



Surge Arresters Catalog



MacLean Power Systems offers a full range of polymer housed surge arresters meeting the needs for transmission, substation, distribution and secondary surge protection. With over 75 years of arrester design and manufacturing under the Joslyn brand, combined with MacLean Power Systems' polymer manufacturing expertise, the MPS arrester product offering provides maximum surge protection for the long term.

All of our arresters are designed for the growing demands of power quality and reliability with safety of workers and the public as a first priority. Each design maximizes protection for each application to extend the life of operating lines and equipment.

Distribution

- Zforce™ direct 'mold-on' polymer housing design provides the best protection for overhead distribution circuits and the best protection against moisture ingress for the most reliable service life
- ZE elbow arresters for distribution underground open point protection

Substation

- ZSP polymer housed station class arresters are lightweight and easy to install
- ZIP polymer housed intermediate class arresters designed for lower energy demands
- ZJP polymer housed, light fault duty, intermediate class arresters for low fault current system applications

Transmission Lines

- ZQPT heavy duty, polymer housed transmission line arresters are designed for line protection to significantly reduce lightning outages and extend recloser life
- ZXLA Insulator-Arrester combination assemblies designed with MPS transmission insulators to provide an easy to install combination for maximum insulation and over-voltage protection

Secondary Voltage

- SurgeTec - 175, 480 and 650 volt secondary arresters with a patented fault withstand safety design. Provide protection for meters and facility service entrance

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MacLean Power Systems



Arresters General Information

Insulation Coordination

Arresters are used to limit voltage surges on an electrical system to a known and controlled level. The concept of insulation coordination means that properly installed arresters limit the incoming voltage surges to levels within the withstand capability of the insulating system. Arresters prevent insulation, such as air, porcelain, oil, cable or wire insulation, etc. from breaking down, therefore, significantly improving the reliability of the electrical system. Figure 1 demonstrates this basic concept. The difference between the two curves is the protective margin.

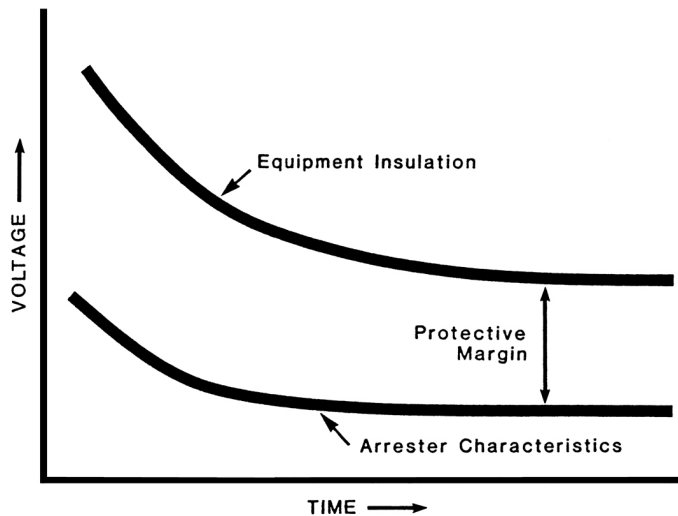


Figure 1

The process of correlating the insulation withstand levels of the protected equipment and the protective characteristics of surge arresters is known as insulation coordination. Without sparkgaps, the insulation coordination between the metal oxide arrester and the insulation being protected is defined by the discharge voltage of the arrester from very short times in the impulse region to longer times in the switching surge region. The equivalent front-of-wave of the arrester is used to coordinate with the chopped wave withstand value, generally defined as 1.15 x BIL of the transformer. For station class arresters, the equivalent front-of-wave (EFOW) of the arrester is obtained by discharging a 10kA (5kA for intermediate arresters) impulse current wave which produces a voltage wave cresting in 0.5 microseconds.

Discharge voltage, at a specific current level, is used to coordinate with the equipment Basic Insulation Level (BIL). The discharge voltage is the crest voltage that results from an 8/20 microsecond current surge. The coordinating current selected will depend on the shielding of the substation and other system conditions. A typically recommended value for the coordinating current is 10kA.

The switching surge protective level is determined by comparing the switching surge response of the arrester, with the switching surge withstand level of the transformer, generally defined as .83 x BIL of the transformer. The voltage of the arrester is a function of the current. A current of 500 amperes

is used for the intermediate arresters and station class arresters from 3-96kV. A 1000 ampere surge is used for station arresters rated 108kV to 198kV. All current impulses have a 45/90 microsecond wave shape.

To determine the margin of protection, the following equation is used:

$$\text{Percent Margin} = \left[\left(\frac{\text{Transformer Withstand Level}}{\text{Arrester Protective Level}} \right) - 1 \right] \times 100$$

A Type ZSP arrester rated 108 kV protecting a transformer with a 450 kV BIL has the following margins of protection:

Chopped Wave Withstand - Equivalent Front of Wave

$$\text{Percent Margin} = \left[\left(\frac{1.15 \times 450}{273.7} \right) - 1 \right] \times 100 = 82 \%$$

Full Wave Withstand - Discharge Voltage for a 10kA Impulse Current

$$\text{Percent Margin} = \left[\left(\frac{450}{249.2} \right) - 1 \right] \times 100 = 74 \%$$

Switching Surge Withstand - Switching Surge Voltage

$$\text{Percent Margin} = \left[\left(\frac{0.83 \times 450}{195.2} \right) - 1 \right] \times 100 = 73 \%$$

All margins are well above the minimum 20% margin recommendation of the ANSI application guide C62.22.

Application

Proper application of metal oxide arresters is needed to receive appropriate performance and adequate protection. Arrester selection depends on the application and should be based on the level of protection needed, durability of the arrester and quality assurance of the manufacturer.

Level of protection is the first and most important factor in applying arresters. The purpose of an arrester is to protect system equipment against damaging surges. The level of protection is a function of the discharge voltage characteristics of the arrester. The lower the discharge voltage, the greater the level of protection provided. The discharge voltage characteristics of distribution arresters provide excellent margins of protection needed for even the most severe applications.

Protective margins are not the only criteria in arrester selection. Proper performance is based on selecting the appropriate ratings to withstand system conditions. The maximum continuous line-to-ground voltage of the system should not exceed the MCOV rating of the arrester. The MPS arrester ratings are in accordance with the ANSI/IEEE C62.11-2005 Standard for Metal Oxide Surge Arresters for AC Power Circuits. Temporary overvoltages (TOV) can have damaging effects on metal oxide arresters. The excellent TOV characteristics of the MOV arresters will exceed the potential system overvoltages when properly selected.



Arresters General Information

There are four basic types of arresters defined by industry standards. The arrester type selected for the application depends on the equipment being protected and what level of protection is required.

Secondary—Available in ratings up to 650 volts, secondary arresters are used to protect equipment at the utilization voltage level.

Distribution—Typically used for the protection of equipment on power distribution circuits. They are available in ratings up to 36kV. This type of arrester is further defined by Normal Duty and Heavy Duty and includes special application arresters such as riser pole or dead front elbow type.

Intermediate—Available in ratings up to 144kV, intermediate type arresters offer improved protective characteristics and durability. They are generally used for protection of smaller substations, or medium class power equipment.

Station—Available in ratings up to 216kV, station class arresters offer the best performance among the four different types. They are typically used to protect substation equipment, rotating machines or other applications where premium protection is required.

Fault Current Data

Fault current testing, also known as short circuit testing, demonstrates an arrester failure based on the most probable failure modes over a range of fault currents. Two failure modes are tested: 1) a fuse wire runs along the side of the internal valve elements to simulate an internal flashover (moisture or collar failure), 2) overvoltage the arrester until the resistive elements fail to simulate a system overvoltage exceeding the unit's TOV capability.

ANSI/IEEE C62.11 2005, specifies the test procedures and acceptance criteria for fault current tests on surge arresters.

Temporary Overvoltage

Temporary power frequency overvoltages (TOV) can occur due to the voltage rise on unfaulted phases during a line-to-ground fault, the loss of the neutral ground of an effectively grounded system, sudden loss of load, generator over speed and other conditions. Overvoltages exceeding an arrester's MCOV (U_c) rating cause an increase in current, resulting in increased power loss and temperature, thereby, affecting the arrester's stability.

Quality Assurance

ISO 9001:2000 Certified

MacLean Power Systems metal oxide facility is ISO 9001:2000 certified. Years of extensive quality control processes easily met the requirements of ISO certification, and has been proven with unsurpassed field performance of arresters. MPS employs an extensive quality system from raw materials through final assembly.

Each block is selected for final assembly based on discharge voltage, to assure the discharge voltage of the arrester will not exceed published values. After final assembly, the complete arrester once again receives a series of electrical tests including watts loss, reference voltage and radio influence voltage. Only units accepted by the computerized tester continue on for final packaging and shipping.

Research and Development

Research and development is an on-going process at MPS. Our engineers are continually striving for new materials or processes that will lead to improved arrester performance in the field. Specifically designed test equipment provides the capability to properly evaluate new developments. Research and Development is an important part of our business and commitment to the future.



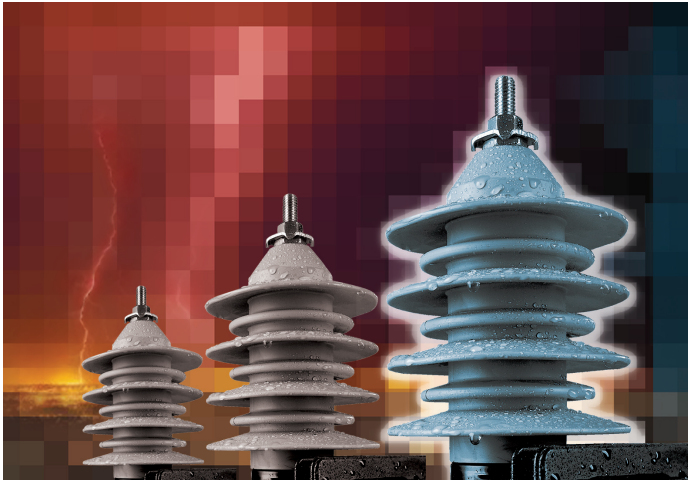
Arrester Ratings for Various System Voltages

System L-L Voltage (kV)		Grounded Neutral Circuits		Ungrounded, Temporarily Ungrounded Impedance Grounded Circuits	
Nominal	Maximum	Rating	MCOV	Rating	MCOV
2.40	2.52	3*	2.55	3*	2.55
4.16	4.37			6*	5.10
4.80	5.04	6*	5.10	9*	7.65
6.90	7.25			10*	8.40
8.32	8.74			15	12.70
12.00	12.70	10	8.40	18	15.30
12.47	13.20	9*	7.65	15*	12.70
		10	8.40	18	15.30
		10*		15	12.70
13.20	13.90	12	10.20	18*	15.30
		10*	8.40		
13.80	14.50	12	10.20	-	-
23.00	24.20	18*	15.30	27*	22.00
		21	17.00	30	24.40
24.90	26.10	18*	15.30	30*	
		21	17.00	36	29.00
34.50	36.20	27*	22.00	39*	31.50
		30	24.40	45	36.50
46.00	48.30	36*	29.00	48*	39.00
		39	31.50	54	42.00
69.00	72.50	54*	42.00	66*	54.00
		60	48.00	72	57.00
115.00	121.00	90*	70.00	-	-
		96	76.00	108*	84.00
	121.00	108	84.00	120	98.00
138.00	145.00	108*		132*	106.00
		120	98.00	144	115.00
		120*		-	-
161.00	169.00	132	106.00	144*	115.00
		144	115.00	168	131.00
230.00	242.00	172*	140.00	-	-
		180	144.00		
		192	152.00		

*Nominal recommended ratings are highlighted. Use higher rating for severe duty.



Zforce™ Distribution Arresters



Features

- Zforce™ mold-on polymer housing for the ultimate seal against moisture ingress
- High strength fiberglass wrap for high fault-withstand design
- Integrated Ground Lead Disconnect for fast, reliable operation. Operates in less than 2 seconds at 1 amp and less than 2 cycles at 1,000 amps

Zforce™ ZNP (5kA Normal Duty Polymer)

Zforce™ ZHP (10kA Heavy Duty Polymer)

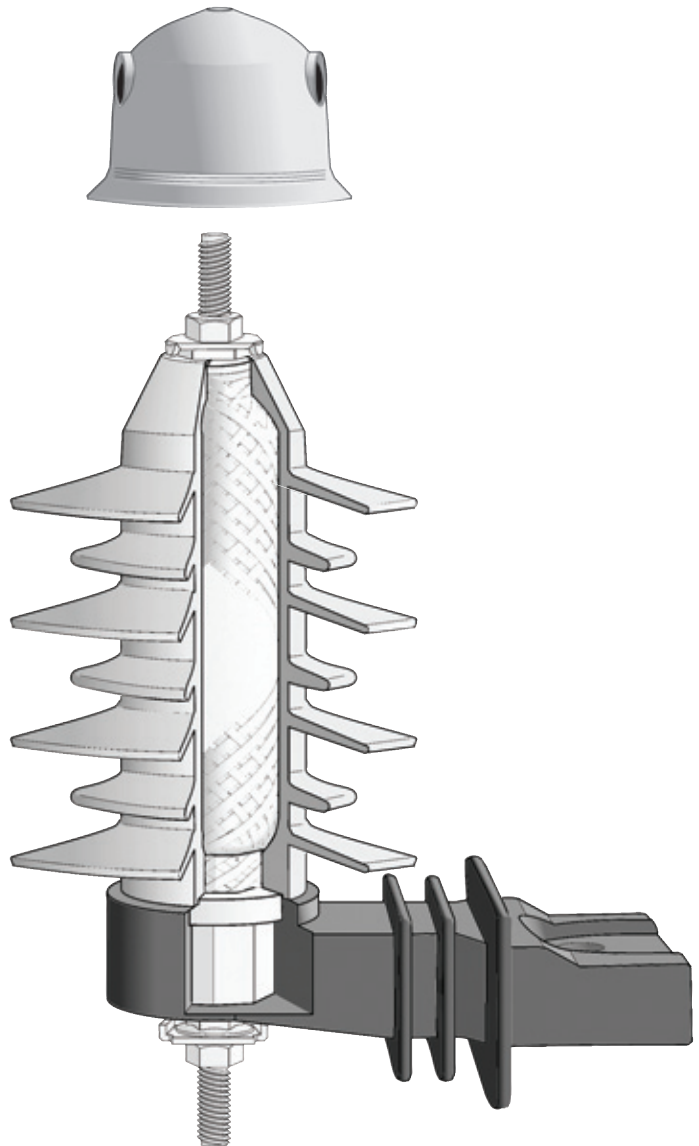
Zforce™ ZRP (10kA Riser Pole Polymer)

Durability

Heavy Duty and Riser Pole Distribution Class arresters have been called upon to serve in the most demanding of applications. Typically unshielded, overhead lines can produce some of the most severe lightning surges on the power system. MPS distribution arresters are designed to meet the demands of protecting underground and overhead equipment, respectively. Tested in accordance with the latest industry standard, ANSI/IEEE C62.11-2005 for metal oxide arresters, Zforce™ distribution arresters withstand the following minimum design tests:

Zforce Design Performance:

- High Current Short Duration
 - ZNP - 65kA
 - ZHP & ZRP - 100kA
- Low Current Long Duration
 - ZNP - 150A
 - ZHP & ZRP - 250A
- Duty Cycle per ANSI
 - ZNP - 5kA
 - ZHP & ZRP - 10kA
- Nominal Discharge Class per IEC:
 - ZNP - 5kA
 - ZHP & ZRP - 10kA, Class 1
- Minimum Switching Energy Capability (2 Surges)
 - ZNP - 2.2kJ/kV MCOV
 - ZHP - 2.7kJ/kV MCOV
 - ZRP - 2.2kJ/kV MCOV
- Lightning Energy Capability (1 Surge)
 - ZNP - 2.3kJ/kV MCOV
 - ZHP - 3.4kJ/kV MCOV
 - ZRP - 2.7kJ/kV MCOV
- Fault Withstand Capability
 - ZNP - 10kA
 - ZHP & ZRP - 20kA
- RUS Listed

