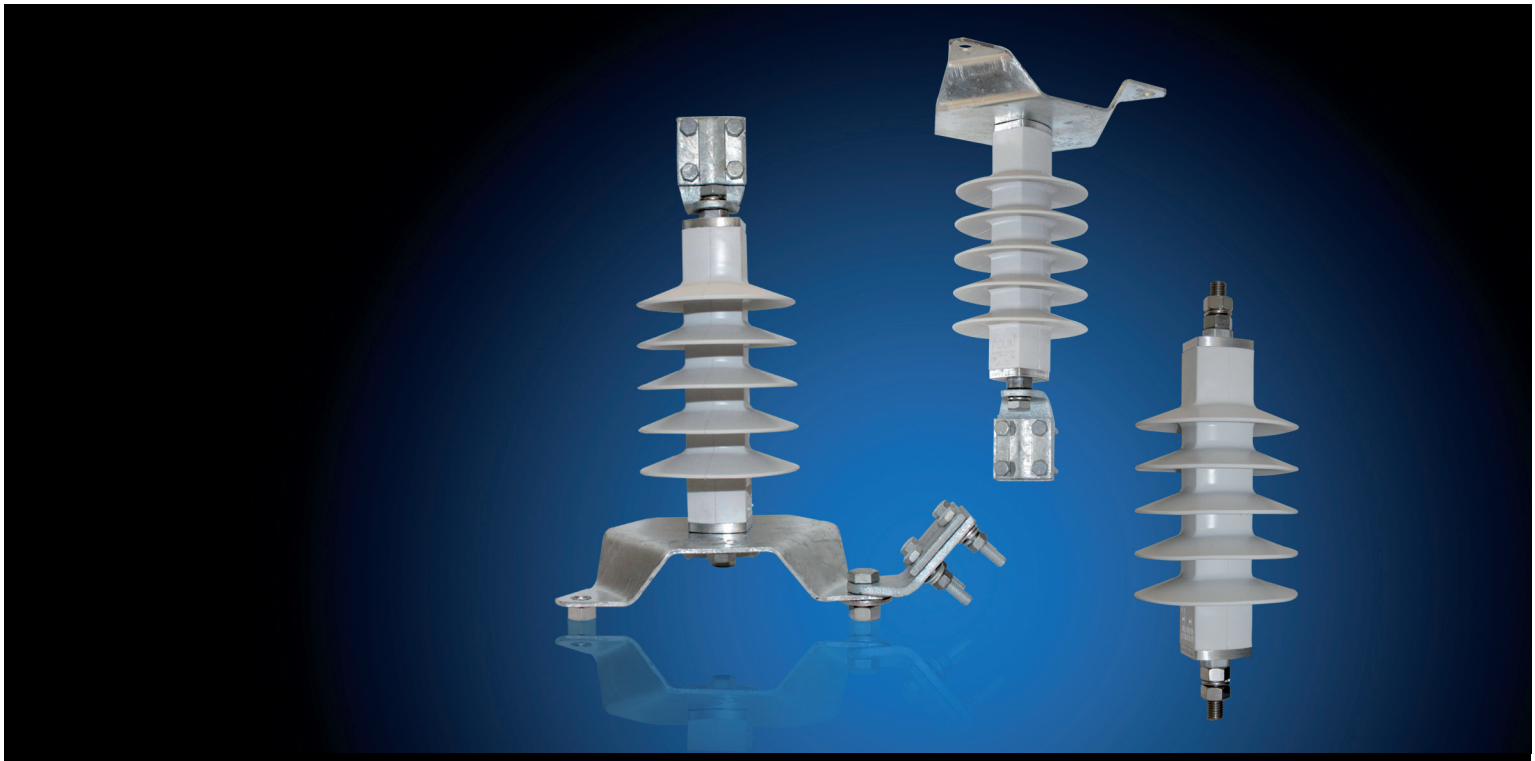


Type XPI-III Surge Arresters
Maximum System Voltage 2 to 48 kV

Power and productivity
for a better world™

XPI-III Metal Oxide Surge Arrester

XPI-III Metal Oxide Surge Arresters are for protection of switchgear, transformers, and other equipment in high voltage systems against lightning and switching overvoltages. For use when requirements of lightning intensity, energy capability and pollution are moderate.

