



Type EXLIM-Q Surge Arresters  
Maximum System Voltage 2.52 to 245 kV

# EXLIM-Q Metal Oxide Gapless Surge Arresters

EXLIM-Q Surge Arresters are used for the protection of switchgear, transformers and other equipment in high voltage systems against atmospheric and switching overvoltages. For use when requirements of lightning intensity and energy capability are moderate.

## Application

The EXLIM-Q Surge Arrester has been verified to meet Station Class requirements of IEEE C62.11 (IEEE Standard for Metal-Oxide Surge Arresters for AC Power Circuits) and Line Discharge Class 3 requirements of IEC 60099-4 (IEC Standard for Metal-Oxide Surge Arresters without gaps for AC Systems). The EXLIM-Q Surge Arrester is designed to meet the following performance data:

## Performance data

Standard porcelain color	ANSI grey <i>Brown available upon request</i>
Maximum system voltage ( $V_m$ )	2.52 to 245 kV <sub>rms</sub>
Duty cycle rated voltage ( $V_r$ )	3 to 228 kV <sub>rms</sub>
Classifying current	
IEEE	10 kA <sub>peak</sub>
IEC	10 kA <sub>peak</sub>
Discharge current withstand strength	
High current 4 / 10 us	100 kA <sub>peak</sub>
Low current 2000 us	900 A <sub>peak</sub>
Energy capability	
2 impulses (IEC Cl 7.5.5)*	9.8 kJ/kV of MCOV
<i>Fullfills requirements of IEEE transmission-line discharge test for 24 kV systems</i>	
Short-circuit / pressure relief capability	65 kA <sub>rms sym</sub>
Mechanical Strength <sup>1</sup>	
Permissible static service load (PSSL)	2212 ft-lbs / 3000 Nm
Maximum permissible dynamic service load (MPDSL)	5531 ft-lbs / 7500 Nm
Service conditions	
Ambient temperature	-50 °C to +45 °C
Design altitude <sup>2,3</sup>	6000 ft / 1830 m
Frequency	15 to 62 Hz

Type tested to the following standards:

IEEE standard C62.11

IEC standard 60099-4 Ed 2.1

## Notes:

1 Higher strength designs available on request

2 Unless otherwise noted

3 Higher altitude designs available on request

## Benefit

### Robust design

The EXLIM Surge Arrester is based on a design with over 70 years of field experience, first as a gapped SiC arrester, in climates and conditions all over the world. EXLIM arresters live up to their name: EXcellent voltage LIMiters. The design is robust and well-matched with other apparatus in substations. Each arrester is built up of one or more units. Each unit is made up of a porcelain housing that contains a single column of metal oxide varistors. Each metal oxide varistor is manufactured by ABB where the design is verified routinely through rigorous testing to ensure superior quality. The metal oxide varistors are dispersed throughout the porcelain housing with the necessary spacers as determined by the electrical design of the arrester.

Aluminum flanges that house the hermetic sealing system and compress the metal oxide varistor stack are cemented to the ends of the porcelain housing. The sealing arrangement in each flange consists of a prestressed stainless steel plate with a rubber gasket. In the event that the arrester is stressed in excess of its design capability, the internal pressure causes the sealing plate to deflect open, allowing the ionized gases to flow out through the venting ducts. The seal is verified on every arrester prior to routine testing.

Each arrester is furnished with a mounting base, 4-hole NEMA line pad, and line and ground terminals for electrical connections.

### Nameplates

Standard (Stainless steel)

<b>ABB</b> EXLIM SURGE ARRESTER		MADE IN USA
STYLE NO.	RATING * kV	
SERIAL NO.	MCOV * kV	
IEEE/IEC CLASS	STATION / 3	PRESS. RELIEF CLASS 65 kA
DATE	WT	GRADING RING

Master nameplate (SSTL)

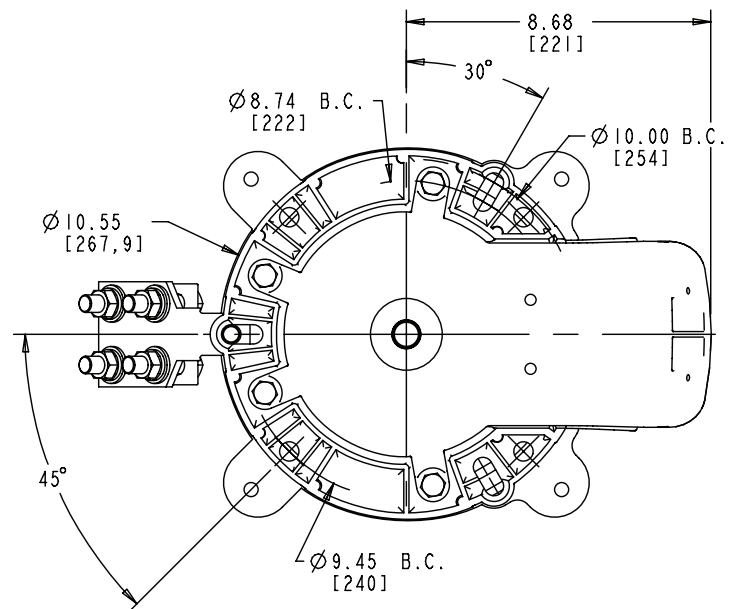
<b>ABB</b> EXLIM SURGE ARRESTER		MADE IN USA
UNIT STACKING ORDER		
BOT	STYLE NO.	SERIAL NO. MCOV kV
2ND		kV
3RD		kV