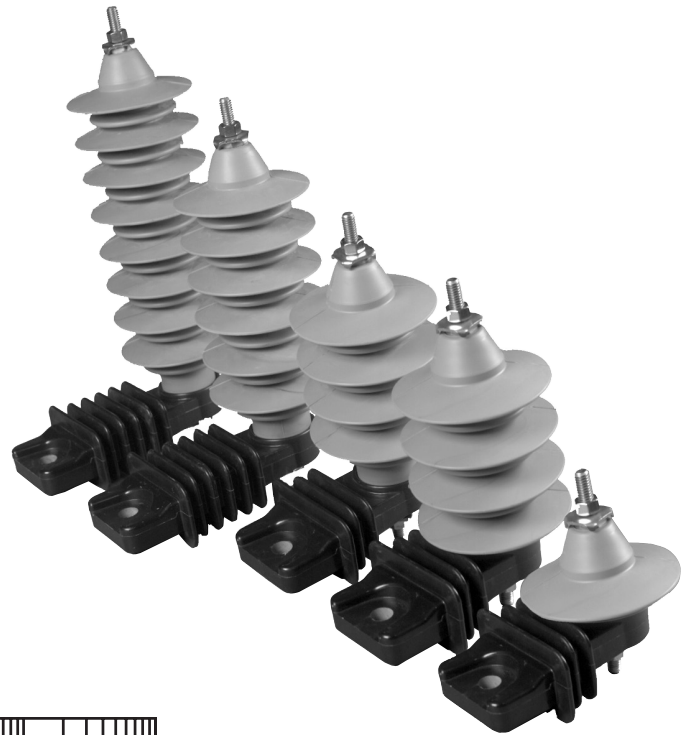




Zforce™ Distribution Arresters

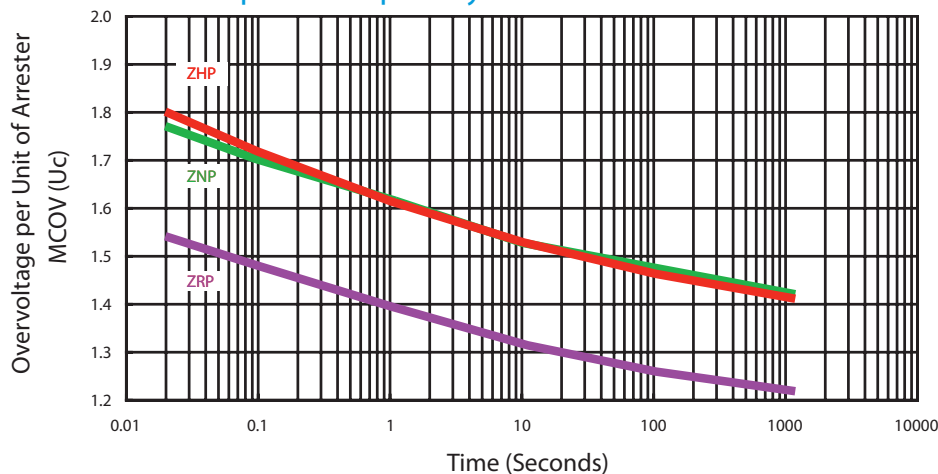
Terminal Connection

Distribution arrester line terminals utilize a stainless steel four corner “Star Clamp” for maximum conductor range and speed of installation. The ground terminals utilize a stainless steel “U clamp”. Both connectors securely clamp aluminum or copper conductors from No. 10 solid through 2/0 stranded. MPS specifies that no more than 20 ft/lbs of torque be applied to the line and ground terminals.



Duration (sec)	Voltage P.U. of MCOV (Uc)		
	ZNP	ZHP	ZRP
0.02	1.77	1.80	1.54
0.10	1.70	1.73	1.48
1.00	1.61	1.63	1.40
10	1.52	1.54	1.31
100	1.47	1.47	1.26
1000	1.42	1.43	1.22

TOV Graph and Capability 3kV to 36kV



Zforce ZNP™ (5kA Normal Duty Polymer)

Physical Characteristics														
kV	Creepage ¹		Strike		A		B		C		D		Weight ²	
	In	Mm	In	Mm	In	Mm	In	Mm	In	Mm	In	Mm	Lb	Kg
9	15.04	382	7.69	195	8.83	224	4.00	102	7.71	195	3.93	100	2.90	1.32
10	17.41	442	8.00	203	9.14	232			8.02	204			3.00	1.36
18	26.59	675	11.23	285	12.23	311			11.16	283	5.43	138	4.80	2.18

Electrical Characteristics									
Voltage Rating (Ur) (kV-rms)	MCOV (Uc) ³ (kV-rms)	Max Equiv FOW ⁴ (kV-Crest)	Max Switch Surge ⁶ (kV-Crest)	Maximum Discharge Voltage (kV-Crest) Using an 8/20 μs Current Impulse					
				1.5 kA	2.5 kA	3.0 kA	5.0 kA	10 kA	20 kA
9	7.65	29.9	23.7	25.4	26.2	26.6	28.2	30.5	33.8
10	8.4	32.9	26.3	28.1	29.2	29.6	31.3	33.9	37.4
18	15.3	59.7	47.4	50.7	52.3	53.1	56.4	61.0	67.5



Zforce ZNP™ and ZHP™ Distribution Arresters



Zforce ZHP™ (10kA Heavy Duty Polymer)

Physical Characteristics														
kV	Creepage ¹		Strike		A		B		C		D		Weight ²	
	In	Mm	In	Mm	In	Mm	In	Mm	In	Mm	In	Mm	Lb	Kg
3	7.96	202	5.47	139	6.52	166	4.30	109	5.40	137	3.93	100	2.30	1.05
6	11.94	303	6.02	153	7.66	195			6.54	166			3.00	1.37
9	15.92	404	7.76	197	8.80	224			7.68	195			3.60	1.64
10	18.28	464	8.21	209	9.14	232			8.02	204			3.70	1.68
12	19.90	506	8.91	226	9.94	253			8.82	224			4.20	1.91
15	23.84	606	10.01	254	11.09	282			10.02	254			4.90	2.23
18	27.87	708	11.40	290	12.23	311			11.16	283	5.43	138	5.90	2.68
21	31.85	809	12.54	319	13.37	340			12.30	312			6.50	2.96
24	35.83	910	13.69	348	14.51	369			13.44	341			7.10	3.23
27	39.92	1014	14.52	369	15.66	398			14.59	371			7.80	3.52
30	43.90	1115	15.51	394	16.78	426			15.71	399			8.40	3.80
36	51.95	1320	17.79	452	19.13	486			18.06	459			9.60	4.38

Electrical Characteristics									
Voltage Rating (Ur) (kV-rms)	MCOV (Uc) ³ (kV-rms)	Max Equiv FOW ⁵ (kV-Crest)	Max Switch Surge ⁶ (kV-Crest)	Maximum Discharge Voltage (kV-Crest) Using an 8/20 μs Current Impulse					
				1.5 kA	2.5 kA	3.0 kA	5.0 kA	10 kA	20 kA
3	2.55	10.4	7.8	8.5	8.8	8.9	9.3	9.9	10.9
6	5.10	20.7	15.5	16.9	17.5	17.7	18.6	19.8	21.8
9	7.65	31.0	23.3	25.4	26.2	26.6	27.9	29.7	32.7
10	8.40	34.5	25.9	28.2	29.1	29.5	31.0	33.0	36.3
12	10.20	41.3	31.0	33.8	34.9	35.4	37.2	39.6	43.5
15	12.70	51.7	38.8	42.2	43.6	44.2	46.5	49.5	54.4
18	15.30	62.0	46.5	50.7	52.3	53.1	55.8	59.4	65.3
21	17.00	72.3	54.3	59.1	61.0	61.9	65.1	69.3	76.2
24	19.50	82.6	62.1	67.6	69.7	70.7	74.4	79.2	87.0
27	22.00	92.9	69.9	76.0	78.4	79.6	83.7	89.1	98.9
30	24.40	103.3	77.6	84.4	87.1	88.4	93.0	99.0	108.8
36	29.00	124.0	93.1	101.3	104.5	106.1	111.5	118.8	130.5

Zforce ZRP™ (10kA Riser Pole Polymer)

Physical Characteristics														
kV	Creepage ¹		Strike		A		B		C		D		Weight ²	
	In	Mm	In	Mm	In	Mm	In	Mm	In	Mm	In	Mm	Lb	Kg
3	7.96	202	5.47	139	6.52	166	4.30	109	5.40	137	3.93	100	2.30	1.05
6	11.94	303	6.02	153	7.66	195			6.54	166			3.00	1.37
9	15.92	404	7.76	197	8.80	224			7.68	195			3.60	1.64
10	18.28	464	8.21	209	9.14	232			8.02	204			3.70	1.68
12	19.90	506	8.91	226	9.94	253			8.82	224			4.20	1.91
15	23.84	606	10.01	254	11.09	282			10.02	254			4.90	2.23
18	27.87	708	11.40	290	12.23	311			11.16	283	5.43	138	5.90	2.68
21	31.85	809	12.54	319	13.37	340			12.30	312			6.50	2.96
24	35.83	910	13.69	348	14.51	369			13.44	341			7.10	3.23
27	39.92	1014	14.52	369	15.66	398			14.59	371			7.80	3.52
30	43.90	1115	15.51	394	16.78	426			15.71	399			8.40	3.80
36	51.95	1320	17.79	452	19.13	486			18.06	459			9.60	4.38



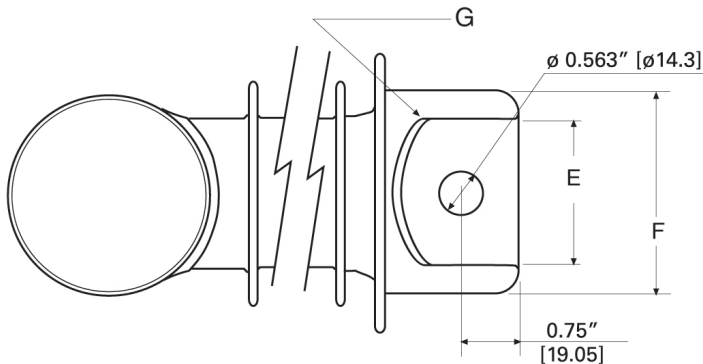
Zforce ZRP™ Distribution Arresters



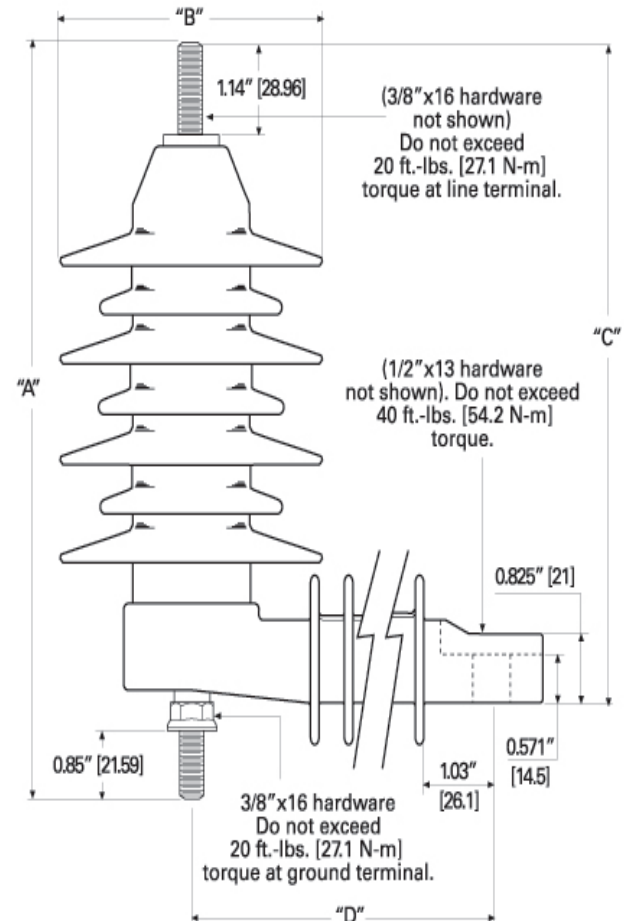
Electrical Characteristics										
Voltage Rating (Ur) (kV-rms)	MCOV (Uc) ³ (kV-rms)	Max Equiv FOW ⁵ (kV-Crest)	Max Switch Surge ⁶ (kV-Crest)	Maximum Discharge Voltage (kV-Crest) Using an 8/20 μ s Current Impulse						
				1.5 kA	2.5 kA	3.0 kA	5.0 kA	10 kA	20 kA	40 kA
3	2.55	8.6	6.2	6.8	7.1	7.2	7.5	8.2	9.0	10.3
6	5.10	17.1	12.4	13.6	14.1	14.3	15.1	16.3	18.1	20.6
9	7.65	25.7	18.6	20.3	21.2	21.5	22.6	24.5	27.1	30.9
10	8.40	28.5	20.7	22.6	23.5	23.9	25.1	27.2	30.1	34.3
12	10.20	34.2	24.8	27.1	28.2	28.7	30.1	32.6	36.1	41.2
15	12.70	42.8	31.1	33.9	35.3	35.9	37.7	40.8	45.2	51.5
18	15.30	51.3	37.3	40.7	42.3	43.0	45.2	49.0	54.2	61.7
21	17.00	59.9	43.5	47.5	49.4	50.2	52.7	57.1	63.2	72.0
24	19.50	68.4	49.7	54.2	56.4	57.4	60.2	65.3	72.2	82.3
27	22.00	77.0	55.9	61.0	63.5	64.5	67.8	73.4	81.3	92.6
30	24.40	85.5	62.1	67.8	70.5	71.7	75.3	81.6	90.3	102.9
36	29.00	102.6	74.5	81.4	84.6	86.0	90.4	97.9	108.4	123.5

Notes:

- 1) Reduce creepage by 1.45 inches (36.8 mm) when ordering without insulating bracket
 - 2) Does not include metal mounting bracket hardware
 - 3) MCOV = Maximum Continuous Operating Voltage that may be applied continuously between the terminals of the arrester
 - 4) The equivalent Front-of-Wave is the maximum discharge voltage for a 5kA impulse current wave which produces a voltage wave cresting in 0.5 μ s
 - 5) The equivalent Front-of-Wave is the maximum discharge voltage for a 10kA impulse current wave which produces a voltage wave cresting in 0.5 μ s
 - 6) Based on a switching surge current impulse of 45x90 μ s, 500 amperes
- * Single pack modifier required for 30 kV and 36 kV ratings



Insulated Bracket Data									
Arrester Rating (kV)	Creepage		Skirts	E		F		G (Radius)	
	In	Mm		In	Mm	In	Mm	In	Mm
3 - 15	4.60	117	3	1.875	47.62	2.70	66.58	1.312	33.34
18 - 36	9.12	232	6	2.130	54.10	2.95	74.93	1.656	42.06





