Catalog 35

Protecta*Lite®

Non-gapped Line Arresters
Externally-gapped Line Arresters

Put Protecta*Lite On, Or It's Lights Out.

Warranty

Warranty – Material

HPS warrants to Buyer that the products sold will be free of defects in workmanship or material for a period of one (1) year (or as otherwise specified) from the date of original shipment by HPS when stored, installed, operated or maintained in accordance with recommendations of HPS and standard industry practice and when used under proper and normal use. HPS shall in no event be responsible or liable for modifications, alterations, misapplication or repairs made to its products by Buyer or others, or for damage caused thereto by negligence, accident or improper use by Buyer or others. This warranty does not include reimbursement for the expenses of labor, transportation, removal or reinstallation of the products. This warranty shall run only to the first Buyer of a product from HPS, from HPS' Buyer, or from an original equipment manufacturer reselling HPS' product, and is non-assignable and non-transferable and shall be of no force and effect if asserted by any person other than such first Buyer. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER WRITTEN, ORAL, EXPRESSED OR IMPLIED. THERE ARE NO WARRANTIES OF MERCHANTABILITY OR FITNESS OF ANY PRODUCT FOR A PARTICULAR PURPOSE.

Warranty – Application

HPS does not warrant the accuracy of and results from product or system performance recommendations resulting from any engineering analysis or study. This applies regardless of whether a charge is made for the recommendation, or if it is provided free of charge. Responsibility for selection of the proper product of application rests solely with the Buyer. In the event of errors or inaccuracies determined to be caused by HPS, its liability will be limited to the re- performance of any such analysis or study.

BUYER INSPECTIONS

Tests, inspections and acceptance of all material must be made at the factory. Buyer's inspectors are welcome at the factories and are provided with the necessary facilities for carrying out their work. Name and phone number of who should be contacted for inspection should be given to HPS no later than two weeks prior to scheduled shipment date.

LIMITATION OF LIABILITY

IN NO EVENT AND UNDER NO CIRCUMSTANCES SHALL HPS BE LIABILE TO BUYER OR TO ANY OTHER PERSON FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL OR INCIDENTAL LOSSES OR DAMAGES, INCLUDING, WITHOUT LIMITATION, DAMAGE TO OR LOSS OF USE OF ANY PRODUCT, LOST SALES, OR PROFITS, OR DELAY OR FAILURE TO PERFORM THIS WARRANTY OBLIGATION, OR CLAIMS OF THIRD PARTIES AGAINST PURCHASER, ARISING OUT OF OR IN CONNECTION WITH THE SALE, INSTALLATION, USE OF, INABILITY TO USE, OR THE REPAIR OR REPLACEMENT OF, HPS' PRODUCTS. As stated herein, the term "person" shall include without limitation, any individual proprietorship, partnership, corporation or entity.

EXCLUSIVE REMEDY

Any claim by Buyer that a product is defective or non-conforming shall be deemed waived by Buyer unless submitted to HPS in writing within thirty (30) days from the date Buyer discovered, or by reasonable inspection should have discovered the alleged defect or non-conformity. Any warranty claim must be brought within one year of discovery of the alleged defect or non-conformity. Upon prompt written notice by the Buyer that a product is defective or non-conforming, HPS' liability shall be limited to repairing or replacing the product, at HPS' option.

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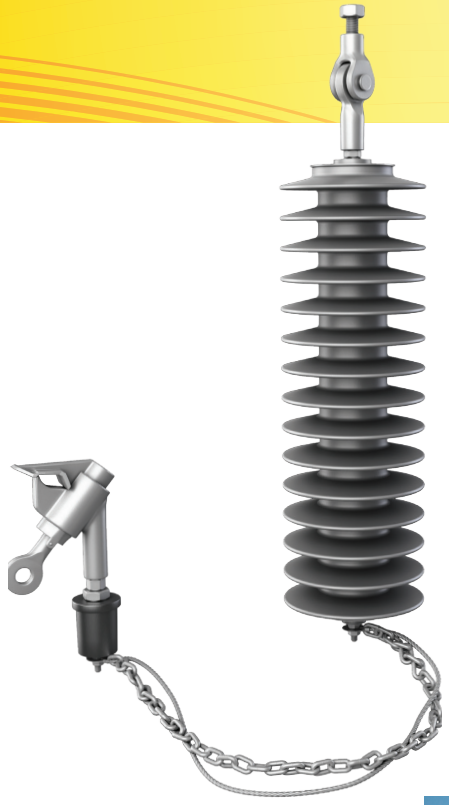
NOTE: Because Hubbell Power Systems Inc., has a policy of continuous product improvement, we reserve the right to change design and specifications without notice.