Superior design where low weight, reduced clearances, flexible mounting, and shatter-proof housing is required.

Application

The XPI-III polymer arrester has been verified to meet or exceed all intermediate class requirements of ANSI C62.11 (IEEE Standard for Metal-Oxide Surge Arresters for AC Power Circuits) and Line Discharge Class 1 requirements of IEC 600099-4 (IEC Standard for Metal-Oxide Surge Arresters without gaps for AC Systems). The XPI-III arrester is designed to meet the following performance data.

Performance data

Maximum system voltages (Vm)	2.52 - 48.3 kV rms
Duty cycle rated voltages (Vr)	3 - 45 kV rms
Classifying current (ANSI/IEEE)	10 kA peak
Discharge current withstand strength:	
High current 4/10 µs	100 kA peak
Low current 2000 µs	250 A peak
Energy capability:	
2 impulses, (IEC Cl. 7.5.5) Fulfills requirements of ANSI transmission-line discharge test for 36.2 kV systems	3.6 kJ / kV of MCOV
Short-circuit / pressure relief capability	20 kA rms sym
Cantilever strength	2200 in - lbs / 250 Nm
Service conditions:	
Ambient temperature	-40 °C to +45 °C
Design altitude	6000 ft / 1830 m
Frequency	15 - 62 Hz

Note: Higher altitudes designs available on request

Benefits

Direct-molded construction

ABB's type XPI-III surge arrester consists of high performance metal oxide disks molded in a shatter-proof polymer housing. The XPI-III now has a new construction to enhance overall lifetime performance.

The metal oxide disks are enclosed in a support assembly consisting of reinforced epoxy / fiberglass loops connecting the upper and lower aluminum end pieces. The silicone polymer material is then molded directly to the metal oxide loop assembly eliminating any air pockets which could cause moisture ingress over time.

Each arrester is furnished with a mounting base for an 8.75 in / 222 mm diameter bolt circle along with 4-hole, line and ground terminals for electrical connections.

100% silicone based housing

The silicone rubber housing features high tracking and arc resistance, excellent hydrophobic properties, and resistance to weathering, UV radiation and pollution.

The incorporation of polymer material in an intermediate class arrester has resulted in many additional advantages. Among these are:

Direct-molded construction

ABB's XPI-III Surge Arrester consists of high performance metal oxide disks molded in a shatter-proof polymer housing. The XPI-III Surge Arrester now has a new construction to enhance overall lifetime performance.

The metal oxide disks are enclosed in a support assembly consisting of reinforced epoxy/fiberglass loops connecting the upper and lower aluminum end pieces. The silicone polymer material is then molded directly to the metal oxide loop assembly eliminating any air pockets which could cause moisture ingress over time.

Reduced electrical clearance

Polymer construction has resulted in much smaller housing dimensions in comparison with porcelain units of the same voltage rating. This size reduction enables efficient use of space for switchgear enclosures, mobile substations and other applications where space restrictions are present.

Lightweight

The XPI-III Surge Arrester is less than 50 percent the weight of its porcelain counterpart, which results in easier handling and installation.

Damage resistant

Polymer construction reduces possible shipping and handling damage, as well as, damage due to vandalism.

Safety

Shatter-resistant construction provides greater protection for personnel, as well as, nearby equipment.

Nameplate

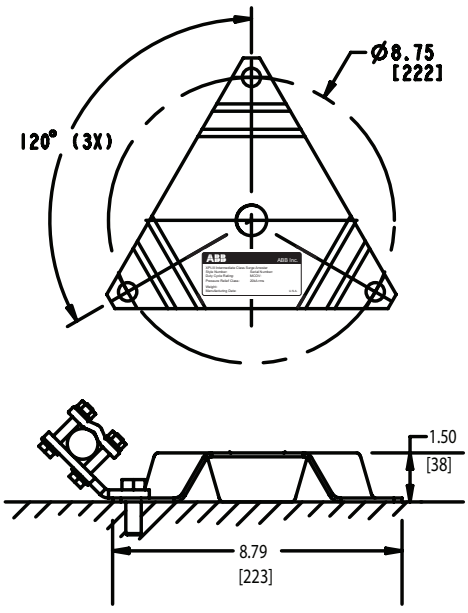
Standard (Mylar)

ABB Inc.