Zforce™ Distribution Arresters EZ Ordering Information

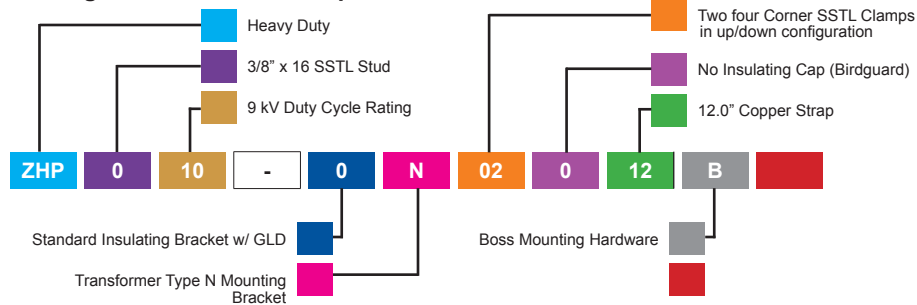


Z_P P0 kV - P1 P2 P3 P4 P5 P6 P7

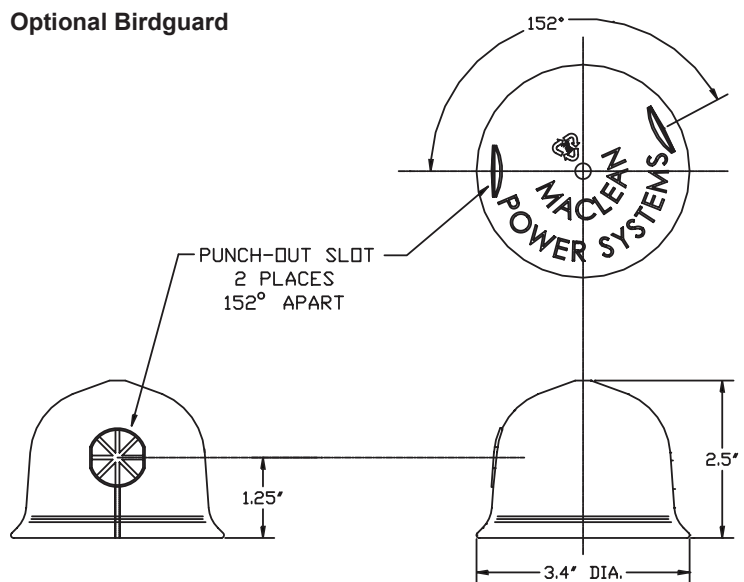
Z_P Pole Type ZNP - Zinc Oxide Normal Duty 5 kA Polymer Arresters ZHP - Zinc Oxide Heavy Duty 10 kA Polymer Arresters ZRP - Zinc Oxide Riser Pole 10 kA Polymer Arresters	P0 General Options 0 - 3/8" x 16 SSTL Studs (line and ground terminals)	kV(U_r) Duty-Cycle Rating of Arresters 03, 06, 09, 10, 12, 15, 18, 21, 24, 27, 30, 36	P1 Insulating Bracket Options 0 - Standard Insulating Bracket, with GLD 1 - Standard Insulating Bracket, no GLD 2 - No Insulating Bracket, with GLD (line arrester) 3 - No Insulating Bracket, no GLD (switchgear application)	P2 - Additional Bracket Options 0 - No NEMA Brackets A - Transformer Type "A" Bracket C - Crossarm Bracket (top mounting with backstrap assembly) N - Transformer Type "N" Bracket W - Transformer Type "W" Bracket	P3 Top Terminal Options* 00 - Standard - Four corner SSTL clamp and nut 02 - Two four corner SSTL clamps 12 - 18" Insulated Wire Lead with two ring terminals/flat washer/lock washer	P4 Universal Insulating Cap (Birdguard) 0 - Without Cap 1 - With Cap 2 - Fuse Kit	P5 Bottom Terminal Options* 00 - Standard - "U" clamp and nut 02 - Two four corner SSTL clamps (up/down) 12 - 12.0" Copper Strap	P6 Bagging Options B - Boss Mounting Hardware	P7 Packaging Options #S - Single pack modifier <u>required</u> only for 30kV and 36kV ratings #K - Bulk packing
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* Top/Bottom Terminal: Fits wire ranges for aluminum or copper conductors from #10 solid (3.0mm diameter) through 2/0 stranded (11.0mm diameter)

Catalog Order Number Example



Optional Birdguard





Zforce™ Distribution Arrester Accessories

Optional Bagging Accessories

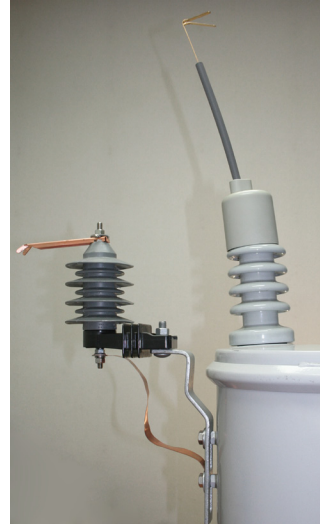
Transformer mounting hardware is available upon request. To specify, add suffix "-B" for boss mounting hardware to catalog number.



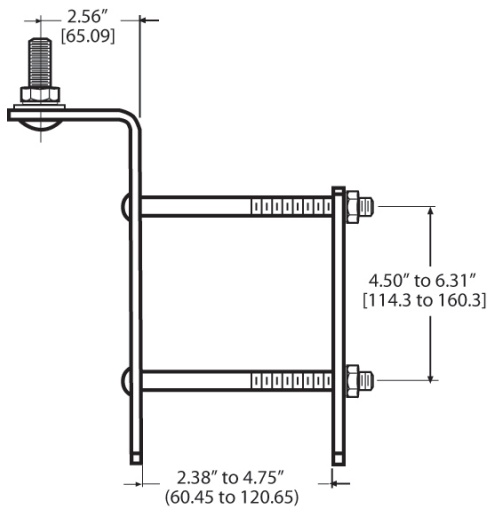
Boss Mounting Hardware
Cat No. AD1137-B

Flipper Fuse Kit

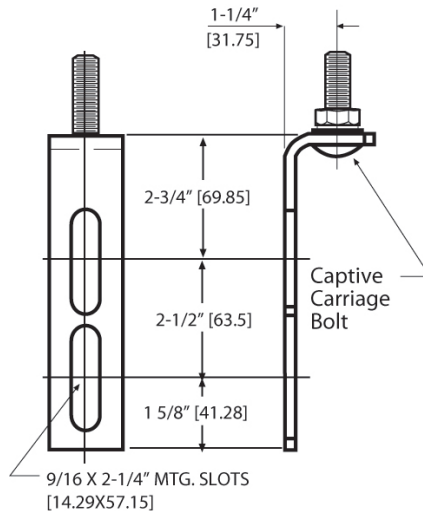
The AD524-Z fuse kit includes a stationary terminal for mounting on the transformer bushing. Its spring arm subjects the fuselink to moderate tension during steady-state operation and provides a positive whip action to quickly separate the link during fault conditions. An insulating cap for the transformer bushing and an insulating sleeve for the spring arm are included for wildlife protection.



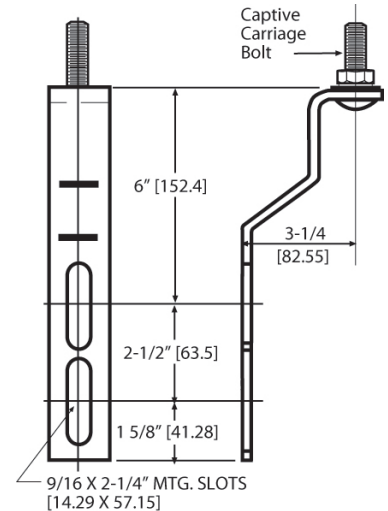
Mounting Brackets



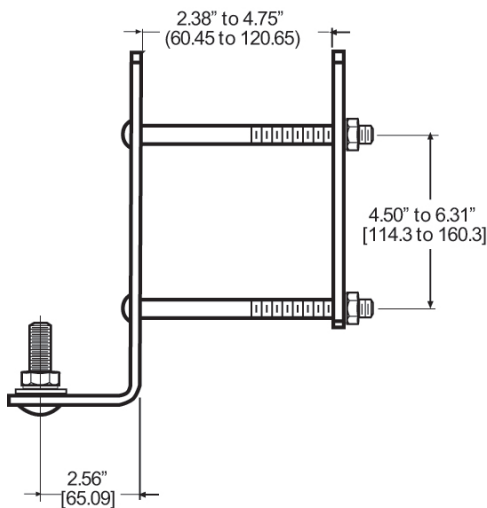
Type "C"
Catalog No. 7106A0025



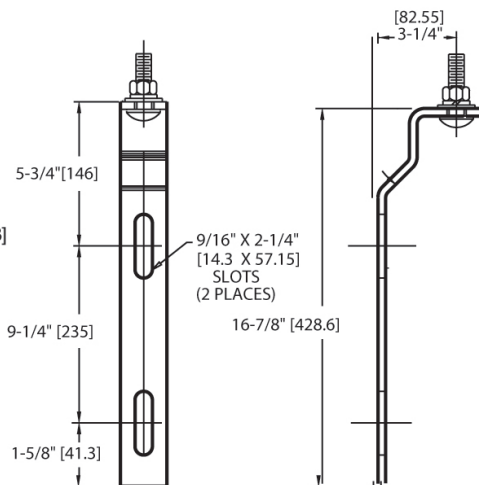
Type "A"
Catalog No. 7106A0013



Type "N"
Catalog No. 7106A0015



Type "E"
Catalog No. J24515



Type "W"
Catalog No. 7106A0047



ZE Elbow Distribution Arresters



The type “ZE” arrester incorporates surge protection in a one-piece, shielded elbow housing. It permits arrester installation on standard separable connector bushings, maintaining the dead front concept.

Performance

The “ZE” elbow arrester consistently withstands the following minimum design tests:

- High Current-Short Duration: 2 current surges of 40kA magnitude
- Low Current-Long Duration: 20 current surges of 75 amperes magnitude and 2000 microsecond duration
- Duty Cycle: 22 discharges with a current surge of 5kA magnitude and 8/20 microsecond wave shape
- Following each of these tests, the “ZE” arrester remains thermally stable and the discharge voltage increase at rated current is less than 10%

Design

The type “ZE” arrester was developed specifically for protection of underground distribution systems. It is installed at the open point of the underground system to prevent voltage wave doubling. When also installed at an intermediate point, voltage reflections from the open point arrester are harmlessly discharged. The housing, made of peroxide cured EPDM rubber, is totally shielded with a molded conductive EPDM jacket to maintain the dead front concept. The one-piece construction requires no field assembly. The “ZE” dead front elbow arrester is RUS listed.

Reliability

Rigid control standards insure that all material conforms to exacting engineering specifications. Each finished arrester is subjected to electrical tests to determine reference voltage, total leakage current and corona levels.

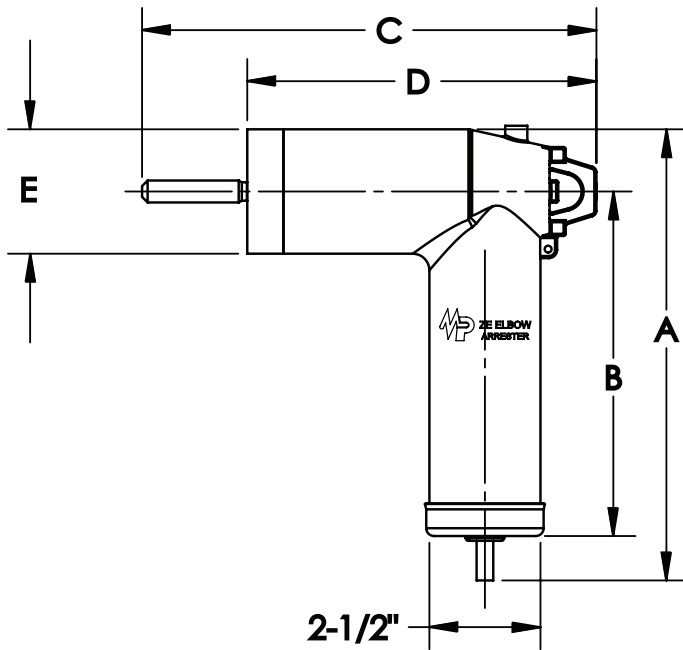
Application

The type “ZE” arrester rated voltage designates the 60Hz voltage applied across the arrester terminals during the duty cycle test. In addition, the type “ZE” arrester Maximum Continuous Operating Voltage (MCOV) designates the maximum power frequency voltage that may be continuously applied across the arrester in service. Selection of the appropriate type “ZE” rating is made on the basis that the maximum continuous line-to-ground voltage on the system does not exceed the MCOV of the arrester.

The 10kV, 18kV and 27kV rated arresters are designed for application on nominal 15kV, 25kV and 35kV URD systems, respectively. The three ratings include standard ANSI/IEEE 386 separable connector interface designs that are compatible with major interface suppliers at each voltage level.



ZE Elbow Distribution Arresters



Probe

Standard load break probe is shipped assembled with each unit

Ground Cable

Size: #5 stranded copper wire- 37" length

Lubricant

Each arrester is shipped with a packet of silicone grease, wiping cloth and instruction sheet

Physical Characteristics														
Catalog Number	kV Rating	A		B		C		D		E		Elbow Interface*	Weight	
		In	Mm	In	Mm	In	Mm	In	Mm	In	Mm		Lb	Kg
8132B0003J001	3	7.0	177.8	4.6	116.8	8.1	205.7	7.7	195.6	2.9	73.7	15kV	3.0	1.4
8132B0006J001	6					10.1	256.5						3.5	1.6
8132B0010J001	10													
8132B1010J001												25kV	4.0	1.8
8132B0012J001	12	8.3	210.8	5.9	149.9	8.1	205.7	7.7	195.6	2.9	73.7	15kV	4.0	1.8
8132B0018J001	18	10.0	254.0	7.6	193.0	10.1	256.5					25kV	4.7	2.1
8132B2024J001	24	13.3	337.8	10.3	261.6	12.6	320.0					10.1	256.5	4.0
8132B1027J001	27	13.4	340.4	11.0	279.4	10.1	256.5	7.7	195.6	2.9	73.7	6.4	2.9	
8132B2027J001		14.5	368.3	11.5	292.1	12.6	320.0	10.1	256.5	4.0	101.6	8.5	3.9	

Electrical Characteristics							
Voltage Rating (Ur) (kV-rms)	MCOV (kV-rms)	Max Equiv FOW* (kV-Crest)	Maximum Discharge Voltage (kV-Crest) Using an 8/20 μ s Current Impulse				
			1.5 kA	3.0 kA	5.0 kA	10 kA	20 kA
3	2.55	10.0	8.5	8.8	9.3	10.2	12.9
6	5.10	20.1	17.0	17.6	18.6	20.4	25.8
10	8.40	30.5	28.0	29.0	30.7	33.7	42.6
12	10.20	40.2	34.0	35.2	37.2	40.8	51.6
18	15.30	60.3	51.0	52.8	55.8	61.2	77.4
24	19.50	80.4	68.0	70.4	74.4	81.6	103.2
27	22.00	90.5	76.5	79.2	83.7	91.8	116.1

Notes:

* Compatible with standard ANSI/IEEE 386, 1995

1) Small 35kV Interface, 21.1/36kV Figure 7 of ANSI/IEEE 386, 1995

2) Large 35kV Interface, 21.1/36.6kV Figure 8 of ANSI/IEEE 386, 1995



ZIP and ZJP Intermediate Class Surge Arresters



The type “ZIP”/“ZJP” intermediate class arresters offer the benefits of polymer housings for system voltages up to 161kV. The arresters are approximately 1/5 the weight of the porcelain equivalent. Handling and installation become much easier tasks. Also, the risk of damage to the housing is reduced compared to porcelain.