Protecta*Lite®

INSIDE.....PAGE

reliability

Hubbell Arresters



Only Protecta*Lite® Systems from Hubbell Power Systems (HPS) combines the reliability of the industry's leading arrester with the effectiveness of the leading insulator.

This proprietary pairing of a Hubbell arrester and Hubbell insulator represents the culmination of nearly a century of HPS high-voltage product experience and innovation. It also represents the HPS tradition of research, testing and development, which has created the industry's most recognized and reliable brands – such as Ohio Brass.

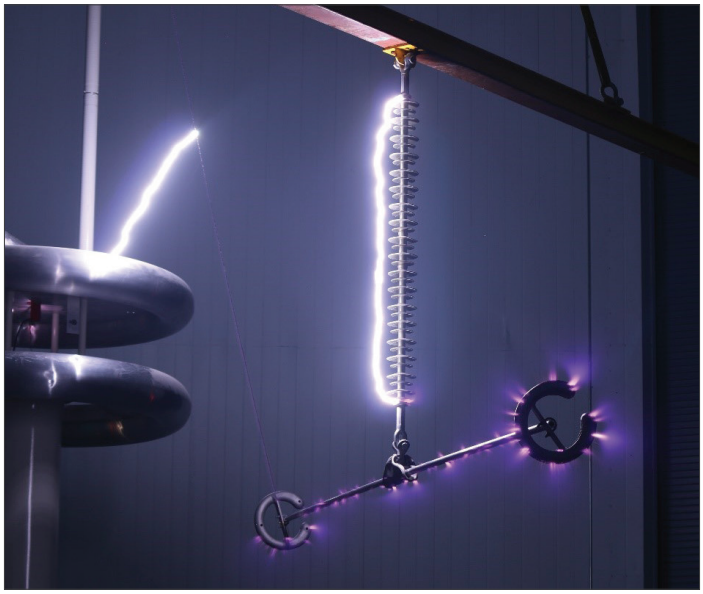
Over the past 32 years, Hubbell has put more than a half-million Protecta*Lite systems to work, protecting lines around the world from lightning flashover.

Keep the power on.
With Protecta*Lite.

solutions

What is Protecta*Lite®?

Protecta*Lite is an arrester specifically designed and configured to prevent lightning from flashing over line insulation. There is no better way to enhance the reliability of your grid during electrical storms.



Protecta*Lite is a line surge arrester (LSA) which is engineered for each application. Hubbell's product family includes non-gapped (NGLA) and externally gapped (EGLA) line arresters. The NGLA offering is directly connected and includes a ground lead disconnector, unless otherwise specified. Mounting hardware, line and ground connections and even insulators can be included depending on the needs of each application.

The EGLA product is a custom designed arrester solution that improves performance and reduces maintenance. It is also equipped with necessary hardware and insulators as needed for your unique installation.

You can use Protecta*Lite to protect your existing insulators or order it factory packaged with HPS Quadri*Sil insulators for new installations. Either way, Protecta*Lite will keep the power flowing during a lightning strike.

History – Hubbell introduced Protecta*Lite® Systems in 1988. The practice of applying polymer line surge arresters was quickly adopted following the introduction of the first MOV polymer housed distribution arrester in 1986 (PDV-100). Since its introduction over 30 years ago, over half a million Protecta*Lite arresters have been installed at varying system voltages around the world. In a continuing effort to lead the industry, Hubbell introduced the EGLA solution in 2022 for improved power grid reliability.