XPI-III Intermediate Class Surge Arrester

Style Number:	Serial Number:
Duty Cycle Rating:	MCOV:
Pressure Relief Class:	20kA rms
Weight:	
Manufacturing Date:	U.S.A.

Drilling plan



Quick selection guide

	System Voltage			Surge Arrester ANSI/IEEE Ratings		
		Nominal				
	Maximum V_m (kV_{rms})	Three-Wire V_n (kV_{rms})	Four-Wire V_n (kV_{rms})	Three-Wire V_r / V_{MCOV} (kV_{rms})	Four-Wire Grounded V_r / V_{MCOV} (kV_{rms})	Four-Wire Grounded High Impedance V_r / V_{MCOV} (kV_{rms})
Medium Voltage	2.52	2.4		3 / 2.55		
	4.37Y / 2.52		4.16Y / 2.4		3 / 2.55	5 / 4.25
	4.37	4.16		5 / 4.25		
	5.04	4.8		6 / 5.1		
	7.24	6.9		9 / 7.65		
	8.73Y / 5.04		8.32Y / 4.8		6 / 5.1	12 / 10.2
	12.6Y / 7.27		12.0Y / 6.93		9 / 7.65	15 / 12.7
	13.09Y / 7.56		12.47Y / 7.2		9 / 7.65	18 / 15.3
	13.86Y / 8.0		13.2Y / 7.62		10 / 8.4	18 / 15.3
	14.49Y / 8.37		13.8Y / 7.97		10 / 8.4	18 / 15.3
	14.49	13.8		18 / 15.3		
	21.82Y / 12.6		20.78Y / 12.0		15 / 12.7	27/ 22
	24.0Y / 13.86		22.86Y / 13.2		18 / 15.3	30 / 24.4
	24.15	23.0		30 / 24.4		
	26.19Y / 15.12		24.94Y / 14.4		21 / 17	33 / 27
	36.23Y / 20.92		34.5Y / 19.92		27 / 22	42 / 34
	36.23	34.5				
High Voltage	48.30	46		36 / 29		

Key

V_n	Nominal System Voltage per NEMA C84.1
V_m	Maximum System Voltage per NEMA C84.1
V_r	Duty Cycle Rated Voltage per IEEE C62.11
MCOV	Maximum Continuous Operating Voltage per IEEE C62.11
TOV	Temporary Overvoltage
SPL	Switching Protective Level
	500 A 3-132 V_r (kV_{rms})
LPL	Lightning Protective Level
FOW	Front of Wave

Guaranteed performance data

Electrical characteristics											
Ratings (kV_{rms})		TOV (kV_{rms})		Maximum residual voltage with current wave, (kV_{peak})							
Voltage	MCOV	with prior energy single impulse of 3.6 kJ/kV_r		SPL (SIPL) 30/60 µS	LPL (LIPL) 8/20 µs						FOW 0.5 µs
V_r	V_{MCOV}	1 sec	10 sec	500 A	1.5 kA	3 kA	5 kA	10 kA	20 kA	40 kA	10 kA
3.0	2.55	4.2	4.0	11.1	11.7	12.2	13.1	14.0	15.9	18.2	16.0
4.0	3.40	4.2	4.0	11.1	11.7	12.2	13.1	14.0	15.9	18.2	16.0
5.0	4.25	8.3	8.0	16.6	17.5	18.3	19.6	21.0	23.9	27.3	24.0
6.0	5.10	8.3	8.0	16.6	17.5	18.3	19.6	21.0	23.9	27.3	24.0
7.0	5.95	8.3	8.0	16.6	17.5	18.3	19.6	21.0	23.9	27.3	24.0
9.0	7.65	12.5	12.0	22.2	23.3	24.4	26.1	28.0	31.8	36.4	32.0
10.0	8.40	13.9	13.3	27.7	23.3	30.5	32.6	35.0	39.8	45.5	39.9
12.0	10.2	16.6	16.0	33.2	29.1	36.6	39.1	42.0	47.7	54.6	47.9
15.0	12.7	20.8	20.0	38.8	34.9	42.7	45.6	49.0	55.7	63.7	55.9
18.0	15.3	25.0	24.1	44.3	46.5	48.8	52.1	56.0	63.6	72.8	63.9
21.0	17.0	29.1	28.1	49.8	52.3	54.9	58.6	63.0	71.6	81.9	71.9
24.0	19.5	33.3	32.1	55.3	58.1	60.9	65.1	70.0	79.5	91.0	79.8
27.0	22.0	37.5	36.1	60.9	64.0	67.0	71.7	77.0	87.4	101	87.8
30.0	24.4	41.7	40.1	66.0	69.8	73.1	78.2	84.0	95.4	110	95.8
33.0	27.0	45.8	44.2	77.0	81.4	85.3	91.2	98.0	112	129	112
36.0	29.0	50.0	48.2	83.1	87.3	91.4	97.8	105	120	138	120
39.0	31.5	54.2	52.2	88.1	93.1	97.5	105	112	128	147	128
42.0	34.0	58.3	56.2	93.6	98.9	104	111	119	136	156	136
45.0	36.5	62.5	60.3	99.1	105	110	118	126	144	166	144