Unit stacking order nameplate (SSTL)

<b>ABB</b> EXLIM SURGE ARRESTER		MADE IN USA
UNIT INFORMATION		
UNIT STYLE NO.		
UNIT SERIAL NO.		
UNIT MCOV		kV

Unit nameplate (SSTL)

### Drilling plan



Alternate bolt hole patterns available upon request.

# Quick selection guide

	System Voltage		Surge Arrester ANSI/IEEE Ratings			
	Maximum $V_m$ (kV <sub>rms</sub> )	Nominal		Three-Wire $V_r / V_{MCOV}$ (kV <sub>rms</sub> )	Four-Wire Grounded $V_r / V_{MCOV}$ (kV <sub>rms</sub> )	Four-Wire Grounded High Impedance $V_r / V_{MCOV}$ (kV <sub>rms</sub> )
		Three-Wire $V_n$ (kV <sub>rms</sub> )	Four-Wire $V_n$ (kV <sub>rms</sub> )			
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						
High Voltage	48.30			48 / 39		
	72.50			60 / 48		
	123			108 / 84		
	145			120 / 98		
	170			144 / 115		
	245			192 / 152		

## 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 <sub>rms</sub> )
	1000 A    144-228 $V_r$ (kV <sub>rms</sub> )
LPL	Lightning Protective Level
FOW	Front of Wave

# Guaranteed performance data

Electrical characteristics											
Ratings (kV <sub>rms</sub> )		TOV (kV <sub>rms</sub> )		Maximum residual voltage with current wave, (kV <sub>peak</sub> )							
Voltage V <sub>r</sub>	MCOV V <sub>MCOV</sub>	with prior energy single impulse of 5.6 kJ/kV <sub>MCOV</sub>		SPL (SIPL) 30/60 μs	LPL (LIPL) 8/20 μs					FOW 0.5 μs 10 kA	
		1 sec	10 sec		1.5 kA	3 kA	5 kA	10 kA	20 kA		40 kA
3.0	2.55	5.15	4.93	9.77	10.5	10.9	11.2	11.3	12.9	14.4	12.8
4.0	3.40	5.15	4.93	10.0	10.8	11.2	11.5	11.6	13.3	14.8	13.1
5.0	4.25	6.87	6.57	12.3	13.2	13.7	14.2	14.4	16.3	18.2	16.1
6.0	5.10	6.87	6.57	12.8	13.8	14.3	14.8	15.0	17.0	19.0	16.8
7.0	5.95	10.3	9.86	17.7	19.1	19.8	20.5	21.0	23.6	26.3	23.3
8.0	6.80	10.3	9.86	18.5	20.0	20.7	21.4	22.0	24.7	27.6	24.4
9.0	7.65	10.3	9.86	19.0	20.5	21.3	22.0	22.6	25.4	28.3	25.0
10	8.40	11.5	11.0	21.0	22.6	23.5	24.3	25.0	28.0	31.3	27.6
12	10.2	13.7	13.1	25.1	27.1	28.1	29.0	30.0	33.5	37.4	33.1
15	12.7	17.2	16.4	31.3	33.7	35.0	36.1	37.5	41.8	46.6	41.2
18	15.3	20.6	19.7	37.4	40.3	41.9	43.3	45.0	50.0	55.9	49.3
21	17.0	24.0	23.0	41.8	45.1	46.9	48.4	50.4	55.9	62.5	55.2
24	19.5	27.5	26.3	47.7	51.5	53.5	55.2	57.6	63.9	71.3	63.0
27	22.0	30.9	29.6	53.6	57.8	60.1	62.1	64.8	71.8	80.2	70.8
30	24.4	34.4	32.9	59.5	64.2	66.7	68.9	72.0	79.7	89.1	78.6
33	27.0	37.8	36.1	65.4	70.6	73.4	75.7	79.2	87.6	97.9	86.4
36	29.0	41.2	39.4	71.3	77.0	80.0	82.6	86.4	95.5	107	94.2
39	31.5	44.7	42.7	77.3	83.3	86.6	89.4	93.6	103	116	102
42	34.0	48.1	46.0	83.3	89.9	93.4	96.5	101	112	125	110
45	36.5	51.5	49.3	89.1	96.1	99.9	103	108	119	133	118
48	39	55.0	52.6	95.6	103	107	111	116	128	143	126
54	42	61.8	59.1	107	116	120	124	130	144	160	142
60	48	68.7	65.7	119	128	133	137	144	159	178	157
66	53	75.6	72.3	131	141	147	152	159	175	196	173
72	57	82.4	78.8	142	154	160	165	173	191	213	188
78	63	89.3	85.4	155	167	173	179	188	207	232	204
84	68	96.2	92.0	166	179	186	192	202	223	249	220
90	70	103	98.6	178	192	199	206	216	238	266	235
94	73	108	103	186	201	208	215	226	249	278	246
96	76	110	105	190	205	213	220	231	255	285	251
102	82	117	112	201	217	226	233	245	270	302	266
108	84	124	118	214	231	240	248	260	287	320	283
108	88	124	118	214	231	240	248	260	287	320	283
114	92	131	125	225	243	253	261	274	302	338	298
120	98	137	131	237	255	265	274	288	317	355	313
126	102	144	138	249	269	279	288	303	334	373	329
132	106	151	145	260	281	292	302	317	349	390	344
138	111	158	151	273	294	306	316	332	366	409	361
144	115	165	158	284	307	319	329	346	381	426	376
150	121	172	164	296	319	332	343	360	397	443	391
162	131	185	177	319	345	358	370	389	428	479	423
168	134	192	184	332	358	372	384	404	445	497	439
172	140	197	188	339	366	380	393	413	455	508	449
180	144	206	197	355	383	398	411	432	476	532	469
192	152	220	210	379	408	425	438	461	508	568	501
198	160	227	217	391	422	438	453	476	524	586	517
210	170	240	230	414	447	464	479	504	555	620	547
216	173	247	237	426	460	478	494	519	571	639	564
222	179	254	243	438	472	491	507	533	587	656	579