NGLA versus EGLA – Both NGLA and EGLA style arresters offer unique benefits depending on the application needs. An NGLA consists of a varistor unit (VU) which is installed with a disconnecting device. The product is directly connected from line-to-ground without an external gap. An EGLA assembly consists of a series varistor unit (SVU) and an external series gap. The EGLA is mounted electrically in parallel with the insulator assembly. The use of the series gap eliminates the direct line-to-ground connection and the need for a lead or ground lead disconnector. In the event of a lightning strike on a transmission or distribution system the NGLA and EGLA designs will function differently while offering the same high level of protection. An NGLA shunts the resulting current to ground while limiting the resulting voltage. The MOV blocks inside the arrester limit the resulting current and allow the system to continue operating. In contrast the EGLA gap will flashover before the MOV blocks go into conduction. The MOV blocks in turn will limit the follow current and extinguish the external power arc within milliseconds. Both designs limit the resulting voltage on the system while preventing an upstream breaker from operating. Contact your Hubbell representative to learn how your system can benefit from the NGLA or EGLA product offerings.

What is Protecta*Lite®?

How Protecta*Lite Works – Protecta*Lite protects transmission and distribution lines by protecting the air around the insulator from a lightning induced external flashover. The lightning surge is safely diverted to ground in a controlled manner and the resulting voltage is limited to a level below the insulation strength.

Lightning severity is generally assessed by considering the Ground Flash Density (GFD) for a region. The severity for an area varies drastically when considering different locations, such as California versus Florida in the United States. Both the magnitude and frequency of lightning activity is subject to annual changes.

When lightning strikes a transmission line there is a high probability an external flashover of line insulation will occur. This power arc will persist until an over current device operates to clear the arc. If the line is protected with a well-grounded overhead shield wire (OHSW), the lightning surge should be successfully discharged to ground without an external flashover. If the line is protected with a poorly grounded OHSW, backflash may occur on the phases with the lowest coupling factor.

Backflash is generally the cause of interruptions on shielded lines experiencing a large number of trip outs. Backflash is most prevalent in areas where poor grounding exists and thus, lightning induced voltages on structures are highest. The phases with the lowest coupling factors have the highest voltage stress across the insulators during a lightning discharge.

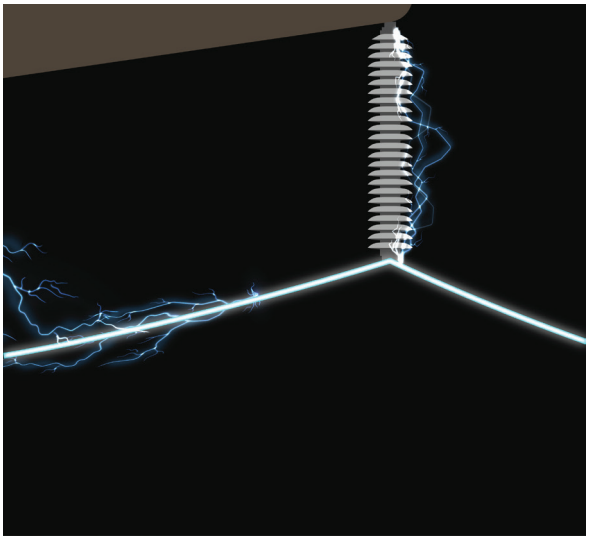
Available for applications ranging from 2.4kV to 765kV, Protecta*Lite protects your line performance, even when faced with adverse wind and ice conditions.

It can even protect unshielded lines.

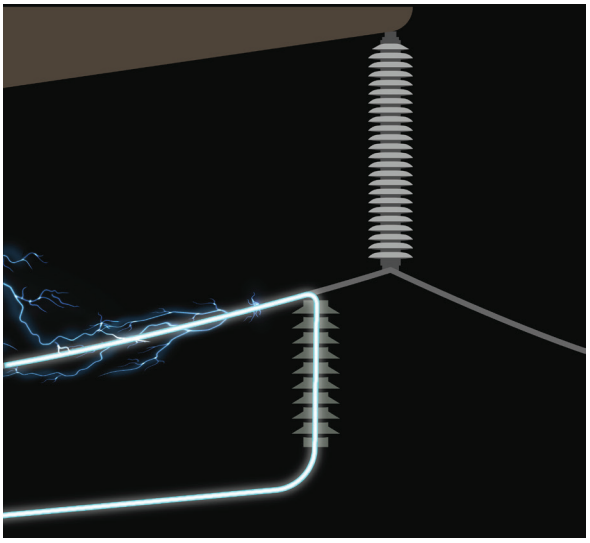
Reliability – The continued advancement of technology and the way society communicates has generated a drastic shift in the demand and expectations for high quality electricity. Everyday consumers now expect an uninterrupted supply of power, even under challenging environmental conditions. The same is true for industrial consumers and high-profile facilities, such as government offices, hospitals and other critical infrastructures. Line surge arresters offer numerous benefits including:

- Improve reliability indexes, such as Momentary Average Interruption Frequency Index (MAIFI)
- Extend the life expectancy of valuable utility assets
- Reduce wear and tear on substation equipment and line insulators
- Reduce construction costs by including Protecta*Lite in the design process
- Reduce minimum approach distance (MAD)
- Increase system voltage ratings by reducing potential overvoltage exposures

What is Protecta*Lite®?



Unprotected line during lightning strike



Line with Protecta*Lite during lightning strike

Cost Benefits – Protecta*Lite protects millions of dollars' worth of system reliability when installed on lines. In the event of a strike, your largest infrastructure investments will remain safe and secure.

When using Protecta*Lite arresters, the system is less expensive to protect compared to improving grounds or adding an overhead shield wire (OHSW), and Protecta*Lite arresters adds to the overall reliability of your power system. By installing Protecta*Lite to improve your system's performance, you can improve your reliability goals.

The cost for constructing a new line varies depending on several factors including line design, altitude, topography and even the number of crews used during line construction. However, the cost can be estimated using commercially available data. A US utility estimated that a new double circuit 69 kV transmission line could cost upwards of $2M per mile. When compared to these estimates, Protecta*Lite is clearly a more economical solution.

Additionally, Protecta*Lite enables you to creatively upgrade lines to higher system voltages without requiring more space and possible pole upgrades. This allows the use of existing right of ways and significantly lowers crew labor.

Ease of Installation – Protect your power lines – and your bottom line – with quick and easy installation. The Protecta*Lite system is lightweight, which reduces line-loading and makes installation easier, all while delivering top performance. Depending on the application a design can be recommended to alleviate application and installation concerns.

What is Protecta*Lite®?

Installation & Usage – Each transmission application is quite unique and requires consideration to develop an appropriate protection scheme. The inclusion or lack of an OHSW in conjunction with the tower footing resistance are two variables which have a large impact on the occurrence of momentary interruptions. As such, the line characteristics will dictate the installation strategy, including both the location and frequency of applying line surge arresters. General guidance on LSA usage can be provided based on prior analysis, research and experience.

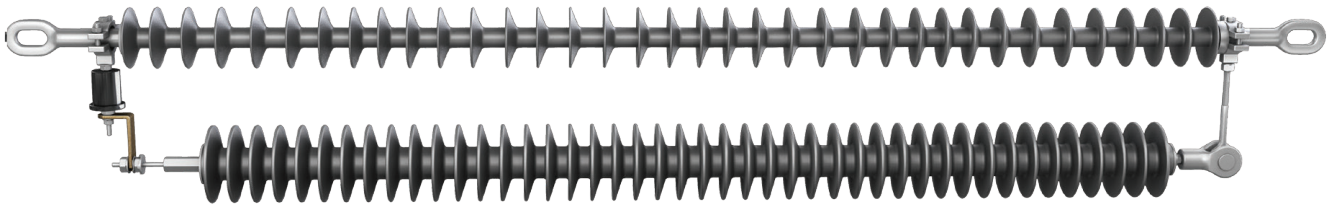
Installations that do not benefit from an OHSW or that have a poor shielding angle infer shielding failures are the cause of interruptions. This is common for installations that have height restrictions or even older lines that do not meet current utility transmission standards. LSA's can be installed on the top phase only, which will offer varying levels of effectiveness depending on the structure geometry. Arresters can be installed on the top and middle phases or all phases to provide even greater lightning protection.