Style numbers and technical data for housings

Vertical mounting styles with standard creepage distance

Surge Arrester IEEE Ratings V_r / V_{MCOV} (kV)	Style Number	Creepage Distance inches (mm)	Strike Distance inches (mm)	BIL 1.2/50 µs dry kV_{peak}	Weight (Mass) lbs (kg)	A max inches (mm)	Fig
3.0 / 2.55	U003SA002B	6 (153)	4.76 (121)	78	5 (2.3)	9.89 (251.3)	1
4.0 / 3.40	U004SA003B	6 (153)	4.76 (121)	78	5 (2.3)	9.89 (251.3)	1
5.0 / 4.25	U005SA004B	6 (153)	4.76 (121)	78	5 (2.3)	9.89 (251.3)	1
6.0 / 5.10	U006SA005B	6 (153)	4.76 (121)	78	5 (2.3)	9.89 (251.3)	1
7.0 / 5.95	U007SA005B	6 (153)	4.76 (121)	78	5 (2.3)	9.89 (251.3)	1
9.0 / 7.65	U009SA007B	12 (306)	6.69 (170)	110	6 (2.7)	11.74 (298.3)	1
10 / 8.40	U010SA008B	12 (306)	6.69 (170)	110	6 (2.7)	11.74 (298.3)	1
12 / 10.2.	U012SA010B	12 (306)	6.69 (170)	110	6 (2.7)	11.74 (298.3)	1
15 / 12.7	U015SA012B	18 (460)	8.54 (217)	140	7 (3.2)	13.63 (346.3)	1
18 / 15.3	U018SA015B	18 (460)	8.54 (217)	140	7 (3.2)	13.63 (346.3)	1
21 / 17.0	U021SA017B	18 (460)	8.54 (217)	140	7 (3.2)	13.63 (346.3)	1
24 / 19.5	U024SA019B	24 (610)	10.39 (264)	170	8 (3.6)	15.48 (393.3)	1
27 / 22.0	U027SA022B	24 (610)	10.39 (264)	170	8 (3.6)	15.48 (393.3)	1
30 / 24.4	U030SA024B	24 (610)	10.39 (264)	170	8 (3.6)	15.48 (393.3)	1
33 / 27.0	U033SA027B	51.6 (1311)	20.23 (514)	296	14 (6.4)	24.62 (625.3)	1
36 / 29.0	U036SA029B	51.6 (1311)	20.23 (514)	296	14 (6.4)	24.62 (625.3)	1
39 / 31.0	U039SA031B	51.6 (1311)	20.23 (514)	296	14 (6.4)	24.62 (625.3)	1
42 / 34.0	U042SA034B	51.6 (1311)	20.23 (514)	296	14 (6.4)	24.62 (625.3)	1
45 / 36.0	U045SA036B	51.6 (1311)	20.23 (514)	296	14 (6.4)	24.62 (625.3)	1