# Style numbers and technical data for housings

## Vertical mounting styles with standard creepage distance

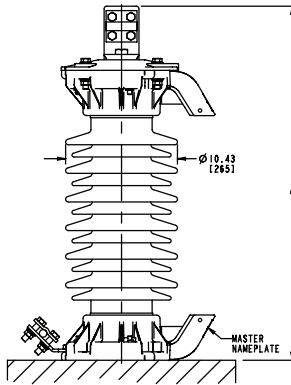
Surge Arrester IEEE Ratings $V_r / V_{MOV}$ (kV)	Style Number	Creepage Distance inches (mm)	Strike Distance inches (mm)	BIL 1.2/50 $\mu$ s dry $kV_{peak}$	Weight (Mass) lbs (kg)	A inches (mm)	B inches (mm)	C inches (mm)	D inches (mm)	Fig
3.0 / 2.55	Q003NA002A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
4.0 / 3.40	Q004NA003A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
5.0 / 4.25	Q005NA004A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
6.0 / 5.10	Q006NA005A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
7.0 / 5.95	Q007NA006A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
8.0 / 6.80	Q008NA007A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
9.0 / 7.65	Q009NA008A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
10 / 8.40	Q010NA008A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
12 / 10.2	Q012NA010A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
15 / 12.7	Q015NA012A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
18 / 15.3	Q018NA015A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
21 / 17.0	Q021NA017A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
24 / 19.5	Q024NA019A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
27 / 22.0	Q027NA022A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
30 / 24.4	Q030NA024A	33.0 (839)	10.63 (270)		77 (35)	25.04 (636)				1
33 / 27.0	Q033NA027A	63.6 (1615)	18.62 (473)	275	106 (48)	33.03 (839)				1
36 / 29.0	Q036NA029A	63.6 (1615)	18.62 (473)	275	106 (48)	33.03 (839)				1
39 / 31.5	Q039NA031A	63.6 (1615)	18.62 (473)	275	106 (48)	33.03 (839)				1
42 / 34.0	Q042NA034A	63.6 (1615)	18.62 (473)	275	106 (48)	33.03 (839)				1
45 / 36.5	Q045NA037A	63.6 (1615)	18.62 (473)	275	106 (48)	33.03 (839)				1
48 / 39.0	Q048NA039A	63.6 (1615)	18.62 (473)	275	106 (48)	33.03 (839)				1
54 / 42.0	Q054NA042A	63.6 (1615)	18.62 (473)	275	106 (48)	33.03 (839)				1
60 / 48.0	Q060NA048A	63.6 (1615)	18.62 (473)	275	106 (48)	33.03 (839)				1
66 / 53.0	Q066NA053A	104.4 (2651)	29.33 (745)	394	148 (67)	43.74 (1111)				1
72 / 57.0	Q072NA057A	104.4 (2651)	29.33 (745)	394	148 (67)	43.74 (1111)				1
78 / 63.0	Q078NA063A	104.4 (2651)	29.33 (745)	394	148 (67)	43.74 (1111)				1
84 / 68.0	Q084NA068A	104.4 (2651)	29.33 (745)	394	148 (67)	43.74 (1111)				1
90 / 70.0	Q090NA070A	104.4 (2651)	29.33 (745)	394	148 (67)	43.74 (1111)				1
94 / 73.0	Q094NA073A	104.4 (2651)	29.33 (745)	394	148 (67)	43.74 (1111)				1
96 / 76.0	Q096NA076A	104.4 (2651)	29.33 (745)	394	148 (67)	43.74 (1111)				1
102 / 82.0	Q102NA082A	104.4 (2651)	29.33 (745)	394	148 (67)	43.74 (1111)				1
108 / 84.0	Q108NA084A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
108 / 88.0	Q108NA088A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
114 / 92.0	Q114NA092A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
120 / 98.0	Q120NA098A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
126 / 102	Q126NA102A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
132 / 106	Q132NA106A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
138 / 111	Q138NA111A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
144 / 115	Q144NA115A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
150 / 121	Q150NA121A	168.0 (4266)	47.95 (1218)	669	249 (113)	70.79 (1798)				2
162 / 131	Q162NA131A	168.0 (4266)	47.95 (1218)	669	249 (113)	70.79 (1798)				2
168 / 134	Q168NA134A	208.7 (5302)	58.66 (1490)	788	283 (128)	81.50 (2070)				2
172 / 140	Q172NA140A	208.7 (5302)	58.66 (1490)	788	283 (128)	81.50 (2070)				2
180 / 144	Q180NA144A	208.6 (5300)	51.03 (1296)	843	300 (136)	81.46 (2069)	23.62 (600)		11.81 (300)	3
192 / 152	Q192NA152A	249.4 (6336)	57.80 (1468)	962	333 (151)	92.17 (2341)	31.50 (800)		15.75 (400)	3
198 / 160	Q198NA160A	249.4 (6336)	57.80 (1468)	962	333 (151)	92.17 (2341)	31.50 (800)		15.75 (400)	3
210 / 170	Q210NA170A	249.4 (6336)	61.74 (1568)	962	333 (151)	92.17 (2341)	23.62 (600)		11.81 (300)	3
216 / 173	Q216NA173A	249.4 (6336)	61.74 (1568)	962	333 (151)	92.17 (2341)	23.62 (600)		11.81 (300)	3
222 / 179	Q222NA179A	290.2 (7370)	72.41 (1839)	1136	393 (178)	102.83 (2612)	23.62 (600)		11.81 (300)	3
228 / 180	Q228NA180A	290.2 (7370)	72.41 (1839)	1136	393 (178)	102.83 (2612)	23.62 (600)		11.81 (300)	3