Installations that exhibit a high tower footing resistance infer back flashovers are the cause of interruptions. This is common for installations that have rocky terrain or experience severe droughts. LSA's can be installed on the bottom phase only, which will offer an immediate improvement in line performance. Arresters may additionally be installed on the middle and top phases to provide even greater lightning protection. With installations varying for every customer, Hubbell offers both NGLA (non-gapped) and EGLA (externally gapped) arrester solutions to fit any variety of applications and needs.

A major interest in the selection of a line arrester is the charge imparted on an arrester during a lightning discharge. The charge can vary based on different types of lightning duty with variables such as stroke location, waveshape, polarity and magnitude. The charge requirement would generally be lower for a properly shielded application, compared to an unshielded line. Studies suggest tower footing resistance has little impact on the charge seen by an arrester. If multiple arresters are installed on the same structure there is some charge sharing amongst these arresters.

Theoretically, all lightning flashovers could be eliminated by installing arresters on all phases of every structure. A more thorough review of each application can yield other placement schemes which are typically more economical options.

Effective Protection for Older Systems – Existing power systems can be a challenge to protect against flashovers. Questionable grounding, outdated construction standards and degraded materials can all present threats to system reliability during a surge.



Each Protecta*Lite system is custom made to fit your existing towers and systems. It can be suspended, mounted to a steel arm, hung from an insulator or configured however you need pertinent to your individual safety concerns and processes.

Raising the Bar for Reliability – Hubbell has been manufacturing surge arresters for over 70 years. We continue to raise the bar with new technology to ensure our customers achieve the reliability they require. All Hubbell arresters are highly resistant to moisture ingress, a leading cause of arrester failure. Protecta*Lite arresters have over 30 years of field experience and have proven to be reliable, and highly resistant to tracking and other environmental damage.

Simply put, we build these products to last. You can count on them to protect your system for years and provide maintenance-free service.

Selection Guidelines

Hubbell manufactures a wide range of line surge arresters to meet each application's unique requirements. All Hubbell surge arresters are qualified to the latest version of IEEE C62.11 or IEC 60099-4. The EGLA product line is qualified to the latest version of IEC 60099-8. Lightweight, easy to handle polymer arresters are exclusively used for all Hubbell line arrester applications. Several design types are available to meet varying isokeraunic levels and mechanical requirements for each client's specific needs. Hubbell line surge arresters are installed in various environments across the world and continue to improve system reliability.

Selecting the Right Arrester for Your Needs – Selecting an appropriate Protecta*Lite arrester requires knowledge about your specific application. Main factors to consider include:

- Maximum system voltage
- Levels and durations of power frequency overvoltages
- Insulation level of equipment to be protected
- Structure type
- Tower footing resistance
- Use of an OHSW
- Available line-to-ground fault current
- Method of installation: hot line or deenergized
- Any unique environmental conditions

Standard operating conditions for a.c. surge arresters are identified in IEC 60099-4 and IEEE C62.11, including:

- Nominal power system frequency of 48 to 62 Hz
- Altitude of 6000 ft (1800 m)
- Ambient air temperature in the general vicinity of the arrester between -40 °C and 40 °C
- Wind speeds ≤ 111 ft/s (34 m/s)

Exposure to conditions outside of these limits will require special consideration in the design and application of surge arresters. Note the service conditions and uniqueness of each application for line surge arresters are vast and wide ranging. Arresters can be exposed to high levels of contamination, conductor galloping, hurricane force winds, wildlife interference and varying other conditions. Ensuring the arrester is selected, configured and installed properly to successfully survive these conditions is key to ensuring arrester longevity and protection of your valuable assets.

* For applications outside the usual service conditions, or any other application related question, please contact your Hubbell Power Systems Representative at **1.573.682.5521**.

NGLA Non-Gapped Line Arrester

EGLA Externally Gapped Line Arrester

Selecting Protecta*Lite® - NGLA

Protecting your power grid begins with selecting the proper Protecta*Lite® System. Four facets are generally considered to tailor a Protecta*Lite solution. However, each application is often unique. Use these steps to determine what Protecta*Lite system will fit your application needs. Each design is then custom built to meet your unique needs and may require additional considerations outside of this guide.

Step 1: Selecting the Correct MCOV

Selection of an arrester is based upon the maximum continuous operating voltage (MCOV or U_c) that is applied across the arrester in service (line-to-ground). The table below provides general guidelines for solidly grounded applications. A higher rated arrester may be required depending on the exact application. Please consult with Hubbell for additional support to select the appropriate arrester MCOV for your specific application.