Performance

ZIP:

3 kV through 144 kV duty cycle rating, 2.55 kV through 115 kV MCOV, 2.4 kV through 161 kV system line-line voltage

ZJP:

3 kV through 45 kV duty cycle rating, 2.55 kV through 36.5 kV MCOV, 2.4 kV through 46 kV system line-line voltage

The arrester designs are tested in accordance with the latest industry standards for metal oxide arresters. The “ZIP”/“ZJP” arresters consistently withstand the following minimum design tests:

- High Current-Short Duration: 100 kA crest
- Duty Cycle per ANSI: 10 kA
- Nominal Discharge Current per IEC: 10 kA
- Line Discharge Class per IEC: Class 2
- Minimum Energy Capability: 5.0 kJ/kV MCOV
- Fault Withstand Capability:
 - ZIP—50 kA rms
 - ZJP—20 kA rms
- Working Cantilever Strength:
 - ZIP—5000 in.-lbs.
 - ZJP—720 in.-lbs.
- ZIP RUS listed

Design

The design consists of a number of metal oxide valve elements contained within a fiberglass winding and then inserted into the polymer housing. Type “ZIP”/“ZJP” arresters are shipped as single units for all ratings. There is no need to combine sections, even for the 144kV duty cycle rating. The metal oxide valve elements combine excellent protective characteristics with steady state performance to maximize protection over many years of service.

Fault Current Withstand

The severity of a failure depends on the duration and magnitude of the available fault current conducting through the arrester at the time of failure. This type of arrester, with its polymer housing, eliminates the potential danger of porcelain fragmentation. The design uses a fiberglass epoxy wrap to relieve the pressure that is present during a fault.

Benefits

The use of polymer housings for our arresters provides many benefits over porcelain designs.

- **LIGHTWEIGHT**—The lightweight design provides much easier handling and installation. The polymer arresters are less than 1/5 the weight of the porcelain equivalents. The burden on mounting structures and personnel is greatly reduced.
- **REDUCED CLEARANCES**—The smaller physical size of the polymer housing and the line side of the arrester allow the clearances to be reduced. This provides added flexibility with design and layout since they can be used in tighter areas.
- **SINGLE UNIT DESIGN**—The single unit design simplifies installation by reducing handling that was previously required for multi-section porcelain designs. This also provides improved contamination performance over multi-unit arresters.
- **DAMAGE RESISTANT**—The polymer housings resist damage from handling where porcelain units are most vulnerable to chipping and breakage.
- **SAFETY**—The “ZIP”/“ZJP” arresters minimize safety hazards to personnel and nearby equipment that exists with porcelain housings.

Reliability

Each completed “ZIP”/“ZJP” arrester unit must pass the following electrical tests: reference voltage, power loss, and RIV.



ZIP Intermediate Class Surge Arresters

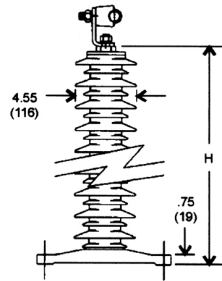


Figure 1

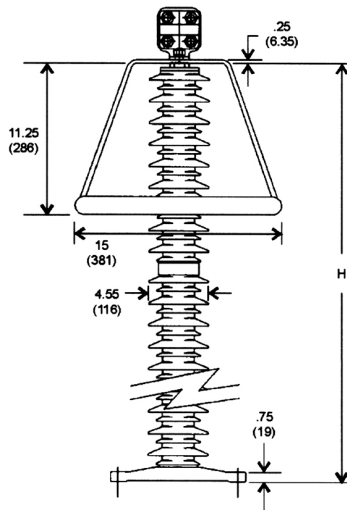


Figure 2

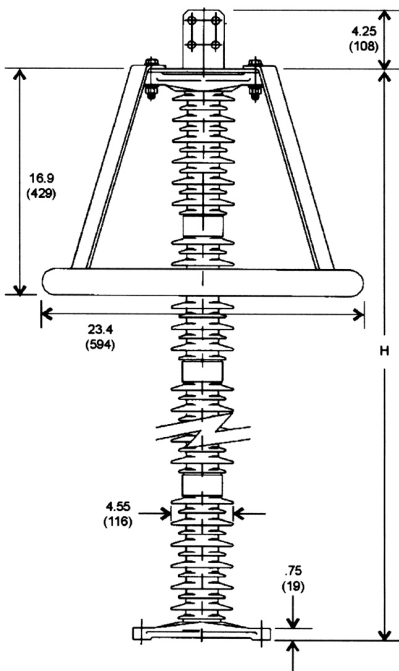
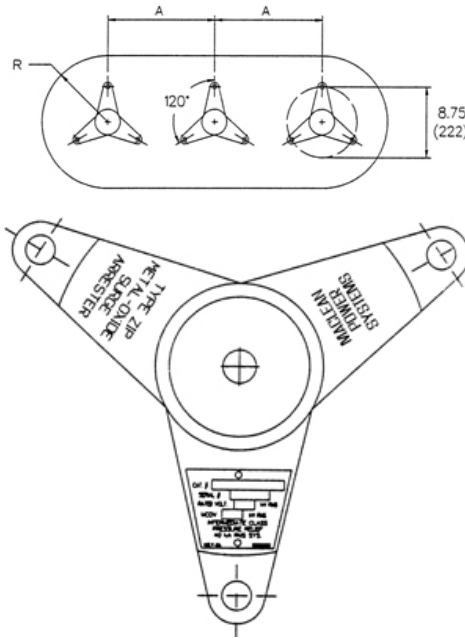


Figure 3



Three Phase Installation Layout

The holes for mounting are .56" (42 mm) for 1/2" bolts. Mounting bolts and washers are not furnished with arrester.

Nameplates

In addition to the information that is included on the tripod base, a nameplate is attached to the casting to provide all of the required arrester details. The catalog number, the rated voltage, the maximum continuous operating voltage, and the pressure relief current rating are shown. The serial number includes information about the time of manufacture.

Physical Characteristics and Clearances															
Catalog Number	Figure	kV Rating	MCOV kV	Total Height		Creepage		Minimum Clearances ¹				Weight			
				In	Mm	In	Mm	A		R		Lb	Kg		
ZIP0003	1	3	2.55	6.80	173	15.70	400	9.5	241	5.5	140	8.0	3.6		
ZIP0006		6	5.10	6.80	173							9.0	4.1		
ZIP0009		9	7.65	6.82	173									11.0	5.0
ZIP0010		10	8.40	6.87	175	15.80	401								
ZIP0012		12	10.20	6.85	174							20.20	512		
ZIP0015		15	12.70	8.31	211									22.00	559
ZIP0018		18	15.30	9.22	234	5.8	147								
ZIP0021		21	17.00	10.70	272					26.40	671				
ZIP0024		24	19.50	12.10	308							30.70	781		
ZIP0027		27	22.00	13.10	333	33.70	856								
ZIP0030		30	24.40	14.60	370			38.10	967						
ZIP0033		33	26.70	15.90	403					40.30	1024				
ZIP0036		36	29.00	16.80	428	44.20	1122								
ZIP0039		39	31.50	18.30	466			48.60	1234						
ZIP0042		42	34.00	19.20	489					51.40	1307				
ZIP0045		45	36.50	21.30	542	54.50	1385								
ZIP0048		48	39.00	23.00	583			61.70	1567						
ZIP0054		54	42.00	24.90	634					67.60	1718				
ZIP0060		60	48.00	27.90	708	76.40	1940								
ZIP0066		66	54.00	30.50	774			80.80	2054						
ZIP0072		72	57.00	32.40	823					88.60	2251				
ZIP0084		84	68.00	37.20	945	103.00	2620								
ZIP0090	90	70.00	41.40	1051	109.00			2775							
ZIP0096	96	76.00	43.80	1112					119.00	3027					
ZIP0108	108	84.00	48.00	1218		133.00	3379								
ZIP0120	120	98.00	53.30	1355	149.00			3788							
ZIP0132	132	106.00	59.30	1507					161.00	4088					
ZIP0144	3	144	115.00	63.50		1613	177.00				4507	67.0	1702	55	1397

Notes:

1) These minimum clearances are determined by the protective capabilities of the arresters and they are secondary to any other clearance requirement that may exist for specific applications.



ZIP Intermediate Class Surge Arresters

Electrical Characteristics												
Catalog Number	Voltage Rating (kV-rms)	MCOV (kV-rms)	TOV ¹		Max Equiv FOW ² (kV-Crest)	Max Switch Surge ³ (kV-Crest)	Maximum Discharge Voltage (kV-Crest) Using an 8/20 μ s Current Impulse					
			1 s (kV-rms)	10 s (kV-rms)			1.5 kA	3.0 kA	5.0 kA	10 kA	20 kA	40 kA
ZIP0003	3	2.55	3.7	3.5	8.55	6.34	6.79	7.17	7.50	8.09	8.96	10.1
ZIP0006	6	5.10	7.41	7.04	17.1	12.7	13.6	14.3	15	16.2	17.9	20.2
ZIP0009	9	7.65	11.10	10.6	25.9	19.2	20.5	21.7	22.7	24.5	27.1	30.5
ZIP0010	10	8.40	12.20	11.6	28.3	21	22.5	23.7	24.8	26.8	29.6	33.4
ZIP0012	12	10.20	14.80	14.1	34.2	25.4	27.2	28.7	30	32.4	35.8	40.4
ZIP0015	15	12.70	18.40	17.5	43.1	32	34.2	36.1	37.8	40.8	45.1	50.8
ZIP0018	18	15.30	22.20	21.1	51.3	38.1	40.8	43	45	48.6	53.8	60.6
ZIP0021	21	17.00	24.70	23.5	56.6	42	44.9	47.5	49.6	53.6	59.3	66.8
ZIP0024	24	19.50	28.30	26.9	68.5	50.8	54.3	57.4	60	64.8	71.7	80.7
ZIP0027	27	22.00	31.90	30.4	77.3	57.4	61.4	64.8	67.8	73.2	81	91.2
ZIP0030	30	24.40	35.40	33.7	83.5	61.9	66.2	70	73.2	79	87.4	98.4
ZIP0033	33	26.70	38.80	36.9	91.9	68.2	72.9	77	80.6	86.9	96.3	108
ZIP0036	36	29.00	42.10	40	98.9	73.4	78.5	82.9	86.7	93.5	104	117
ZIP0039	39	31.50	45.70	43.5	109	80.5	86.1	90.9	95.1	103	114	128
ZIP0042	42	34.00	49.40	47	117	86.7	92.7	97.9	102	111	122	138
ZIP0045	45	36.50	53.00	50.4	125	92.9	99.4	105	110	119	131	148
ZIP0048	48	39.00	56.60	53.9	137	102	109	115	120	130	143	161
ZIP0054	54	42.00	61.00	58	155	115	123	130	136	146	162	182
ZIP0060	60	48.00	69.70	66.3	167	124	132	140	146	158	175	197
ZIP0066	66	54.00	78.40	74.6	184	136	146	154	161	174	193	217
ZIP0072	72	57.00	82.80	78.7	198	147	157	166	173	187	207	233
ZIP0084	84	68.00	98.70	93.9	234	173	185	196	205	221	245	276
ZIP0090	90	70.00	102.00	96.7	251	186	199	210	220	237	262	296
ZIP0096	96	76.00	110.00	105	267	198	212	224	234	253	280	315
ZIP0108	108	84.00	122.00	116	297	220	235	249	260	281	311	350
ZIP0120	120	98.00	142.00	135	334	248	265	280	293	316	350	394
ZIP0132	132	106.00	154.00	146	367	273	292	308	322	348	385	433
ZIP0144	144	115.00	167.00	159	396	293	314	332	347	374	414	467

Notes:

- 1) Temporary Overvoltage without any Prior Duty
- 2) The equivalent Front-of-Wave is the maximum discharge voltage for a 10kA impulse current wave which produces a voltage wave cresting in a 0.5 μ s
- 3) Based on a switching surge current of 500 amperes



ZJP Intermediate Class Surge Arresters

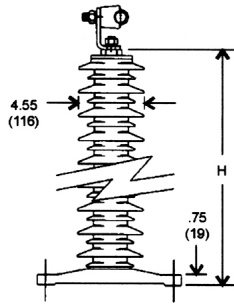


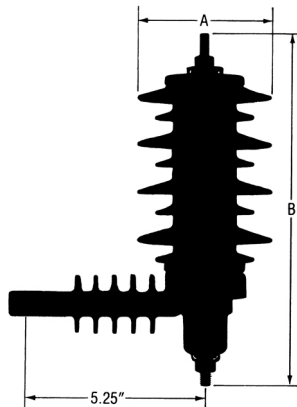
Figure 1

Physical Characteristics and Clearances													
Catalog Number	Figure	kV Rating	MCOV kV	Total Height		Creepage		Minimum Clearances ¹				Weight	
				In	Mm	In	Mm	A		R		Lb	Kg
ZJP0003-1211	1	3	2.55	6.8	173	15.7	400	9.5	241	5.5	140	7.7	3.5
ZJP0006-1211		6	5.10				400	9.5	241	5.5	140	8.1	3.7
ZJP0009-1211		9	7.65				400	9.5	241	5.5	140	8.4	3.8
ZJP0010-1211		10	8.40	6.87	175	15.8	401	9.5	241	5.5	140	8.6	3.9
ZJP0012-1211		12	10.20	6.85	174		401	9.5	241	5.5	140	10.7	4.9
ZJP0015-1211		15	12.70	8.31	211	20.2	512	9.5	241	5.5	140	11	5
ZJP0018-1211		18	15.30	9.22	234	22	559	9.5	241	5.8	147	11.4	5.2
ZJP0021-1211		21	17.00	10.7	272	26.4	671	9.5	241	6.8	173	11.9	5.4
ZJP0024-1211		24	19.50	12.1	308	30.7	781	9.5	241	7.8	198	14	6.4
ZJP0027-1211		27	22.00	13.1	333	33.7	856	10.5	267	8.8	224	14.7	6.7
ZJP0030-1211		30	24.40	14.6	370	38.1	967	10.5	267	8.8	224	14.7	6.7
ZJP0033-1211		33	26.70	15.9	403	40.3	1024	10.5	267	8.8	224	15.7	7.1
ZJP0036-1211		36	29.00	16.8	428	44.2	1122	12.5	318	10.8	274	16.6	7.5
ZJP0039-1211		39	31.50	18.3	466	48.6	1234	13.5	343	11.8	300	17.5	8
ZJP0042-1211		42	34.00	19.2	489	51.4	1307	14.5	369	12.8	326	18.4	8.4
ZJP0045-1211		45	36.50	21.3	542	54.5	1385	15.5	394	13.8	351	19.3	8.8

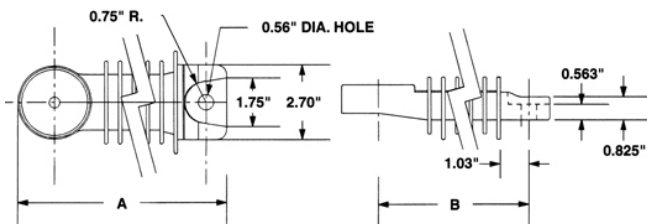
Notes:

1) These minimum clearances are determined by the protective capabilities of the arresters and they are secondary to any other clearance requirement that may exist for specific applications.