Note: Arrester assembly consists of arrester unit, line and ground terminals

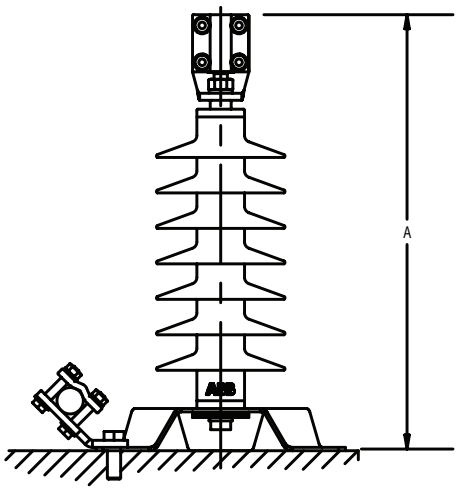
Vertical mounting styles with extra creepage distance

Surge Arrester IEEE Ratings V_r / V_{MCOV} (kV)	Style Number	Creepage Distance inches (mm)	Strike Distance inches (mm)	BIL 1.2/50 µs dry kV_{peak}	Weight (Mass) lbs (kg)	A max inches (mm)	Fig
3.0 / 2.55	U003SB002B	9.76 (248)	5.35 (136)	88	5 (2.3)	9.89 (251.3)	1
4.0 / 3.40	U004SB003B	9.76 (248)	5.35 (136)	88	5 (2.3)	9.89 (251.3)	1
5.0 / 4.25	U005SB004B	9.76 (248)	5.35 (136)	88	5 (2.3)	9.89 (251.3)	1
6.0 / 5.10	U006SB005B	9.76 (248)	5.35 (136)	88	5 (2.3)	9.89 (251.3)	1
7.0 / 5.95	U007SB005B	9.76 (248)	5.35 (136)	88	5 (2.3)	9.89 (251.3)	1
9.0 / 7.65	U009SB007B	14.76 (375)	7.16 (182)	118	6 (2.7)	11.74 (298.3)	1
10 / 8.40	U010SB008B	14.76 (375)	7.16 (182)	118	6 (2.7)	11.74 (298.3)	1
12 / 10.2.	U012SB010B	19.92 (506)	9.01 (229)	148	6 (2.7)	13.63 (346.3)	1
15 / 12.7	U015SB012B	19.92 (506)	9.01 (229)	148	7 (3.2)	13.63 (346.3)	1
18 / 15.3	U018SB015B	19.92 (506)	9.01 (229)	148	7 (3.2)	13.63 (346.3)	1
21 / 17.0	U021SB017B	28.15 (715)	12.91 (328)	213	7 (3.2)	17.37 (441.2)	1
24 / 19.5	U024SB019B	28.15 (715)	12.91 (328)	213	8 (3.6)	17.37 (441.2)	1
27 / 22.0	U027SB022B	43.35 (1101)	16.53 (420)	273	8 (3.6)	21.12 (536.4)	1
30 / 24.4	U030SB024B	43.35 (1101)	16.53 (420)	273	8 (3.6)	21.12 (536.4)	1

Figures

Standard mounting

1 Single housing



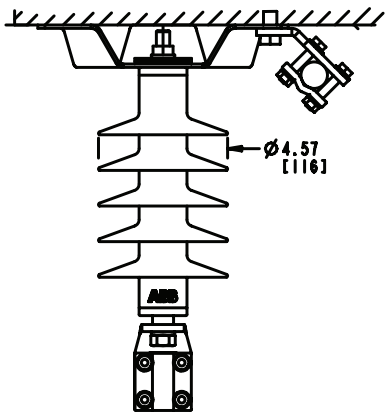
Optional mountings

Under-hung mounted styles

Available for all ratings. To select, add 'UH' to the end of the style number.

(Example: 15kV U015SA012BUH)

2 Single housing under hung

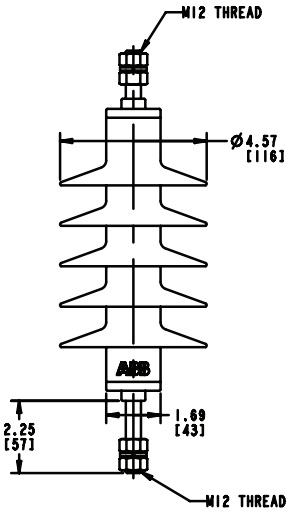


Cubical mounted styles

Available for ratings 3 to 45kV. To select, add 'IAA0' to the end of the style number.