System Voltage (kV)		Arrester MCOV (kV)
		Effectively Grounded Neutral Circuit
Nominal	Maximum	
2.4	2.52	2.55
4.16	4.37	2.55
4.8	5.4	5.1
6.9	7.25	5.1
8.32	8.74	5.1
12	12.6	7.65
12.47	13.1	7.65
13.2	13.9	8.4
13.8	14.5	8.4
20.78	21.8	12.7
22.86	24	15.3
23	24.2	15.3
24.94	26.2	15.3
34.5	36.2	22
46	48.3	29
69	72	42
115	121	70
138	145	84
161	169	98
230	242	140
345	362	211.2
500	525	312

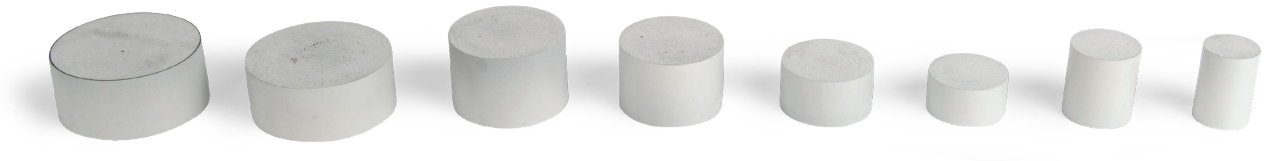
Step 2: Select Arrester Type

In most cases the required MCOV for a specific application will determine the arrester type. Some applications may require a different design to handle excessive lightning duty, high mechanical loading requirements or additional considerations from environmental factors or switching duty. The chart below provides general guidance on key Protecta*Lite designs for system voltages from 3 – 550 kV. Use this guide to help select the correct arrester type for your specific application. Other designs are available for higher system voltages and unique applications. Please contact Hubbell for additional support in the selection process.

Protecta*Lite Arrester Designs

Product Prefix*	Rated Voltage (kV rms)	MCOV (kV rms)	Housing Material	Repetitive Charge Transfer Rating Qrs (C)	Rated Short Circuit Current (kA rms)	Specified Long-term Load (SLL) - in-lb (Nm)	Specified Short-term Load (SSL) - in-lb (Nm)
602	3 - 120	2.55 - 98	ESP™ Polymer	0.5	40	700 (79)	1195 (135)
607	60 - 228	48 - 180	ESP™ Polymer	3.2	63	8,000 (900)	16,000 (1,800)
609	228 - 444	182.4 - 336	Silicone Polymer	5.2	63	35,400 (4,000)	70,800 (8,000)

*The 0 in the product prefix will be modified if an insulator is included in the design
**Other design options and arrester ratings are available



All Hubell Protecta*Lite arresters feature the same high quality MOV blocks found in Hubbell distribution, intermediate and substation class surge arresters. Hubbell has been manufacturing MOV blocks in our state-of-the-art facility since 1977. Our long history with MOV technology ensures the MOV blocks used in all Hubbell arresters meet not only industry standards, but also Hubbell exacting requirements.

Our proprietary ESP™ weathershed material, made of a blend of silicone and EPDM, resists tracking and provides exceptional leakage distance. It has proven its mettle in some of the toughest weather conditions for decades.

These features protect system reliability, your lineman and your bottom line.