ZJP D Series Intermediate Class Arresters



Physical Characteristics and Clearances											
Catalog Number	kV Rating	Width A		Length B		Nominal Strike		Nominal Creepage		Weight	
		In	Mm	In	Mm	In	Mm	In	Mm	Lb	Kg
ZJP0003-D005	3	4.6	116	11.1	282	6.8	173	15.7	400	4.8	2.2
ZJP0006-D005	6			11.12	283	6.82	174	15.8	401	5.2	2.3
ZJP0009-D005	9			11.17	284	6.87	175	15.8	401	5.6	2.5
ZJP0010-D005	10			11.15	283	6.85	174	15.8	401	5.7	2.6
ZJP0012-D005	12			12.61	320	8.31	211	20.2	512	7.8	3.5
ZJP0015-D005	15			13.52	343	9.22	234	22	559	8.2	3.7
ZJP0018-D005	18			15	381	10.7	272	26.4	671	8.5	3.9
ZJP0021-D005	21			16.42	417	12.1	308	30.7	781	9	4.1
ZJP0024-D005	24			17.41	442	13.1	333	33.7	856	11.1	5
ZJP0027-D005	27			18.88	480	14.6	370	38.1	967	11.8	5.4
ZJP0030-D005	30			20.18	513	15.9	403	40.3	1024	12.8	5.8
ZJP0033-D005	33			21.14	537	16.8	428	44.2	1122	13.7	6.2
ZJP0036-D005	36			22.64	575	18.3	466	48.6	1234	14.6	6.6
ZJP0039-D005	39			23.54	598	19.2	489	51.4	1307	15.5	7
ZJP0042-D005	42			25.64	651	21.3	542	54.5	1385	16.4	7.5
ZJP0045-D005	45										





ZJP Intermediate Class Surge Arresters

Electrical Characteristics												
Catalog Number	Voltage Rating (kV-rms)	MCOV (kV-rms)	TOV ¹		Max Equiv FOW ² (kV-Crest)	Max Switch Surge ³ (kV-Crest)	Maximum Discharge Voltage (kV-Crest) Using an 8/20 μ s Current Impulse					
			1 s (kV-rms)	10 s (kV-rms)			1.5 kA	3.0 kA	5.0 kA	10 kA	20 kA	40 kA
ZJP0003	3	2.55	3.7	3.5	8.55	6.34	6.79	7.17	7.5	8.09	8.96	10.1
ZJP0006	6	5.10	7.41	7.04	17.1	12.7	13.6	14.3	15	16.2	17.9	20.2
ZJP0009	9	7.65	11.1	10.6	25.9	19.2	20.5	21.7	22.7	24.5	27.1	30.5
ZJP0010	10	8.40	12.2	11.6	28.3	21	22.5	23.7	24.8	26.8	29.6	33.4
ZJP0012	12	10.20	14.8	14.1	34.2	25.4	27.2	28.7	30	32.4	35.8	40.4
ZJP0015	15	12.70	18.4	17.5	43.1	32	34.2	36.1	37.8	40.8	45.1	50.8
ZJP0018	18	15.30	22.2	21.1	51.3	38.1	40.8	43	45	48.6	53.8	60.6
ZJP0021	21	17.00	24.7	23.5	56.6	42	44.9	47.5	49.6	53.6	59.3	66.8
ZJP0024	24	19.50	28.3	26.9	68.5	50.8	54.3	57.4	60	64.8	71.7	80.7
ZJP0027	27	22.00	31.9	30.4	77.3	57.4	61.4	64.8	67.8	73.2	81	91.2
ZJP0030	30	24.40	35.4	33.7	83.5	61.9	66.2	70	73.2	79	87.4	98.4
ZJP0033	33	26.70	38.8	36.9	91.9	68.2	72.9	77	80.6	86.9	96.3	108
ZJP0036	36	29.00	42.1	40.0	98.9	73.4	78.5	82.9	86.7	93.5	104	117
ZJP0039	39	31.50	45.7	43.5	109	80.5	86.1	90.9	95.1	103	114	128
ZJP0042	42	34.00	49.4	47	117	86.7	92.7	97.9	102	111	122	138
ZJP0045	45	36.50	53	50.4	125	92.9	99.4	105	110	119	131	148.3

Notes:

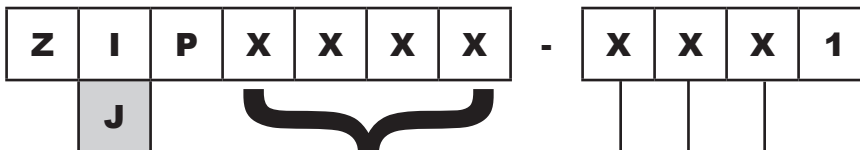
1) Temporary Overvoltage without any Prior Duty

2) The equivalent Front-of-Wave is the maximum discharge voltage for a 10kA impulse current wave which produces a voltage wave cresting in a 0.5 μ s

3) Based on a switching surge current of 500 amperes

ZIP/ZJP Intermediate Class Arrester Ordering Information

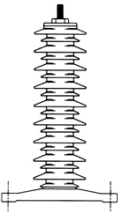
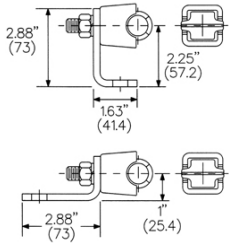
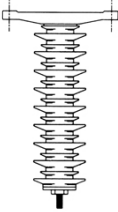
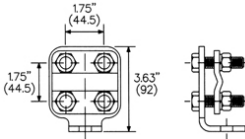
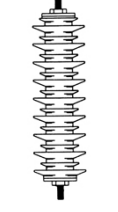
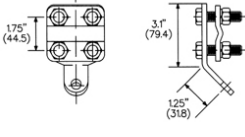
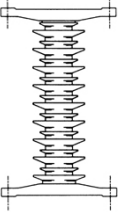
Fault Withstand	
ZIP	= 50kA
ZJP	= 20kA



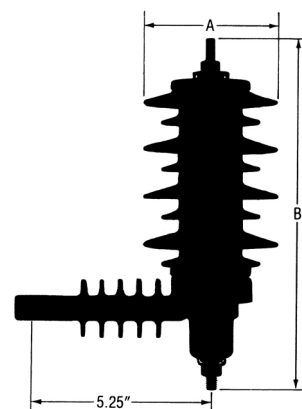
-or-



kV Rating
0003 = 3
0006 = 6
0009 = 9
0010 = 10
0012 = 12
0015 = 15
0018 = 18
0021 = 21
0024 = 24
0027 = 27
0030 = 30
0033 = 33
0036 = 36
0039 = 39
0042 = 42
0045 = 45
0048 = 48
0054 = 54
0060 = 60
0066 = 66
0072 = 72
0084 = 84
0090 = 90
0096 = 96
0108 = 108
0120 = 120
0132 = 132
0144 = 144

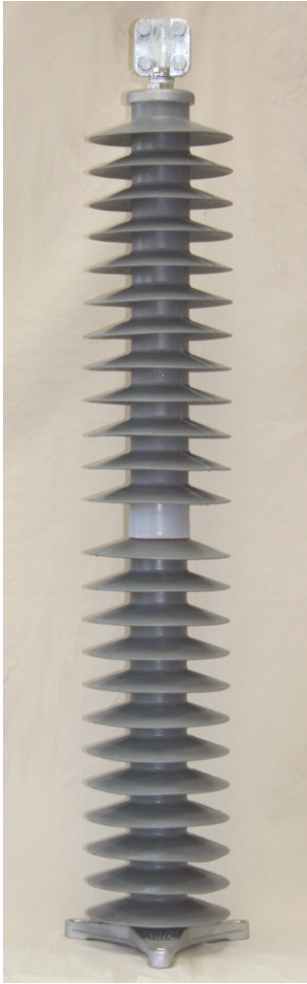
Configuration (not available on "D" Series)	Top & Bottom Connectors (not available on "D" Series)
 <p>1 - Stainless steel top cover with tripod base</p>	 <p>1 - Eyebolt with a 90° angle bracket Conductor Range: 0.25" - 0.75" (6.35 - 19.05 mm)</p>
 <p>2 - Tripod on top with stainless steel bottom cover (Inverted Mounting)</p>	 <p>2 - Four hole NEMA pad with a 90° angle Conductor Range: 0.25" - 1.25" (6.35 - 31.75 mm)</p>
 <p>3 - Stainless steel covers on both ends</p>	 <p>3 - Four hole NEMA pad with a 45° angle Conductor Range: 0.25" - 1.25" (6.35 - 31.75 mm)</p>
 <p>4 - Tripod on both ends</p>	

"D" Series ZJP only	
D001	= Crossarm Bracket
D005	= Standard Unit
D106	= with Birdguard
D109	= Birdguard and Crossarm Bracket





Station Class Arresters



The type “ZSP” station class arresters offer the benefits of polymer housings for system voltages up to 230kV. The arresters are approximately 25% the weight of the porcelain equivalent. Handling and installation become much easier tasks. Also, the risk of damage to the housing is reduced compared to porcelain.

Performance

“ZSP” arresters are available in duty cycle ratings from 3kV through 216kV (2.55kV through 174kV MCOV) and are designed for system line-line voltages of 2.4kV through 230kV. The “ZSP” arrester design is tested in accordance with the latest industry standards for metal oxide arresters. The “ZSP” arresters consistently withstand the following minimum design tests:

- High Current-Short Duration: 100kA crest
- Duty Cycle per ANSI: 10kA
- Nominal Discharge Current per IEC: 10kA
- Line Discharge Class per IEC: Class 2 or 3
- Minimum Energy Capability: 6.1 kJ/kV MCOV
- Fault Withstand Capability: 80kA rms
- Working Cantilever Strength: 10,000 in.-lbs.
- RUS Listed

Design

The design consists of a number of metal oxide valve elements contained within a fiberglass winding and then inserted into the polymer housing. Type “ZSP” arresters are shipped as single units for all ratings. There is no need to combine sections, even for the 216kV duty cycle rating. The metal oxide valve elements combine excellent protective characteristics with steady state performance to maximize protection over many years of service.

Fault Current Withstand

The severity of a failure depends on the duration and magnitude of the available fault current conducting through the arrester at the time of failure. The “ZSP” type arrester with its polymer housing eliminates the potential danger of porcelain fragmentation. The “ZSP” design uses a high strength fiberglass epoxy wrap to relieve the pressure that is present during a fault. The arresters achieved a fault withstand capability of 80kA.

Benefits

The use of polymer housings for our arresters provides many benefits over porcelain designs.

- **LIGHTWEIGHT**—The lightweight design provides much easier handling and installation. The polymer arresters are less than 1/5 the weight of the porcelain equivalents. The burden on mounting structures and personnel is greatly reduced.
- **REDUCED CLEARANCES**—The smaller physical size of the polymer housing and the line side of the arrester allow the clearances to be reduced. This provides added flexibility with design and layout since they can be used in tighter areas.
- **SINGLE UNIT DESIGN**—The single unit design simplifies installation by reducing handling that was previously required for multi-section porcelain designs. This also provides improved contamination performance over multi-unit arresters.
- **DAMAGE RESISTANT**—The polymer housings resist damage from handling where porcelain units are most vulnerable to chipping and breakage.
- **SAFETY**—The ZSP arresters minimize safety hazards to personnel and nearby equipment that exists with porcelain housings.

Reliability

Each completed “ZSP” arrester unit must pass the following electrical tests: reference voltage, power loss, and RIV.



ZSP Electrical Characteristics

Electrical Characteristics												
Catalog Number	Voltage Rating (kV-rms)	MCOV (kV-rms)	TOV ¹		Max Equiv FOW ² (kV-Crest)	Max Switch Surge ³ (kV-Crest)	Maximum Discharge Voltage (kV-Crest) Using an 8/20 μ s Current Impulse					
			1 s (kV-rms)	10 s (kV-rms)			1.5 kA	3.0 kA	5.0 kA	10 kA	20 kA	40 kA
ZSP0003	3	2.55	3.74	3.53	8.23	5.87	6.32	6.65	6.96	7.49	8.27	9.38
ZSP0006	6	5.10	7.47	7.06	16.5	11.7	12.6	13.3	13.9	15	16.5	18.8
ZSP0009	9	7.65	11.2	10.6	24.7	17.6	19	20	20.9	22.5	24.8	28.2
ZSP0010	10	8.40	12.3	11.6	27.8	19.8	21.4	22.5	23.5	25.3	28	31.7
ZSP0012	12	10.20	14.9	14.1	33	23.6	25.4	26.7	27.9	30.1	33.2	37.7
ZSP0015	15	12.70	18.6	17.6	41.3	29.4	31.7	33.4	34.9	37.6	41.5	47.1
ZSP0018	18	15.30	22.4	21.2	49.8	35.5	38.2	40.2	42.1	45.3	50	56.8
ZSP0021	21	17.00	24.9	23.5	55.2	39.4	42.4	44.6	46.7	50.3	55.5	63
ZSP0024	24	19.50	28.6	27	65	46.4	49.9	52.6	55	59.2	65.4	74.2
ZSP0027	27	22.00	32.2	30.5	72.9	52	56	59	61.7	66.4	73.3	83.2
ZSP0030	30	24.40	35.7	33.8	79.9	57	61.4	64.6	67.6	72.7	80.3	91.1
ZSP0033	33	26.70	39.1	37	88	62.7	67.6	71.1	74.4	80.1	88.4	100.4
ZSP0036	36	29	42.5	40.2	96.2	68.6	73.9	77.8	81.5	87.6	96.8	109.8
ZSP0039	39	31.50	46.1	43.6	103	73.5	79.1	83.3	87.2	93.8	103.6	117.5
ZSP0042	42	34	49.8	47.1	113.5	81	87.2	91.8	96.1	103.4	114.2	129.5
ZSP0045	45	36.5	53.5	50.6	120.3	85.8	92.4	97.3	101.8	109.5	120.9	137.2
ZSP0048	48	39	57.1	54	128.6	91.7	98.7	104	108.8	117.1	129.3	146.7
ZSP0054	54	42	61.5	58.2	143.6	102.4	110.3	116.1	121.5	130.8	144.4	163.8
ZSP0060	60	48	70.3	66.5	163.1	116.4	125.3	131.9	138.1	148.5	164	186.1
ZSP0063	63	50.25	73.6	69.6	170.3	121.4	130.8	137.7	144.1	155	171.2	194.3
ZSP0066	66	52.50	76.9	72.7	177.5	126.6	136.3	143.5	150.2	161.6	178.4	202.4
ZSP0072	72	57	83.5	78.9	192.3	137.1	147.7	155.5	162.7	175.1	193.3	219.3
ZSP0072-58*	72	58	85	80.3	192.3	137.1	147.7	155.5	162.7	175.1	193.3	219.3
ZSP0090	90	70	102.6	97	227.1	161.9	174.4	183.6	192.2	206.7	228.3	259
ZSP0090-74*	90	74	108.4	102.5	240.6	171.6	184.8	194.6	203.6	219	241.9	274.5
ZSP0096	96	76	111.3	105.3	257.1	183.4	197.5	207.9	217.6	234.1	258.5	293.3
ZSP0108	108	84	123.1	116.3	273.7	195.2	210.2	221.3	231.6	249.2	275.2	312
ZSP0108-88*	108	88	128.9	121.9	287.2	204.8	220.6	232.3	243.1	261.5	288.8	328
ZSP0120	120	98	143.6	135.7	326	239.7	250.6	263.9	276.1	297.1	328	372
ZSP0120-102*	120	102	149.4	141.3	331	243	254	267.5	279.9	301	333	377
ZSP0132	132	106	155.3	146.8	347	255	266.7	280.8	293.8	316	349	396
ZSP0144	144	115	168.5	159.3	385	282.4	295.3	311	325	350	387	439
ZSP0150	150	121	177.3	167.6	411	302	315	332	347	374	413	468
ZSP0168	168	131	191.9	181.4	450	331	346	364	381	410	453	514
ZSP0172	172	140	205.1	193.9	460	338	354	372	390	419	463	525
ZSP0180	180	144	211	199.4	481	354	370	389	407	438	484	549
ZSP0192	192	152	222.7	210.5	511	375	392	413	432	465	514	583
ZSP0198	198	160	234.4	221.6	532	391	409	431	451	485	535	607
ZSP0210	210	170	249.1	235.5	562	413	432	454	476	512	565	641
ZSP0216	216	174	254.9	241	577	424	443	466	488	525	580	658