Vertical mounting styles with extra creepage distance

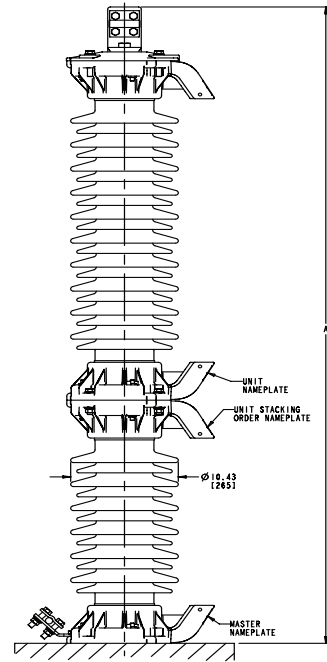
Surge Arrester IEEE Ratings $V_r / V_{MCOV}$ (kV)	Style Number	Creepage Distance inches (mm)	Strike Distance inches (mm)	BIL 1.2/50 $\mu$ s dry $kV_{peak}$	Weight (Mass) lbs (kg)	A inches (mm)	B inches (mm)	C inches (mm)	D inches (mm)	Fig
24 / 19.5	Q024NB019A	63.6 (1615)	18.62 (473)	275	106 (48)	33.03 (839)				1
27 / 22.0	Q027NB022A	63.6 (1615)	18.62 (473)	275	106 (48)	33.03 (839)				1
30 / 24.4	Q030NB024A	63.6 (1615)	18.62 (473)	275	106 (48)	33.03 (839)				1
54 / 42.0	Q054NB042A	104.4 (2651)	29.33 (745)	394	148 (67)	43.74 (1111)				1
60 / 48.0	Q060NB048A	104.4 (2651)	29.33 (745)	394	148 (67)	43.74 (1111)				1
90 / 70.0	Q090NB070A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
90 / 70.0	Q090NC070A	168.0 (4266)	40.36 (1025)	669	234 (106)	70.79 (1798)	23.62 (600)		11.81 (300)	3
94 / 73.0	Q094NB073A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
94 / 73.0	Q094NC073A	168.0 (4266)	40.36 (1025)	669	234 (106)	70.79 (1798)	23.62 (600)		11.81 (300)	3
96 / 76.0	Q096NB076A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
96 / 76.0	Q096NC076A	168.0 (4266)	40.36 (1025)	669	234 (106)	70.79 (1798)	23.62 (600)		11.81 (300)	3
102 / 82.0	Q102NB082A	145.1 (3685)	40.00 (1016)	568	194 (88)	54.41 (1382)				1
102 / 82.0	Q102NC082A	168.0 (4266)	40.36 (1025)	669	234 (106)	70.79 (1798)	23.62 (600)		11.81 (300)	3
108 / 84.0	Q108NB084A	208.7 (5302)	51.06 (1297)	788	273 (124)	81.50 (2070)	23.62 (600)		11.81 (300)	3
108 / 88.0	Q108NB088A	208.7 (5302)	51.06 (1297)	788	273 (124)	81.50 (2070)	23.62 (600)		11.81 (300)	3
114 / 92.0	Q114NB092A	208.7 (5302)	51.06 (1297)	788	273 (124)	81.50 (2070)	23.62 (600)		11.81 (300)	3
120 / 98.0	Q120NB098A	208.7 (5302)	51.06 (1297)	788	273 (124)	81.50 (2070)	23.62 (600)		11.81 (300)	3
126 / 102	Q126NB102A	208.7 (5302)	51.06 (1297)	788	273 (124)	81.50 (2070)	23.62 (600)		11.81 (300)	3
126 / 102	Q126NB102B	178.1 (4524)	43.47 (1104)		271 (123)	73.47 (1866)	23.62 (600)		11.81 (300)	3
126 / 102	Q126NC102B	353.8 (8987)	91.07 (2313)	1356	493 (224)	129.93 (3300)	23.62 (600)		11.81 (300)	4
132 / 106	Q132NB106A	178.1 (4524)	43.47 (1104)		271 (123)	73.47 (1866)	23.62 (600)		11.81 (300)	3
132 / 106	Q132NC106A	208.7 (5302)	51.06 (1297)	788	273 (124)	81.50 (2070)	23.62 (600)		11.81 (300)	3
138 / 111	Q138NB111A	178.1 (4524)	43.47 (1104)		271 (123)	73.47 (1866)	23.62 (600)		11.81 (300)	3
138 / 111	Q138NC111A	208.7 (5302)	51.06 (1297)	788	273 (124)	81.50 (2070)	23.62 (600)		11.81 (300)	3
144 / 115	Q144NB115A	178.1 (4524)	50.63 (1286)		267 (121)	73.47 (1866)				2
144 / 115	Q144NC115A	208.7 (5302)	51.06 (1297)	788	273 (124)	81.50 (2070)	23.62 (600)		11.81 (300)	3
150 / 121	Q150NB121A	208.7 (5302)	58.66 (1490)	798	283 (128)	81.50 (2070)				2
162 / 131	Q162NB131A	208.7 (5302)	58.66 (1490)	798	283 (128)	81.50 (2070)				2
180 / 144	Q180NB144A	249.4 (6336)	57.80 (1468)	962	333 (151)	92.17 (2341)	31.50 (800)		15.75 (400)	3
180 / 144	Q180NC144A	313.0 (7951)	64.61 (1641)	1237	456 (207)	119.22 (3028)	55.12 (1400)	39.37 (1000)	27.56 (700)	4
192 / 152	Q192NB152A	313.0 (7951)	64.61 (1641)	1237	456 (207)	119.22 (3028)	55.12 (1400)	39.37 (1000)	27.56 (700)	4
198 / 160	Q198NB160A	313.0 (7951)	64.61 (1641)	1237	456 (207)	119.22 (3028)	55.12 (1400)	39.37 (1000)	27.56 (700)	4
210 / 170	Q210NB170A	353.8 (8987)	75.32 (1913)	1356	498 (226)	129.93 (3300)	55.12 (1400)	39.37 (1000)	27.56 (700)	4
216 / 173	Q216NB173A	353.8 (8987)	75.32 (1913)	1356	498 (226)	129.93 (3300)	55.12 (1400)	39.37 (1000)	27.56 (700)	4
222 / 179	Q222NB179A	353.8 (8987)	75.32 (1913)	1356	498 (226)	129.93 (3300)	55.12 (1400)	39.37 (1000)	27.56 (700)	4
228 / 180	Q228NB180A	353.8 (8987)	75.32 (1913)	1356	498 (226)	129.93 (3300)	55.12 (1400)	39.37 (1000)	27.56 (700)	4