602 Series Protecta*Lite® - NGLA

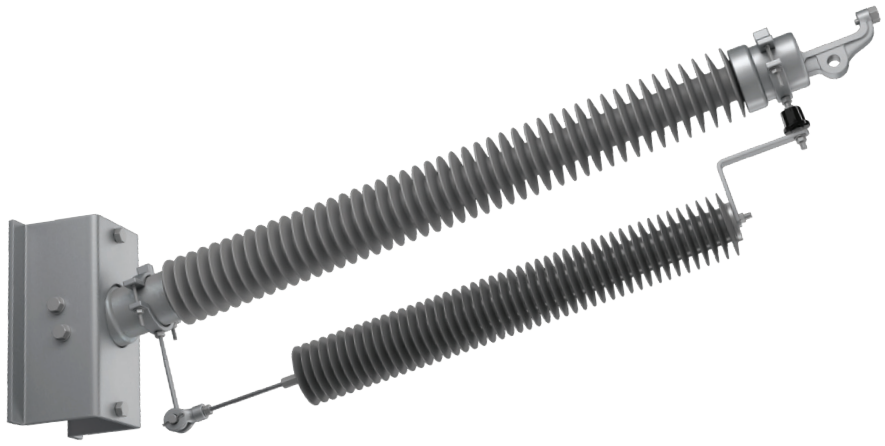
Electrical Characteristics

MCOV (kV)	Rated Voltage (kV)	Temporary overvoltage capability (kV)		Max steep current impulse residual voltage (kV)	Max switching impulse residual voltage (kV)	Max lightning impulse residual voltage (kV)			
		1s	10s	10 kA	0.5 kA	5 kA	10 kA	20 kA	40 kA
2.55	3	3.9	3.7	10.6	7.6	9.0	9.9	11.1	13.2
5.1	6	7.8	7.4	21.3	15.3	18.0	19.8	22.3	26.5
7.65	9	11.7	11.1	31.2	22.4	26.4	29.0	32.6	38.8
8.4	10	12.9	12.2	34.0	24.4	28.8	31.6	35.6	42.3
10.2	12	15.6	14.8	40.4	29.0	34.2	37.6	42.3	50.3
12.7	15	19.5	18.4	51.4	36.9	43.5	47.8	53.8	64.0
15.3	18	23.5	22.2	60.6	43.5	51.3	56.4	63.5	75.5
17	21	26.1	24.7	68.3	49.0	57.8	63.5	71.4	85.0
22	27	33.7	31.9	91.8	65.9	77.7	85.4	96.1	114
24.4	30	37.4	35.4	101	72.5	85.5	94.0	106	126
29	36	44.5	42.1	121	87.0	103	113	127	151
31.5	39	48.3	45.7	129	92.5	109	120	135	161
33.6	42	51.5	48.7	137	98.0	116	127	143	170
36.5	45	56.0	52.9	152	109	129	142	160	190
39	48	59.8	56.6	163	117	138	152	171	204
42	54	64.4	60.9	171	122	144	159	178	212
48	60	73.6	69.6	197	142	167	183	206	246
57	72	87.4	82.7	236	169	200	220	247	294
70	90	107	102	285	204	241	265	298	355
74	90	113	107	303	218	257	282	318	378
76	96	117	110	303	218	257	282	318	378
78	96	120	113	311	223	263	289	325	387
84	108	129	122	342	245	289	318	357	425
88	108	135	128	354	254	300	330	371	442
98	120	150	142	394	283	334	367	413	491

602 Series Protecta*Lite® - NGLA

Physical Characteristics

MCOV	Rated Voltage	Creepage Distance	Arrester only Height	Lightning Withstand Voltage	Arrester only Weight
kV	kV	in (mm)	in (mm)	kV peak	lbs (kg)
2.55	3	8.5 (216)	3.4 (86)	80	1.3 (0.6)
5.1	6	11.3 (287)	4.2 (107)	95	1.7 (0.8)
7.65	9	14.4 (366)	5.3 (135)	110	2.2 (1)
8.4	10	14.4 (366)	5.3 (135)	110	2.2 (1)
10.2	12	17.0 (432)	5.8 (148)	115	2.5 (1.1)
12.7	15	25.2 (640)	8.2 (208)	155	3.7 (1.7)
15.3	18	25.2 (640)	8.2 (208)	155	3.6 (1.7)
17	21	28.1 (714)	9.0 (229)	160	4.1 (1.8)
22	27	36.5 (927)	11.9 (302)	195	5.1 (2.3)
24.4	30	39.7 (1008)	13.0 (331)	215	5.6 (2.5)
29	36	42.3 (1074)	13.6 (344)	225	5.9 (2.7)
31.5	39	50.5 (1282)	15.9 (404)	240	7.1 (3.2)
33.6	42	53.4 (1356)	16.7 (425)	255	7.5 (3.4)
36.5	45	56.3 (1430)	17.6 (446)	270	7.9 (3.6)
39	48	67.5 (1714)	21.3 (540)	320	9.4 (4.2)
42	54	75.7 (1922)	23.6 (600)	350	10.5 (4.8)
48	60	70.7 (1795)	22.4 (569)	330	9.9 (4.5)
57	72	81.5 (2070)	25.3 (642)	370	11.3 (5.1)
70	90	98.8 (2509)	30.9 (786)	445	13.7 (6.2)
74	90	126 (3202)	39.1 (992)	550	17.4 (7.9)
76	96	126 (3202)	39.1 (992)	550	17.4 (7.9)
78	96	126 (3202)	39.1 (992)	550	17.4 (7.9)
84	108	141 (3571)	43.2 (1098)	600	19.5 (8.8)
88	108	151 (3843)	46.8 (1188)	650	20.8 (9.4)
98	120	163 (4137)	50.1 (1272)	690	22.5 (10.2)