Notes:

1) Temporary Overvoltage without any Prior Duty

2) The equivalent Front-of-Wave is the maximum discharge voltage for a 10kA impulse current wave which produces a voltage wave cresting in a 0.5 μ s

3) Based on a switching surge current of 500 amperes for arresters rated 2.55kV MCOV to 84kV MCOV and 1000 amperes for arresters from 88kV MCOV to 174kV MCOV

* The catalog number for special MCOV levels would use the following format = ZSP0090-1231-74 and ZSP 0108-1231-88



ZSP Physical Characteristics and Clearances

Physical Characteristics and Clearances													
Catalog Number	Figure	kV Rating	MCOV kV	Total Height		Creepage		Minimum Clearances ¹				Weight	
				In	Mm	In	Mm	A		R		Lb	Kg
ZSP0003	1	3	2.55	7.6	192	18.1	461	12	305	6	152	18	8.2
ZSP0006		6	5.10										
ZSP0009		9	7.65										
ZSP0010		10	8.40	9.2	234	24.1	612	13	330	7	178	21	9.5
ZSP0012		12	10.20										
ZSP0015		15	12.70										
ZSP0018		18	15.30	11	279	30.1	765	14	356	8	203	25	11.3
ZSP0021		21	17.00										
ZSP0024		24	19.50										
ZSP0027		27	22.00	12.8	325	36.2	920	16	406	10	254	29	13.2
ZSP0030		30	24.40										
ZSP0033		33	26.70					17	432	11	279	31	14.1
ZSP0036		36	29.00	14.5	367	42.2	1071			13	330	33	15
ZSP0039		39	31.50	16	406	48	1218					36	16.3
ZSP0042		42	34.00	18.1	461	54.4	1382	20	508	14	356	41	18.6
ZSP0045		45	36.50										
ZSP0048		48	39.00										
ZSP0054		54	42.00	19.6	498	60.2	1528	23	584	17	432	44	20
ZSP0060		60	48.00	23.3	591	72.4	1838	25	635	19	483	52	23.6
ZSP0063		63	51.00										
ZSP0066		66	54.00										
ZSP0072		72	57.00	23.9	607	73	1855	27	686	22	559	53	24
ZSP0072-58*		72	58.00										
ZSP0090		90	70.00										
ZSP0090-74*		90	74.00	34.7	882	109.6	2783	31	787	25	635	77	34.9
ZSP0096		96	76.00										
ZSP0108		108	84.00										
ZSP0108-88*		108	88.00	44.9	1140	145.4	3694	35	889	30	762	84	38.1
ZSP0120		120	98.00										
ZSP0120-102*		120	102.00										
ZSP132		132	106.00	45	1144	145.6	3697	40	1016	35	889	99	44.9
ZSP0144		144	115.00	46.3	1175	146.8	3728	42	1067	37	940	100	45.4
ZSP0150		150	121	55.8	1418	182.1	4624	46	1168	40	1016	102	46.3
ZSP0168	2	168	131.00	59.8	1519	194.1	4931	48	1219	43	1092	139	63
ZSP0172		172	140.00	63.5	1613	206.4	5243	64	1626	53	1346	146	66.2
ZSP0180		180	144.00	67.2	1706	218.6	5553	65	1651	54	1372	154	69.8
ZSP0192		192	152.00					67	1702	56	1422	162	73.5
ZSP0198		198	157.00					70	1778	58	1473	163	73.9
ZSP0210		210	170	68.4	1739	219.9	5586	72	1829	61	1549	162	73.5
ZSP0216		216	174	69.1	1755	220.5	5602	75	1905	63	1600	165	74.8
				76	1930	65	1651	76	1930	65	1651	167	75.7

Notes:

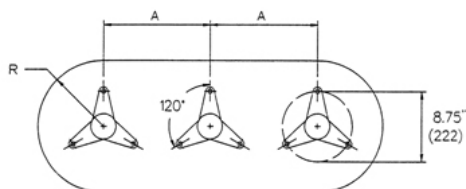
1) These minimum clearances are determined by the protective capabilities of the arresters and they are secondary to any other clearance requirement that may exist for specific applications.

* The catalog number for special MCOV levels would use the following format = ZSP0090-1231-74 and ZSP 0108-1231-88



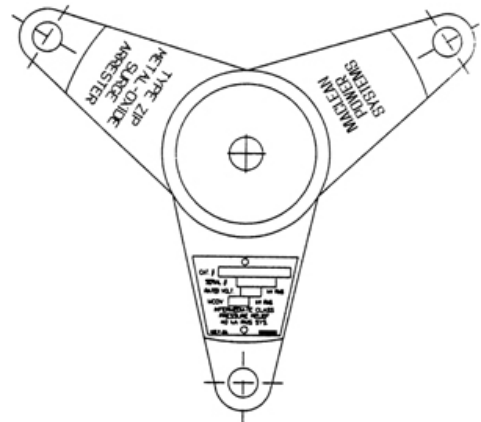
Figure 1

Figure 2



Three Phase Installation Layout

The holes for mounting are .56" (42 mm) for 1/2" bolts. Mounting bolts and washers are not furnished with arrester.



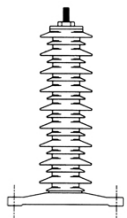
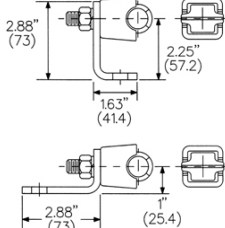
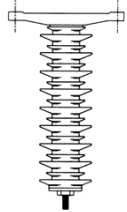
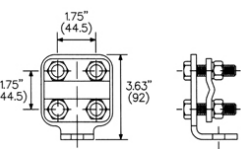
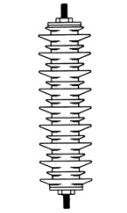
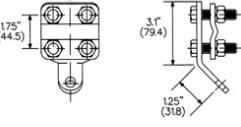
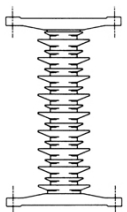
Nameplate

In addition to the information that is included on the tripod base, a nameplate is attached to the casting to provide all of the required arrester details. The catalog number, the rated voltage, the maximum continuous operating voltage, and the pressure relief current rating are shown. The serial number includes information about the time of manufacture.



ZSP Station Class Arrester Ordering Information

Z	S	P	X	X	X	X	-	X	X	X	1
---	---	---	---	---	---	---	---	---	---	---	---

kV Rating	Configuration	Top & Bottom Connectors
0003 = 3 0006 = 6 0009 = 9 0010 = 10 0012 = 12 0015 = 15 0018 = 18 0021 = 21 0024 = 24	 1 - Stainless steel top cover with tripod base	 1 - Eyebolt with a 90° angle bracket Conductor Range: 0.25" - 0.75" (6.35 - 19.05 mm)
0027 = 27 0030 = 30 0033 = 33 0036 = 36 0039 = 39 0042 = 42 0045 = 45	 2 - Tripod on top with stainless steel bottom cover (Inverted Mounting)	 2 - Four hole NEMA pad with a 90° angle Conductor Range: 0.25" - 1.25" (6.35 - 31.75 mm)
0048 = 48 0054 = 54 0060 = 60 0063 = 63 0066 = 66 0072 = 72 0090 = 90	 3 - Stainless steel covers on both ends	 3 - Four hole NEMA pad with a 45° angle Conductor Range: 0.25" - 1.25" (6.35 - 31.75 mm)
0096 = 96 0108 = 108 0120 = 120 0134 = 132 0144 = 144 0168 = 168 0172 = 172 0180 = 180 0192 = 192 0198 = 198 0210 = 210 0216 = 216	 4 - Tripod on both ends	

Special Needs

For special arrester characteristics other than those shown in this catalog, contact your MPS representative

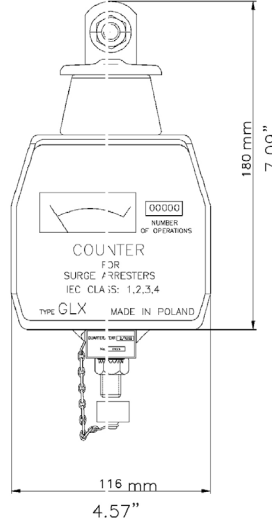
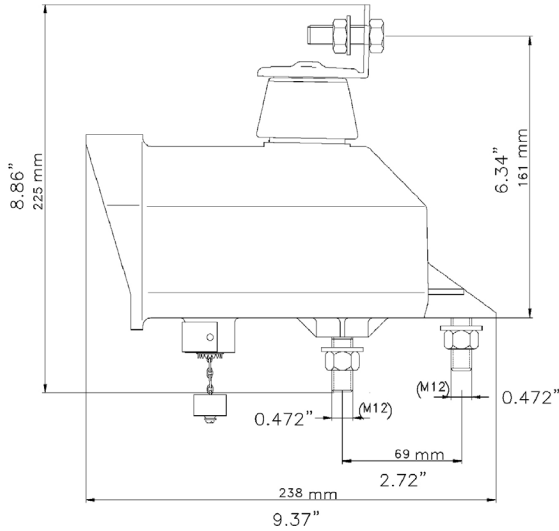
Example

108kV rated arrester with:
Small top cover & tripod base
Top - eyebolt with a 90° angle bracket
Bottom - Four hole NEMA pad with a 45° angle

Catalog Number - ZSP0108-1131



Station and Intermediate Class Arresters Accessories



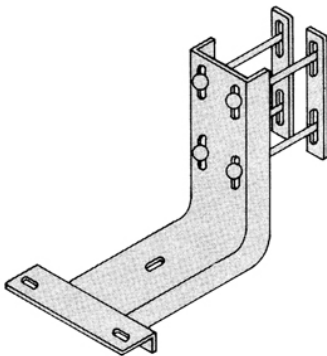
Discharge Counter Catalog No. 7120B0004H0001

The optional discharge counter records the number of current discharges through the ground lead of the arrester. A five-digit cyclometer records each current discharge. The counter registers impulse discharges of an amplitude of 200 amperes or more. No external power source is required. The discharge counter must be used in conjunction with insulating sub-bases.

A milliammeter comes with the discharge counter to provide continuous reading of the total current through the metal oxide valve elements and the leakage current across the external polymer insulation. A 0-30 milliamperes scale is used.

Heavy external contaminants on the polymer housing will increase the level of current registered and may serve as an indication the polymer housing needs washing. Steadily increasing readings with a clean housing may be an indication of potential problems with the arrester metal oxide valve elements.

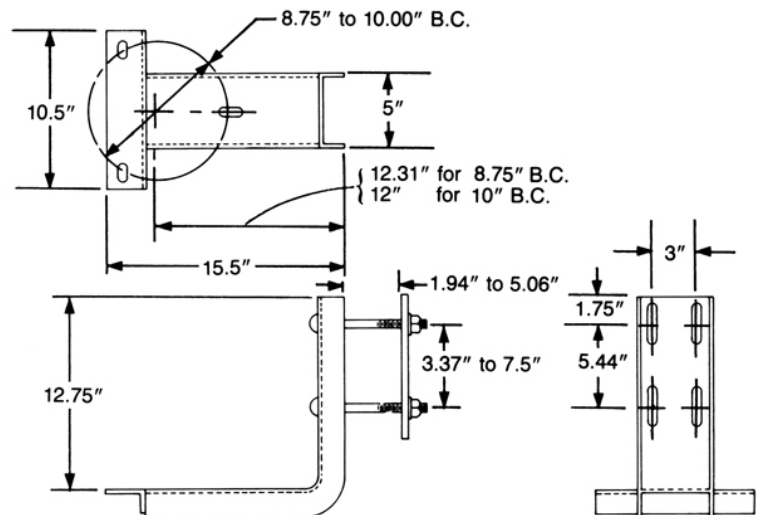
Mounting Brackets Hot Dip Galvanized



Single Crossarm Mounting Bracket Catalog No. 7106C0001

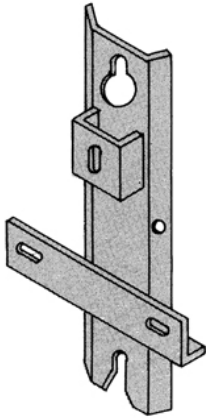
Maximum Arrester Sizes:
ZIP-96kV; ZSP-108kV

Includes 2 backstraps, 1/2" bolt size hardware and pipe spacers for inverted mounting.





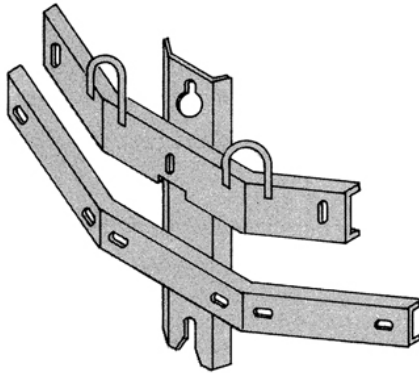
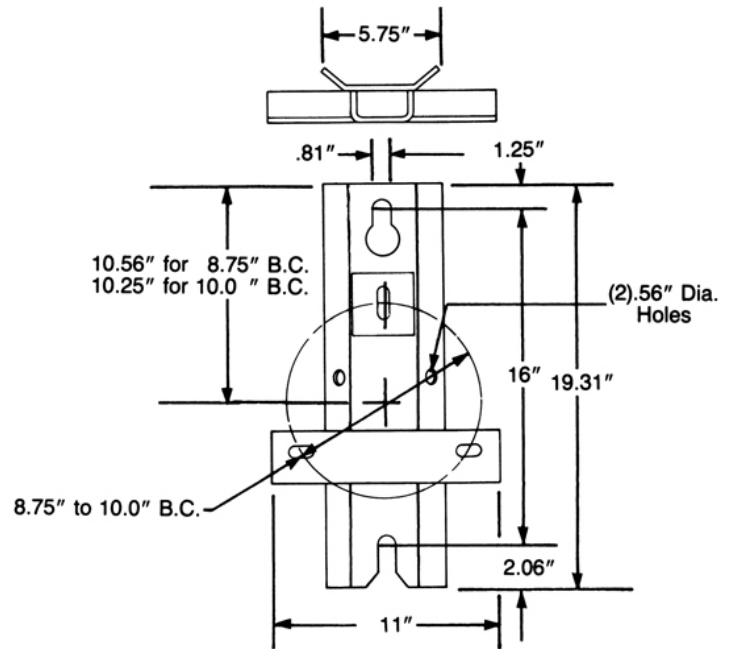
Station Class Arresters Accessories



**Pole Mounting Bracket
One Arrester, Horizontal Mounting
Catalog No. 7102C0003**

Maximum Arrester Sizes:
ZIP-60kV; ZSP-72kV

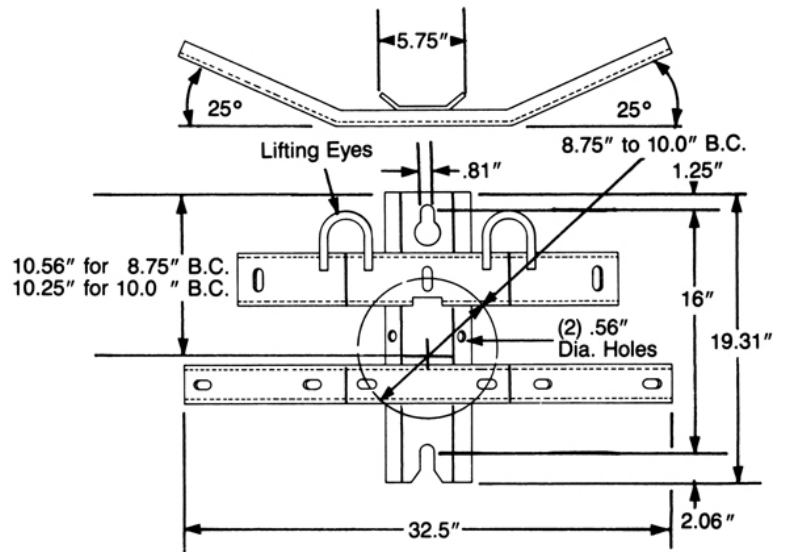
No hardware included.