# Figures

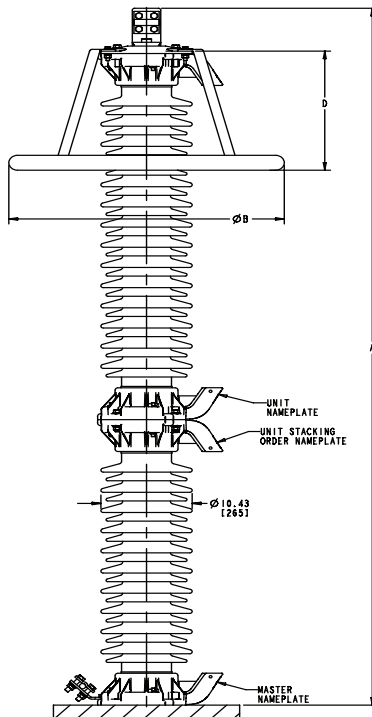
1 Single housing



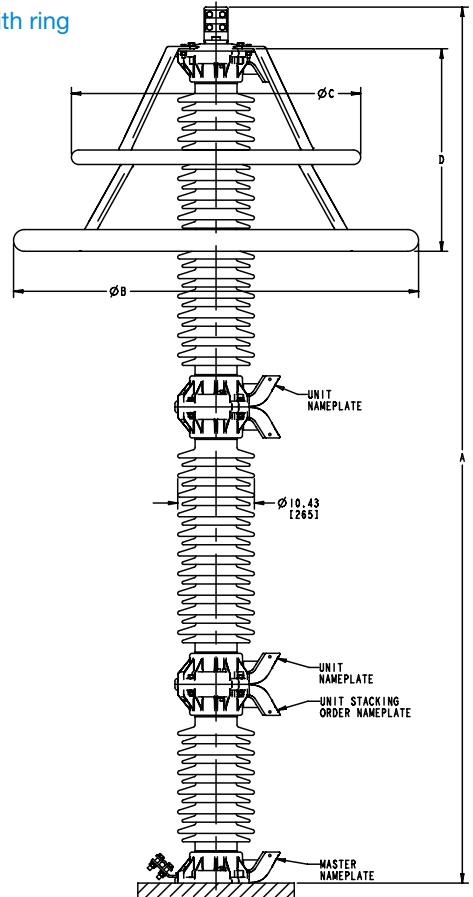
2 Double housing



3 Double housing with ring



4 Triple housing with ring



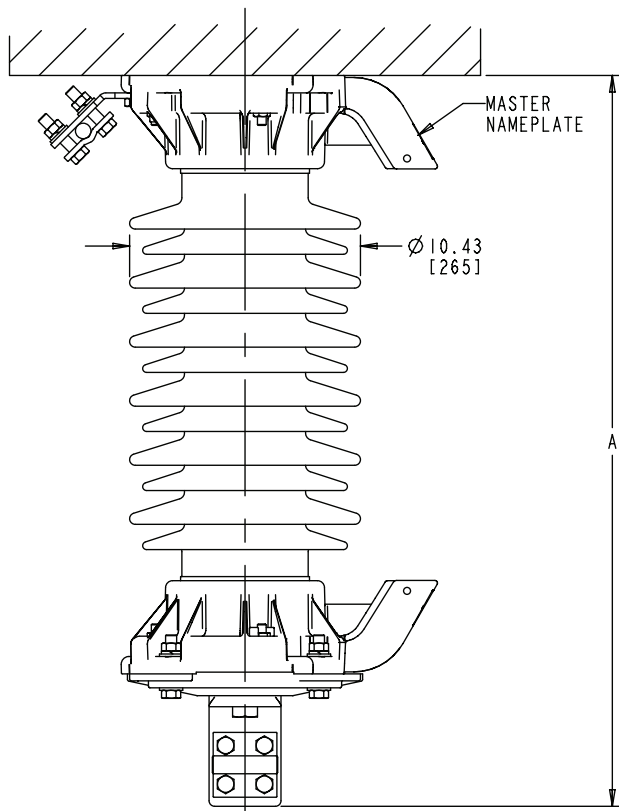
# Optional mountings

## Under-hung mounted styles

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

(Example: 15 kV Q015NA012AUH)