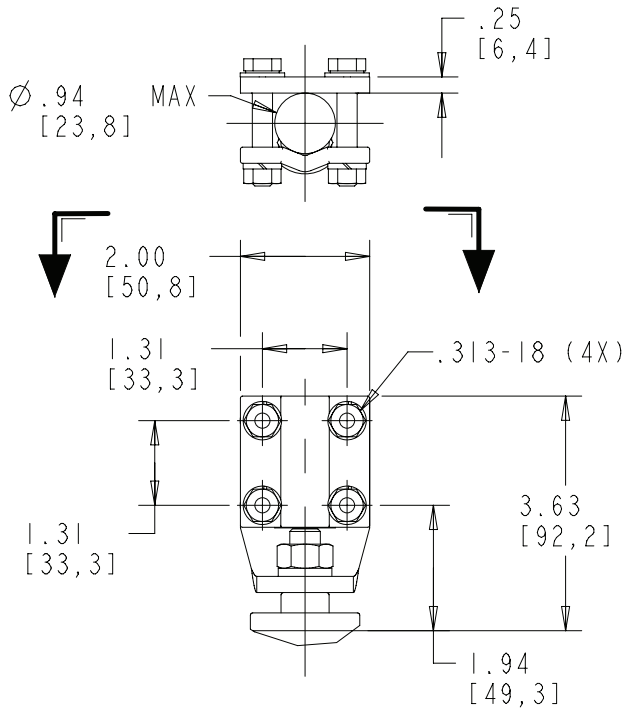
(Example: 15kV U015SA012BIAA0)

3 Single housing cubical

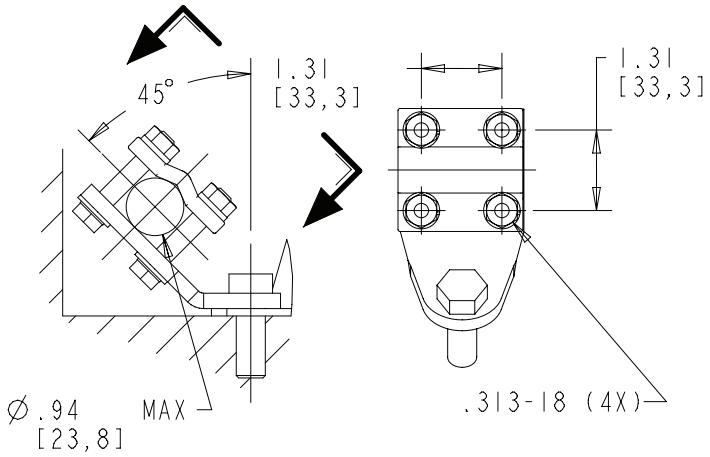


Standard hardware

Line terminal



Ground terminal



Note: Line and ground terminals can accommodate copper or aluminum cable size Number 2 to 600 MCM / 0.25 to 0.94 in. / 6 to 24 mm diameter. Ground terminal can be located on any lug.

Phase-to-ground clearance

The phase-to-ground clearance in substations is usually based on the selected standard rated lightning and switching impulse withstand voltages. International standards, e.g. IEC 60071-2, recommend minimum clearances.

In general, the clearance between a grounded object and a surge arrester should be the same as the phase-to-ground clearance selected for other high voltage equipment in a substation. If it is not possible to use the normal phase-to-ground clearance in special applications of POLIM-S Surge Arresters, a smaller clearance may be chosen, considering the protective characteristics of the arrester. At system voltages 24 kV and below, the margin between the rated withstand voltage of the substation and the protective level of the surge arrester is large. Furthermore, distance effects by fast transients do not exist in the immediate vicinity of the surge arrester.

Thus, the recommended minimum phase-to-ground clearance for POLIM-S Surge Arresters, with regard to lightning and switching overvoltages are presented in Figure 1. These clearances are based on IEC 60071-2, Table VI, and on the protective characteristics of the surge arrester. They include safety margins and altitude correction.