**Pole Mounting Bracket
Three Arrester, Horizontal Mounting
Catalog No. 7102D0002**

Maximum Arrester Sizes:
ZIP-60kV; ZSP-72kV

No hardware included.





Transmission Line Arrester and Assemblies

Type “ZQPT”/“ZXLA”

Available for System Voltages Up to 161kV

Users of electricity have become more and more demanding over recent years. The quality of the power they receive is critical to their operations. Sensitive electronic equipment cannot tolerate voltage fluctuations and many problems are directed to the utility. The heightened awareness of power quality has brought the issue to all levels of operations, including transmission.



In the area of transmission line power quality, MPS offers the “ZQPT”/“ZXLA” transmission line arrester and arrester insulator assembly. The lightweight construction makes it possible to easily mount arresters on transmission line structures. The arresters provide a preferred path between line and ground, guarding against insulator flashover.

Transmission line surge protection is a solution to troublesome outages and customer dissatisfaction. State-of-the-art protection of transmission lines using polymer MOV arresters provides higher power quality which will improve customer satisfaction.

“ZQPT”/“ZXLA” transmission line arresters and assemblies are available for system voltages up to 161kV. The metal oxide blocks are specially selected and wrapped under compression with a strong fiberglass wrap.

Application

“ZQPT”/“ZXLA” transmission line arresters and assemblies are applied to:

- Improve power quality and overall line performance
- Supplement shield wire protection
- Provide protection for lines without a shield wire
- Create more space on structures by eliminating the shield wires
- Protect both new construction and retrofit

The factors that impact transmission line lightning performance include the following: The amount of lightning activity in a given area per year, the stroke magnitude and the wave shape of the lightning, the tower height and the amount of nearby natural shielding from trees or buildings, the tower footing resistance, the presence of an overhead shield wire and the shield angle, and the existing line insulation.

When selecting transmission line arresters for specific application, there are several things to keep in mind. The application is usually different for a line with an overhead shield wire than without. The arrester rating should be coordinated with the arresters in the substation. The transmission line arresters should be the same rating or larger so that they do not end up protecting the substation arresters.

The transmission line arresters should be sized by evaluating the line voltage and the line insulation. By using a high MCOV arrester the temporary overvoltage (TOV) capability will be increased and the energy capability will also be greater. With the added lightning exposure that may be expected on a transmission line, it is helpful to have higher capabilities in these categories. Also, higher rated arresters will not experience as much duty because the reference voltage is higher and will not turn on as soon as lower rated units.

Benefits

Lightning is one of the major causes of power interruption. Currently, shield wires serve as lightning protection for transmission lines.

“ZQPT”/“ZXLA” transmission line arresters and assemblies provide these advantages over the use of shield wire alone:

- Minimize the requirement to lower ground resistance
- Protect against backflash
- Safeguard from induced surges caused by nearby lightning
- Limit effects of switching surges
- Install easily and economically
- Allow for reduction of structure BIL
- Reduce system breaker operations
- Provide protection for isolated problem areas
- Improve overall line performance
- Enhance customer relations



ZQPT Transmission Line Arresters

Physical Characteristics											
Catalog Number	kV Rating	Width A		Length B		Nominal Strike		Nominal Creepage		Weight	
		In	Mm	In	Mm	In	Mm	In	Mm	Lb	Kg
8155CS036T****	36	4.2	107	19.6	498	20.1	511	55	1397	12	5.5
8155CS039T****	39			23.4	595	24.0	610	65	1651	14	6.4
8155CS045T****	45			27.2	691	27.9	709	76	1931	16	7.3
8155CS054T****	54			40.7	1034	41.9	1065	114	2896	24	10.9
8155CS060T****	60			41.5	1055	41.2	1047			26	11.8
8155CS072T****	72			47.5	1207	47.3	1202	131	3328	29	13.2
8155CS090T****	90	4.5	115	51.2	1301	51.2	1301	141	3582	31	14.1
8155CS096T****	96			55.0	1397	58.1	1476	152	3861	33	15.0
8155CS108T****	108										
8155CS120T****	120										

Notes:

* The asterisks identify the mounting hardware

Electrical Characteristics										
Catalog Number	Voltage Rating (kV-rms)	MCOV (kV-rms)	Max Equiv FOW ¹ (kV-Crest)	Max Switch Surge ² (kV-Crest)	Maximum Discharge Voltage (kV-Crest) Using an 8/20 μ s Current Impulse					
					1.5 kA	3.0 kA	5.0 kA	10 kA	20 kA	40 kA
8155CS036T****	36	29.0	130.2	84.9	95.1	98.5	104.1	115.5	131.3	155.1
8155CS039T****	39	31.5	134.7	87.8	98.4	101.9	107.8	119.5	135.9	160.5
8155CS045T****	45	36.5	156.8	102.2	114.5	118.6	125.4	139	158.1	186.8
8155CS054T****	54	42	195.8	127.7	143	148.1	156.7	173.7	197.5	233.3
8155CS060T****	60	48	217.3	141.7	158.7	164.4	173.9	192.8	219.2	258.9
8155CS072T****	72	57	261.5	170.5	191	197.8	209.2	231.9	263.7	311.5
8155CS090T****	90	70	326	212.6	238.1	246.6	260.8	289.1	328.8	388.3
8155CS096T****	96	76	347.5	226.6	253.8	262.9	278	308.2	350.5	414
8155CS108T****	108	88	391.1	255	285.6	295.9	312.9	346.9	394.5	465
8155CS120T****	120	98	434.6	283.5	317.5	328.8	347.7	385.5	438.4	517

Notes:

- 1) The equivalent Front-of-Wave is the maximum discharge voltage for a 10kA impulse current wave which produces a voltage wave cresting in a 0.5 μ s
- 2) Based on a switching surge current of 500 amperes for arresters rated 3kV to 90kV and 1000 amperes for arresters from 108kV to 144kV



ZXLA Transmission Line Arresters and Insulator Assembly

Horizontal Transmission Assembly

Line Voltage	ZXLA Catalog No.	Arrester Duty Voltage Rating	Arrester Catalog No.	MCOV	Insulator Catalog No.	Insulator Section Length	Assembly Leakage	Assembly Weight
kV		kV		kV		in (mm)	in (mm)	lbs (kg)
46	ZH4PKG13-036	36	8155CS036T****	29.0	NPKG20XG13S0 OLPK-13-SIL-GB-12	25.2 (640)	42.3 (1074)	38.0 (17.2)
	ZH4PKG13-039	39	8155CS039T****	31.5				
69	ZH4PKG17-054	54	8155CS054T****	42.0	NPKG20XG17S0 OLPK-17-SIL-GB-12	29.2 (742)	54.0 (1372)	45.0 (20.4)
	ZH4PKG17-060	60	8155CS060T****	48.0				
69	ZH4PKG21-054	54	8155CS054T****	42.0	NPKG20XGM21S0 MLPK-21-SIL-GB-12	29.2 (742)	59.4 (1509)	46.0 (20.9)
	ZH4PKG21-060	60	8155CS060T****	48.0				
69	ZH4PKG25-060	60	8155CS060T****	48.0	NPKG20XGM25S0 MLPK-25-SIL-GB-12	31.2 (792)	71.1 (1806)	48.0 (21.8)

* Consult factory for system voltages greater than 69kV

Vertical Transmission Assembly

Line Voltage	ZXLA Catalog No.	Arrester Duty Voltage Rating	Arrester Catalog No.	MCOV	Insulator Catalog No.	Insulator Section Length	Assembly Leakage	Assembly Weight
kV		kV		kV		in (mm)	in (mm)	lbs (kg)
46	ZV4PKG13-036	36	8155CS036T****	29.0	NPKV20XG13S0 OLPK-13-SIL-VB-12	23.4 (594)	42.3 (1074)	38.0 (17.2)
	ZV4PKG13-039	39	8155CS039T****	31.5				
69	ZV4PKG17-054	54	8155CS054T****	42.0	NPKV20XG17S0 OLPK-17-SIL-VB-12	27.4 (696)	54.0 (1372)	45.0 (20.4)
	ZV4PKG17-060	60	8155CS060T****	48.0				
69	ZV4PKG21-054	54	8155CS054T****	42.0	NPKV20XGM21S0 MLPK-21-SIL-VB-12	27.4 (696)	59.4 (1509)	46.0 (20.9)
	ZV4PKG21-060	60	8155CS060T****	48.0				
69	ZV4PKG25-060	60	8155CS060T****	48.0	NPKV20XGM25S0 MLPK-25-SIL-VB-12	31.4 (798)	71.1 (1806)	48.0 (21.8)

* Consult factory for system voltages greater than 69kV

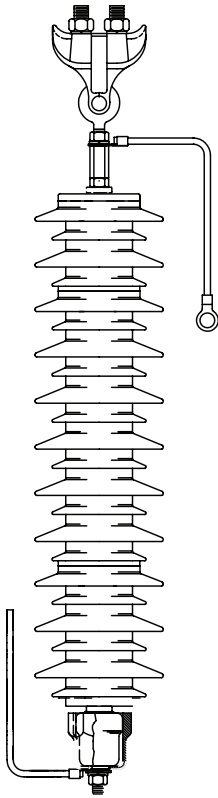
Deadend Transmission Assembly

Line Voltage	ZXLA Catalog No.	Arrester Duty Voltage Rating	Arrester Catalog No.	MCOV	Insulator Catalog No.	Insulator Section Length	Assembly Leakage	Total Weight (Est)
kV		kV		kV		in (mm)	in (mm)	lbs (kg)
46	ZD148035MX01-039	39	8155CS039T****	31.5	S148035MX01	35.4 [899]	60.8 [1544]	27.3 [12.4]
69	ZD148035MX01-054	54	8155CS054T****	42.0	S148035MX01	35.4 [899]	60.8 [1544]	39.3 [17.8]
	ZD148035MX01-060	60	8155CS060T****	48.0				
	ZD148035MX01-072	72	8155CS072T****	57.0				
115	ZD148035MX01-090	90	8155CS090T****	70.0	S148054MX01	54.3 [1379]	109.2 [2774]	45.6 [20.7]
138	ZD148035MX01-108	108	8155CS0108T****	48.0	S148065MX01	65.3 [1659]	137.4 [3490]	57.1 [25.9]
	ZD148035MX01-132	132	8155CS0132T****	106.0				

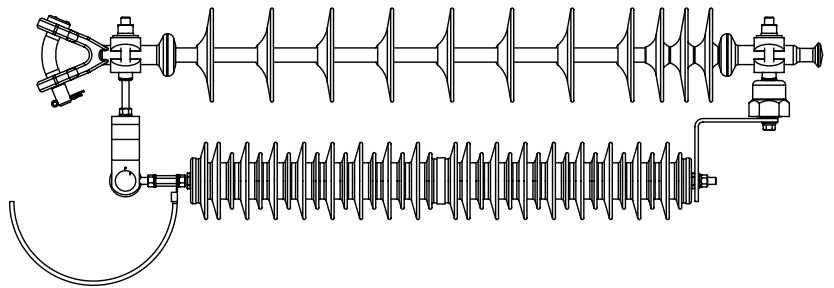
* Consult factory for system voltages greater than 138 kV



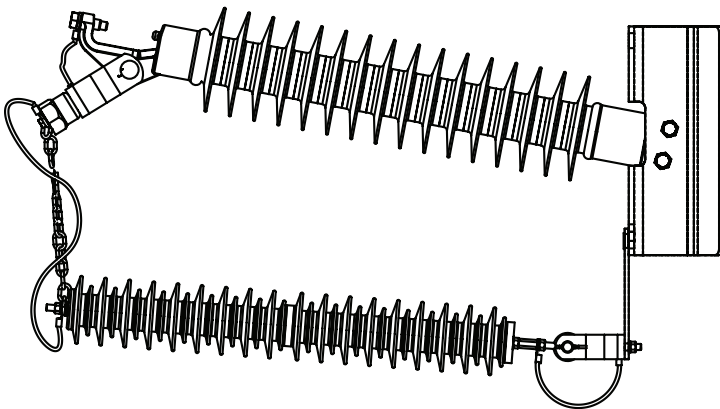
Transmission Line Protection Configurations



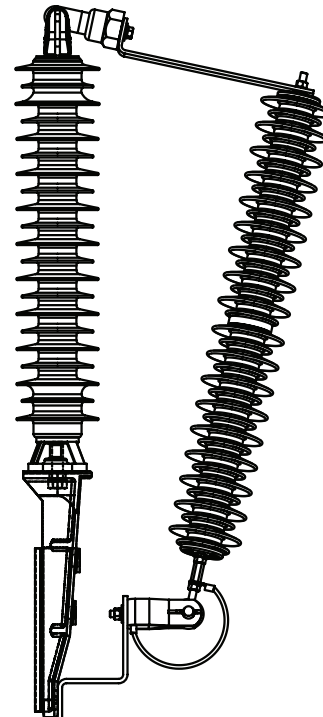
Suspension Configuration



Deadend Configuration



Horizontal Configuration



Vertical Configuration



Surge Tec® Secondary Arresters



Electricity users, from the homeowner to big business, are more interested today in the quality of the power they receive than in the past, and with good reason. Advances in technology have introduced new electronic equipment and appliances that are more susceptible to damage by power surges. Replacing or repairing damaged equipment is inconvenient and can be costly.

Lightning or an interruption in the power line can generate a power surge. These high energy surges can enter a home or building through the electric service entrance. Once the surge enters the building, there is a possibility that high voltages resulting from the surge current will damage electrical wiring or equipment. Surge Tec® arresters are designed to limit surge voltages by discharging (bypassing) surge current to ground.

Individuals should assess their risk by evaluating the potential impact that a power surge may have on their property. In many cases, the cost of protection is relatively inexpensive compared to the possible loss. The Surge Tec® arrester is designed to provide brute force protection against surges at the service entrance, where protection is needed the most. The family of Surge Tec® arresters provides an excellent first line of defense for any critical electrical service, whether it is in a home, business or industrial applications.

Surge Arrester Application

MPS' Surge Tec® arresters are designed for service entrance installations. The arresters are designed for repeated operation and continuous protection.

Surge arresters provide the path of least resistance to ground for surges on a system. THE ARRESTERS SHOULD BE INSTALLED BY A LICENSED ELECTRICIAN. To provide the best protection, the lead wires should be kept as short as possible. When installed properly, they will divert lightning surges to ground very quickly. Surge Tec® arresters offer the first line of defense for the entire electrical service and protect wiring, major appliances, pumps, and heating/air conditioning equipment. For added protection to computers, MPS recommends plug-in-strip type of device with lower clamping voltages as a second line of defense. This type of coordination provides excellent surge protection for the entire electric service.

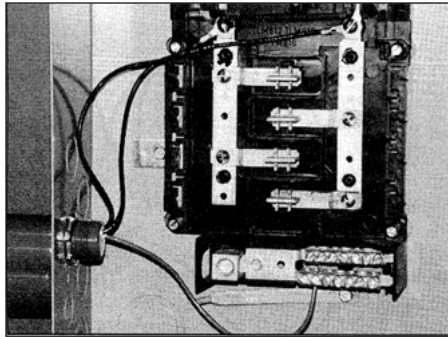
Features

Surge Tec® arresters incorporate special features that make them stand above other Secondary Arresters and Transient Voltage Surge Suppressors (TVSS). These arresters use a patented (#5,502,612) fault withstand design along with replacement indication. The arresters are available in 175 volt, 480 volt and 650 volt AC ratings for application on system voltages below 650 volts phase to ground and operate at frequencies between 48 and 62 Hz. The units come with 18 inch, #14 AWG solid copper wire leads and are designed to be mounted outdoors or indoors.