### Single housing under-hung

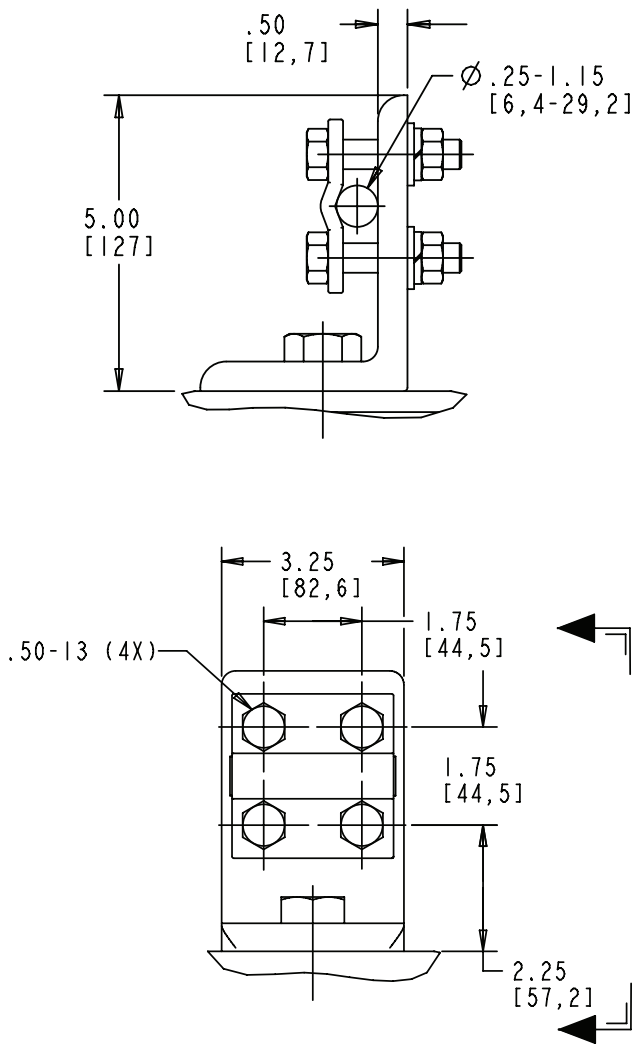


Multi-rated arresters available upon request.

# Standard hardware

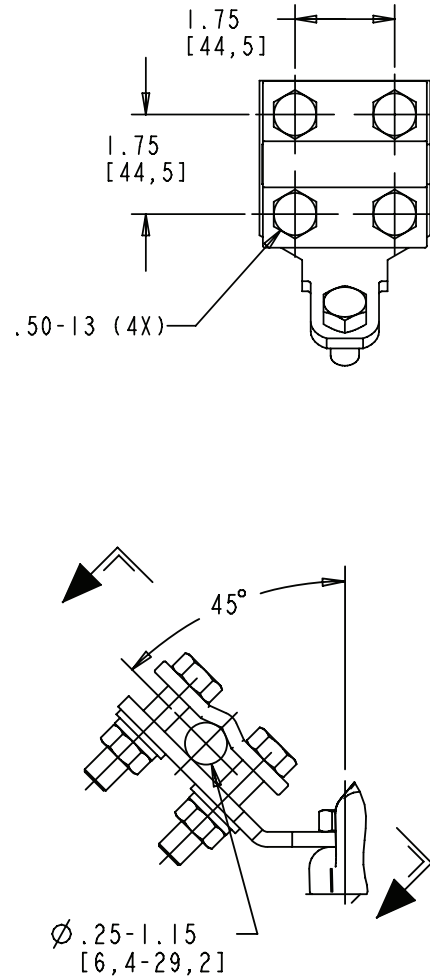
## Line terminal

Aluminum / galvanized steel



## Ground terminal

Galvanized steel



**Note:** Line and ground terminals can accommodate copper or aluminum