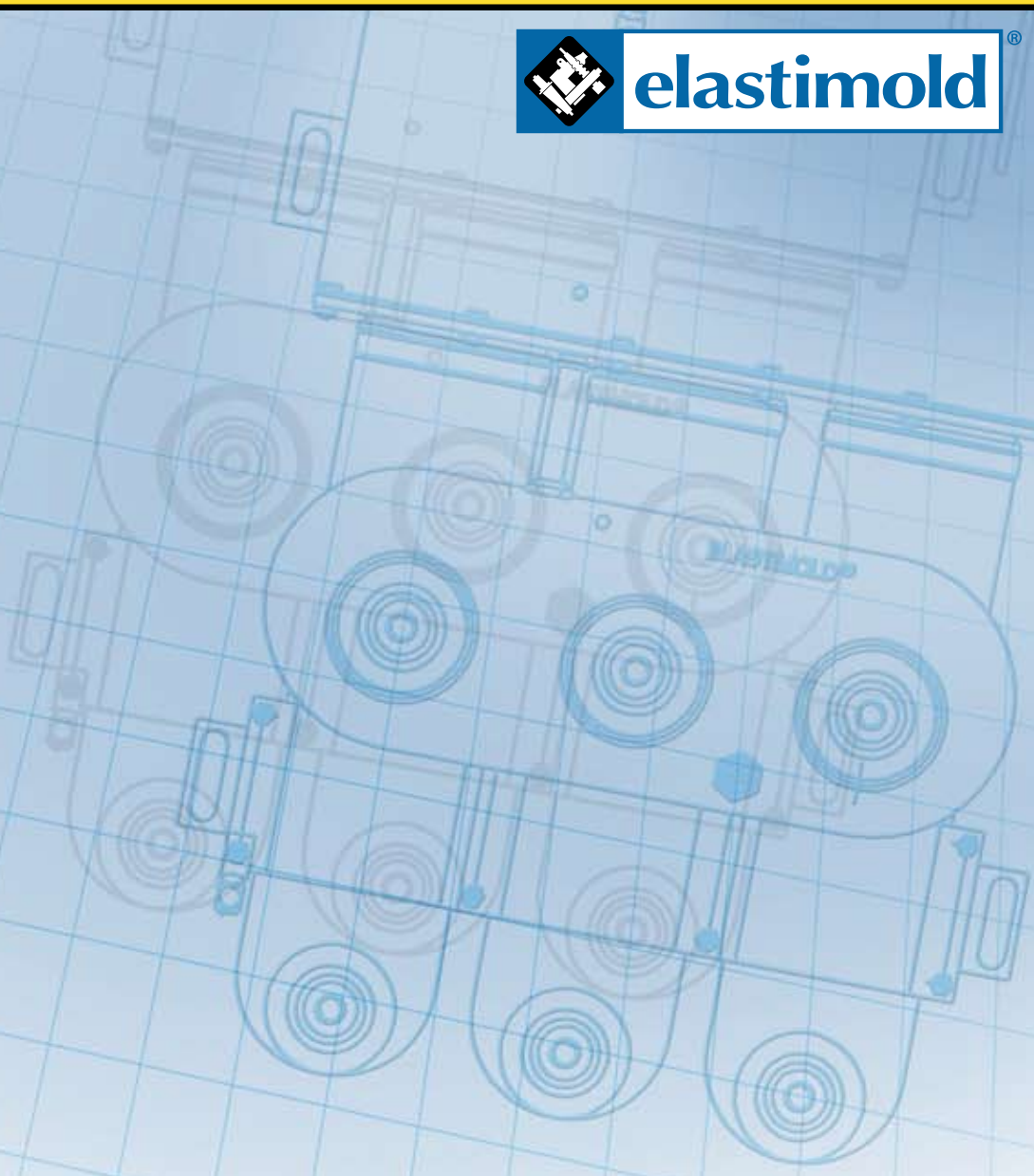
Motor Control

Motor Operated Switch

NOTE:
Consult your local representative on specific Distribution Automation Packages and configurations available.

POWER DELIVERY

elastimold®



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