The *Adjusted Protective Level* to be used in Figure 1, is defined as:

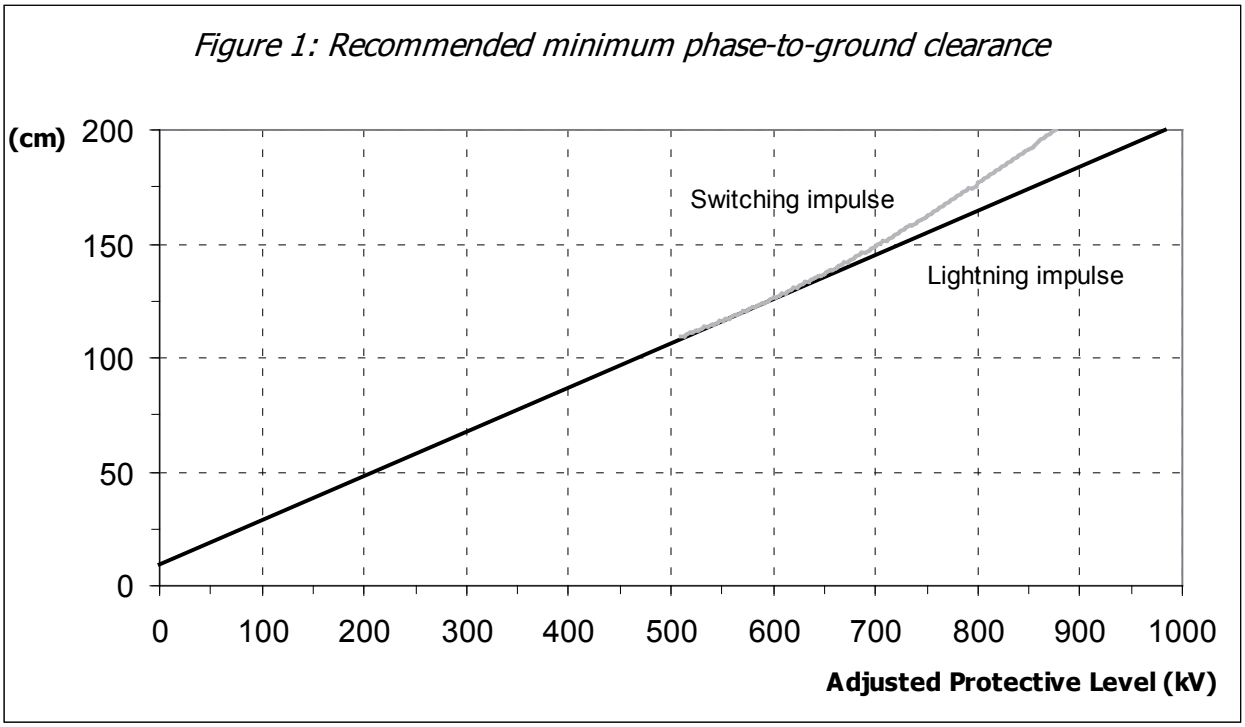
- *For lightning impulse:*
  $L_{pl} \times 1.15 \times e^{H/8150}$
- *For switching impulse:*
  $S_{pl} \times 1.10 \times e^{H/8150}$

H is the altitude in meters above sea level.

L_{pl} and S_{pl} are the lightning and switching impulse protective levels for the selected POLIM-S Surge Arresters at the respective coordinating currents.

The minimum clearance is determined either by lightning or switching impulse withstand, whichever renders a larger value.

Figure 1: Recommended minimum phase-to-ground clearance



Phase-to-phase clearance

The phase-to-phase clearance for high voltage equipment in a substation is normally based on the selected standard rated lightning and switching impulse phase-to-phase withstand voltages. International standards, e.g. IEC 60071-3 recommend minimum phase-to-phase clearances. Note that the normal election of surge arrester protective levels does not directly protect the phase-to-phase insulation.

In general, the clearance between surge arresters in adjacent phases should be the same as the phase-to-phase clearance selected for other high voltage equipment in the substation. If it is not possible to use the normal phase-to-phase clearance in a special application of POLIM-S Surge Arresters, the minimum clearance with regard to lightning overvoltages can be derived from Figure 2.

The clearances shown in Figure 2 are based on the assumption that one phase is subjected to a lightning overvoltage, while the voltage on the adjacent phase is at the peak of the maximum power frequency operating voltage (opposite polarity). Obviously, these clearances will also cover the case of lightning overvoltages of the same polarity appearing simultaneously on two or three phases.