cable size Number 2 to 1000 MCM / 0.25 to 1.15 in. 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 EXLIM-Q 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 EXLIM-Q 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:

$$L_{pl} \times 1.15 \times e^{H/8150}$$

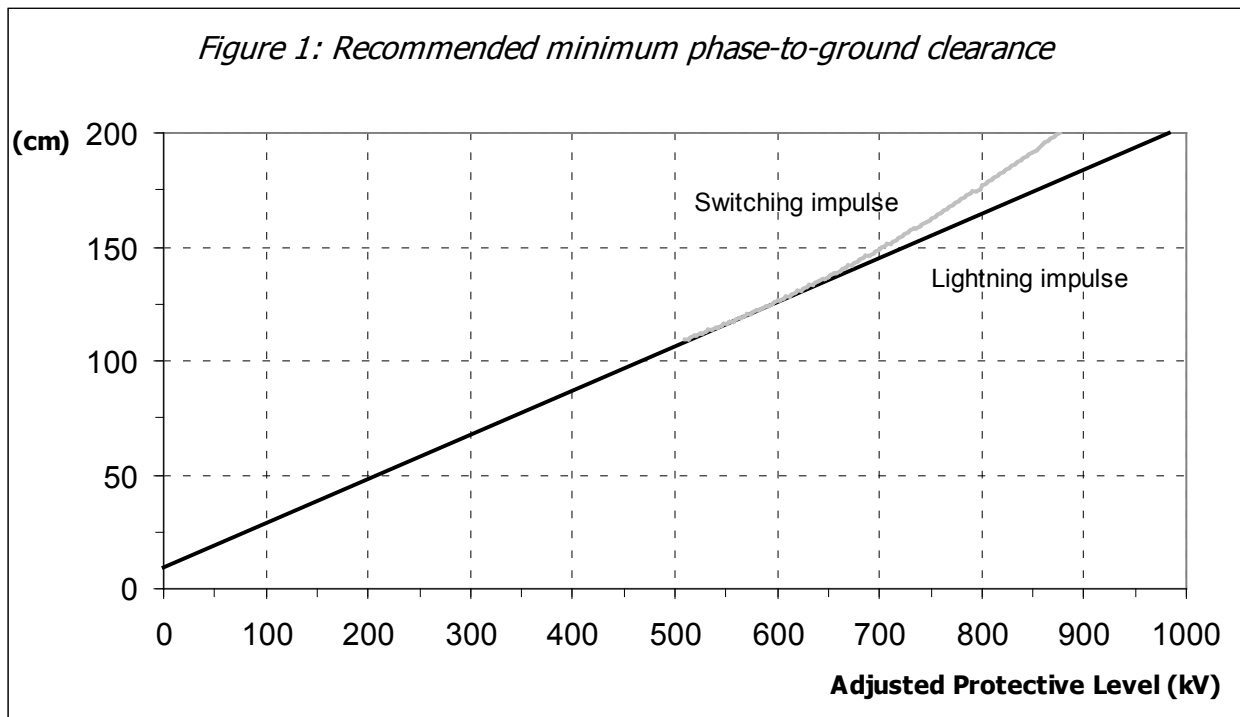
- For switching impulse:

$$S_{pl} \times 1.10 \times e^{H/8150}$$

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 EXLIM-Q Surge Arresters at the respective coordinating currents.

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



# 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 EXLIM-Q Surge Arresters, the minimum clearance with regard to lightning overvoltages can be derived from Figure 2.

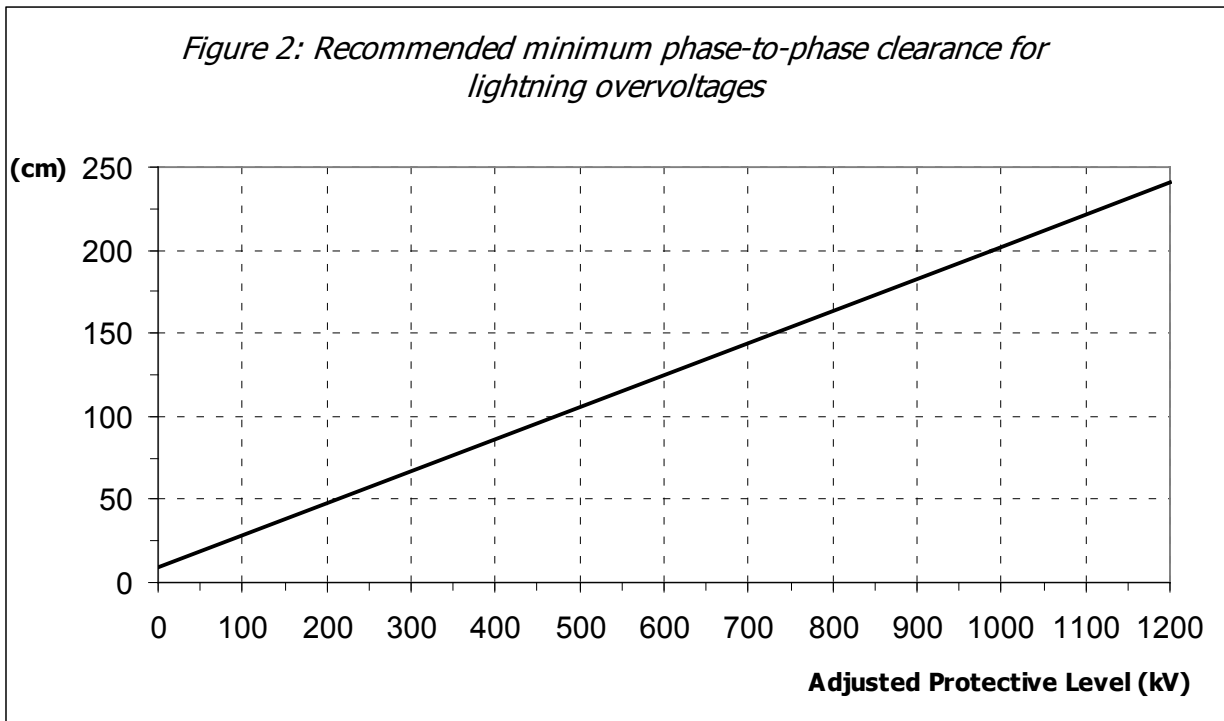
The clearances shown in Figure 2 are based on the assumption that one phase is subjected to a lightning overvoltage, while the voltage on the adjacent phase is at the peak of the maximum power frequency operating voltage (opposite polarity). Obviously, these clearances will also cover the case of lightning 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 EXLIM-Q 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 EXLIM-Q 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 EXLIM-Q Surge Arresters may permit a further reduction of the phase-to-phase clearance.



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