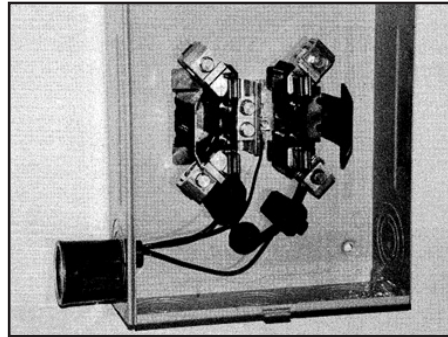
- **METAL OXIDE VARISTORS**—Surge Tec® arresters use metal oxide varistors (MOV). This takes advantage of our experience with metal oxide production for the utility industry. The arresters meet ANSI/IEEE C62.11-1993 for secondary arresters. In addition, they have passed a 5kA Duty Cycle test. They provide high speed response and excellent energy capability for today's critical electric loads.
- **REPLACEMENT INDICATION**—A visual indication on the front label permits routine checks of the arrester's operational status. Indication windows on the label turn black if the arrester has faulted. The arrester should be replaced when any area of any window turns black.
- **FAULT WITHSTAND CAPABILITY**—The Surge Tec® secondary arresters have a patented fault withstand design. This unique design has been tested at high current failure modes to verify its ability to withstand a failure without a violent fracture of the housing. Fault current is the full available system current that the device conducts in the event it is short circuited by conducting a surge beyond the designed capability. This provides significant advantages in the area of secondary voltage protection. There currently is not a standard requirement or test specification for fault withstand capability of secondary arresters. The Surge Tec® arresters were tested by failing them with an overvoltage and then applying fault currents of 4kA and 10kA. The arresters achieved the fault withstand capability of 10kA rms without the use of, or the requirement for, any external fusing.
- **COST EFFECTIVE**—The Surge Tec® arresters are very inexpensive compared to potential equipment damage.



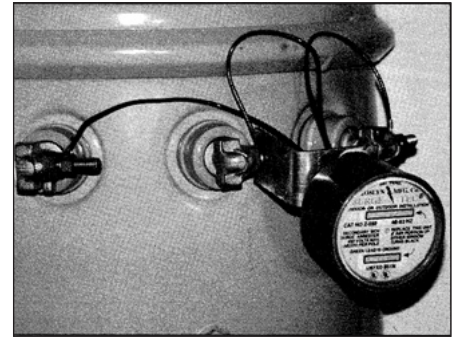
Surge Tec® Physical and Electrical Characteristics



Knockout Mounting
Z2-175-0



Meterbase Mounting
with insulating piercing connector



Transformer Mounting
Z2-480-4C
Z2-650-4C
(for 3/8" hardware)

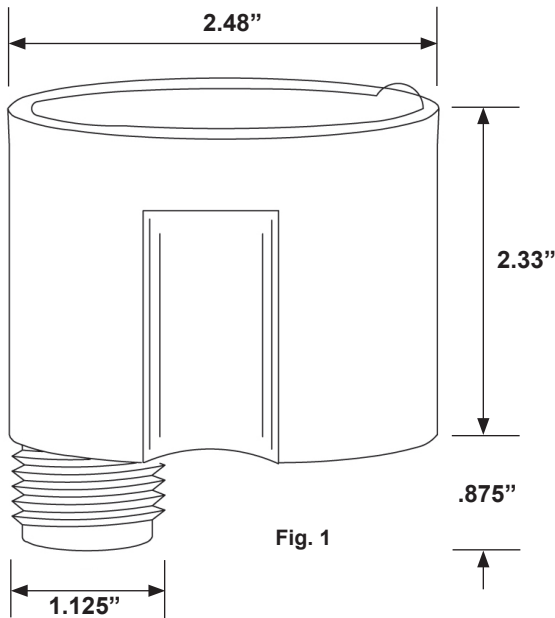


Fig. 1

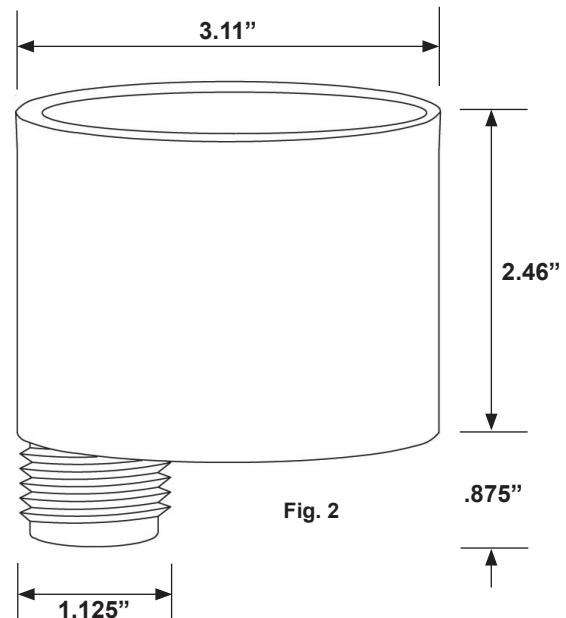


Fig. 2

Physical and Electrical Characteristics

Catalog No.	Voltage Rating MCOV	Poles	Weight Oz (Gram)	Figure	Energy Capability (Joules/Phase)	Response Time (nsec)	Front-of-Wave Protection Level (kV-Crest)	Max. Discharge Voltage Clamping Using an 8/20 μ sec Current Wave (units-kV)		
								1.5kA	5.0kA	10kA
Z1-175-0	175	1	14 (435)	1	427	<5	1.21	0.75	0.95	1.27
Z2-175-0		2	15 (466)							
Z3-175-0		3	18 (560)	2						

*Add an "A" suffix to obtain the mounting bracket (e.g. Z1-175-0A)

Z1-480-0	480	1	15 (466)	1	742	<5	1.90	1.42	1.76	2.16
Z2-480-0		2	19 (590)	2						
Z3-480-0		3	20 (622)							

*Add an "A" suffix to obtain the mounting bracket (e.g. Z1-480-0A)

Z1-650-0	650	1	19 (590)	1	919	<5	2.48	2.01	2.44	2.55
Z2-650-0		2	20 (622)	2						
Z3-650-0		3	21 (653)							

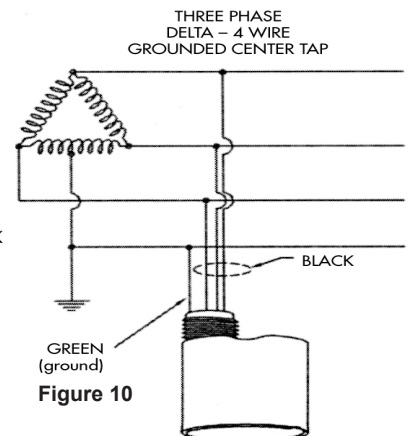
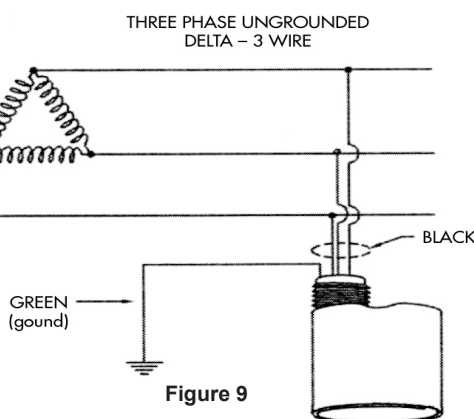
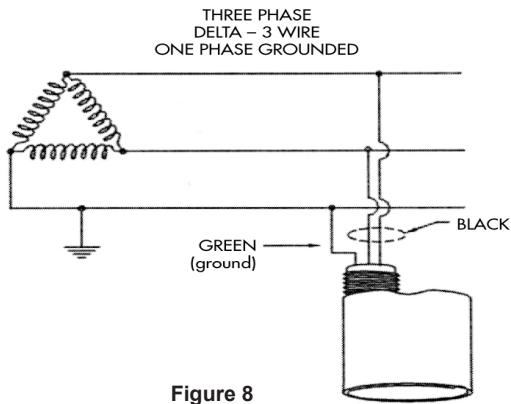
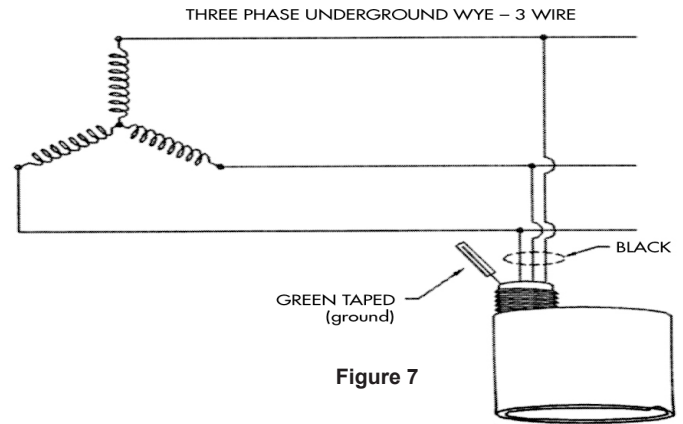
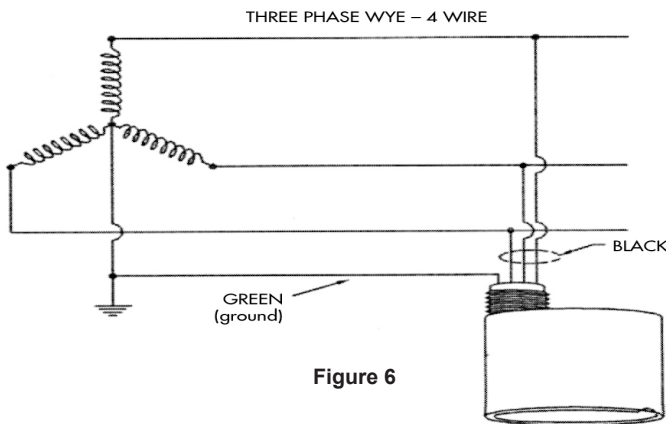
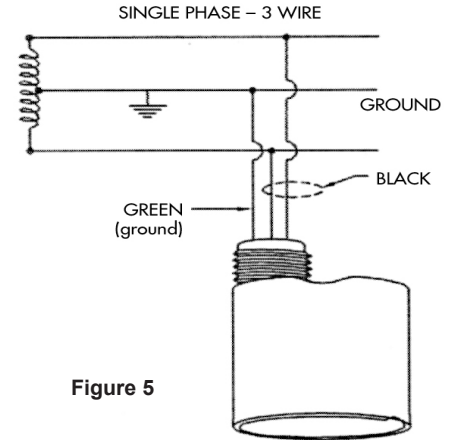
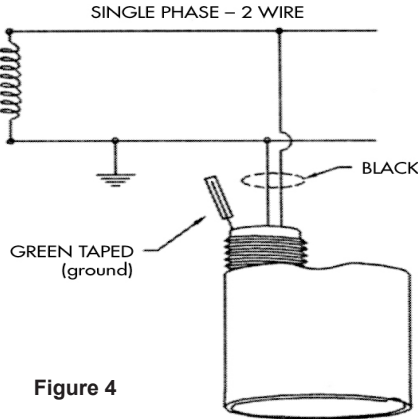
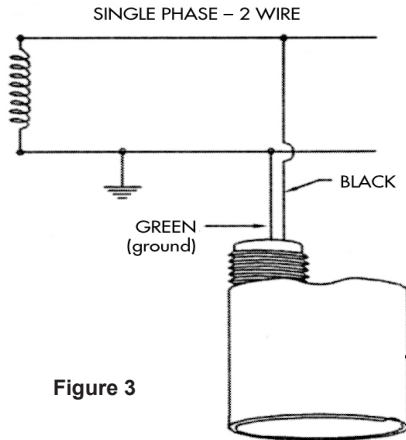
*Add an "A" suffix to obtain the mounting bracket (e.g. Z1-650-0A)



Surge Tec® Typical Wiring Connections

Maximum Phase-Phase/Phase-Ground Voltages									
Figure No.	Z1-175	Z2-175	Z3-175	Z1-480	Z2-480	Z3-480	Z1-650	Z2-650	Z3-650
3	175/NA			480/NA			650/NA		
4		350/NA			960/NA			1300/NA	
5		350/175			960/480			1300/650	
6			303/175			831/480			1125/650
7									
8		175			480			650	
9			175/101			480/277			650/375
10									

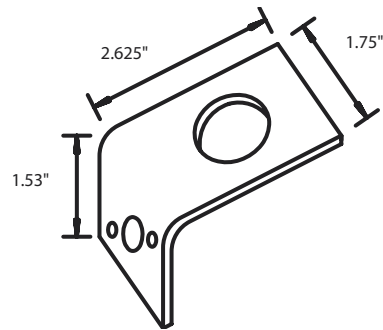
For severe duty applications, select arrester with next highest voltage rating.



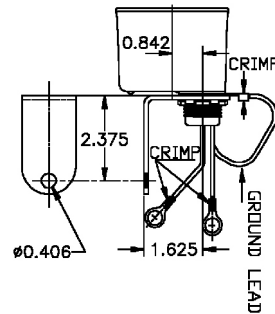


Surge Tec® Catalog Numbering System

Z	2	-	175	-	0	A
	Number of Poles		Max. Voltage per Pole (MCOV)		Lead Wire Length (in/mm)	Mounting Bracket/Hardware Options
1 - One pole 2 - Two poles 3 - Three poles		175 - 175 volt 480 - 480 volt 650 - 650 volt		0 - 18"/457 1 - 24"/610 2 - 36"/914		A - Aluminum 'A' Bracket C - Aluminum 'C' Bracket 1" Ring Terminals - Ground 3/8" Ring Terminals - Line Connections



'A' Bracket
Part No. 8340903



Option 'C'



Catalog Number	Description	Page
7102C0003	Pole Mounting Bracket; One Arrester, Horizontal Mounting	AR-26
7102D0002	Pole Mounting Bracket; Three Arrester, Horizontal Mounting	AR-26
7106C0001	Single Crossarm Mounting Bracket	AR-25
712B0004H0001	Discharge Counter	AR-25
Z1-175	Surge Tec®	AR-31 - 34
Z1-480	Surge Tec®	AR-31 - 34
Z1-650	Surge Tec®	AR-31 - 34
Z2-175	Surge Tec®	AR-31 - 34
Z2-480	Surge Tec®	AR-31 - 34
Z2-650	Surge Tec®	AR-31 - 34
Z3-175	Surge Tec®	AR-31 - 34
Z3-480	Surge Tec®	AR-31 - 34
Z3-650	Surge Tec®	AR-31 - 34
ZE Series	ZE Elbow Distribution Arresters	AR-12 - 13
ZHP Series	Zforce ZHP™ (10kA Heavy Duty Polymer)	AR-8
ZIP Series	ZIP Intermediate Class Surge Arresters	AR-14 - 19
ZJP Series	ZJP Intermediate Class Surge Arresters	AR-14 - 19
ZNP Series	Zforce™ ZNP (5kA Normal Duty Polymer)	AR-8
ZQPT Series	ZQPT Transmission Line Arresters	AR-27 - 28
ZRP Series	ZRP™ (10kA Riser Pole Polymer)	AR-9
ZSP Series	Station Class Arresters	AR-20 - 24
ZXLA Series	ZXLA Transmission Line Arrester and Insulator Assembly	AR-27 - 29