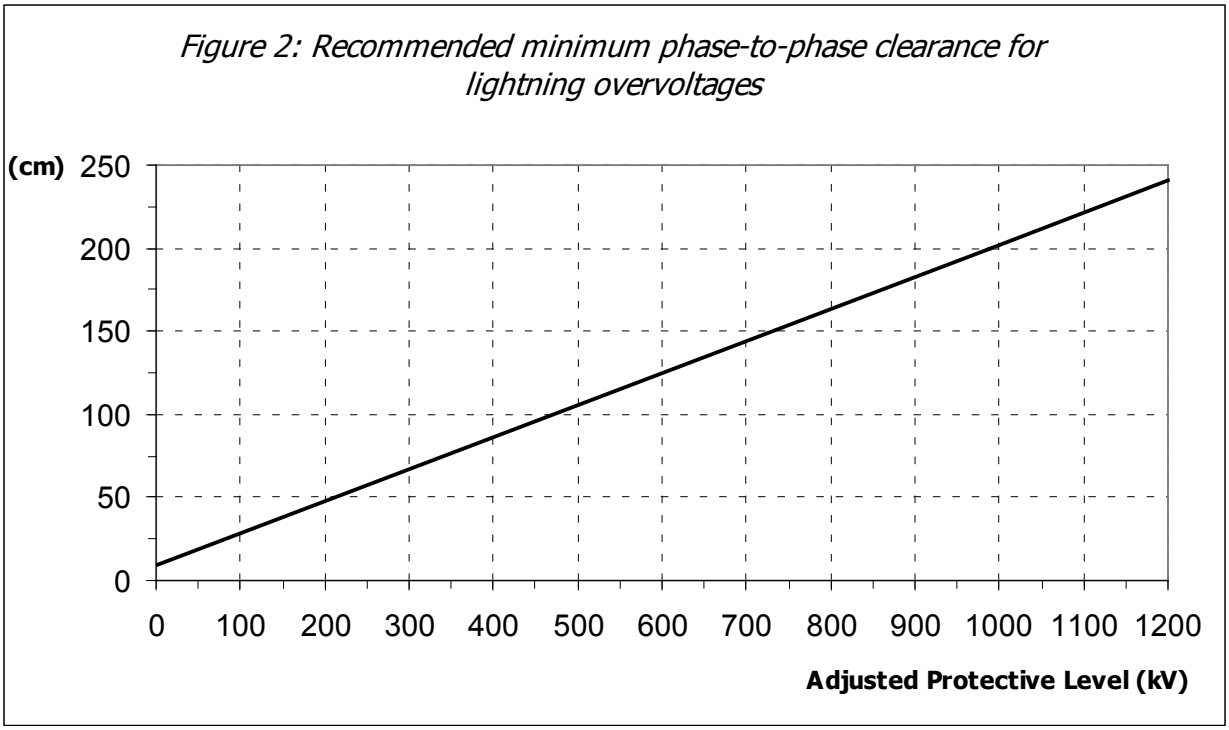
The *Adjusted Protective Level* shown in Figure 2 is based on the lightning protective characteristics of the selected POLIM-S Surge Arresters. It includes safety margin and altitude correction factors and is defined as:

$L_{pl} \times 1.15 \times e^{H/8150} + V_m \times \sqrt{2} / \sqrt{3}$

- V_m is the highest voltage for equipment according to IEC 60071-1, which is usually equal to the highest system voltage.
- L_{pl} is the lightning impulse protective level for the selected POLIM-S Surge Arrester.

The minimum phase-to-phase clearance for arresters with respect to switching overvoltages should always be based on the selected standard rated switching impulse phase-to-phase withstand voltage for the substation. Consequently, the clearances specified in IEC 60071-3, Table VI, are valid for most applications of arresters. If a special application requires a minimized phase spacing, the favorable electrode configuration established by the grading rings on POLIM-S Surge Arresters may permit a further reduction of the phase-to-phase clearance.

Figure 2: Recommended minimum phase-to-phase clearance for lightning overvoltages



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Document Number: 2GNM110006 / April 2013

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