607 Series Protecta*Lite® - NGLA

Electrical Characteristics

MCOV (kV)	Rated Voltage (kV)	Temporary overvoltage capability (kV)		Max steep current impulse residual voltage (kV)	Max switching impulse residual voltage (kV)	Max lightning impulse residual voltage (kV)			
		1s	10s	10 kA	0.5 kA	5 kA	10 kA	20 kA	40 kA
48	60	69	66	161	116	138	147	161	180
53	66	75.9	72.6	176	128	151	162	177	198
57	72	82.8	79.3	193	139	165	177	194	216
70	90	104	99.3	243	175	207	221	243	271
76	96	111	106	259	186	221	237	259	289
84	108	125	120	290	210	249	267	292	327
88	108	125	120	290	210	249	267	292	327
98	120	139	133	324	234	278	297	326	364
106	132	152	145	352	255	303	324	355	396
115	144	166	159	384	279	330	354	387	433
131	168	194	185	449	326	386	413	452	505
140	172	199	191	465	335	397	425	465	520
144	180	207	198	482	348	413	442	484	540
152	192	221	211	513	372	440	471	516	577
154	192	221	211	513	372	440	471	516	577
180	228	262	251	608	441	523	560	613	685

Physical Characteristics

MCOV	Rated Voltage	Creepage Distance	Arrester only Height	Lightning Withstand Voltage	Arrester only Weight
kV	kV	in (mm)	in (mm)	kV peak	lbs (kg)
48	60	71.9 (1827)	28.2 (716)	367	35.9 (16.3)
53	66	71.9 (1827)	28.2 (716)	367	35.9 (16.3)
57	72	82.4 (2093)	31.9 (810)	421	41.1 (18.6)
70	90	123 (3124)	46.3 (1177)	631	58.9 (26.7)
76	96	123 (3124)	46.3 (1177)	631	58.9 (26.7)
84	108	123 (3124)	46.3 (1177)	631	58.9 (26.7)
88	108	123 (3124)	46.3 (1177)	631	58.9 (26.7)
98	120	144 (3654)	53.7 (1364)	652	73.1 (33.2)
106	132	144 (3654)	53.7 (1364)	652	73.1 (33.2)
115	144	165 (4185)	61.0 (1550)	758	82.1 (37.2)
131	168	185 (4686)	72.5 (1841)	926	97.0 (44.1)
140	172	216 (5482)	83.5 (2121)	1006	120 (54.6)
144	180	216 (5482)	83.5 (2121)	1006	120 (54.6)
152	192	216 (5482)	83.5 (2121)	1006	120 (54.6)
154	192	216 (5482)	83.5 (2121)	1006	120 (54.6)
180	228	247 (6278)	94.5 (2400)	1166	133 (60.1)

609 Series Protecta*Lite® - NGLA

Electrical Characteristics

MCOV (kV)	Rated Voltage (kV)	Temporary overvoltage capability (kV)		Max steep current impulse residual voltage (kV)	Max switching impulse residual voltage (kV)	Max lightning impulse residual voltage (kV)			
		1s	10s	10 kA	0.5 kA	5 kA	10 kA	20 kA	40 kA
182.4	228	251	235	643	445	510	535	573	631
192	240	264	247	678	469	537	564	604	665
206.4	258	284	266	728	503	577	606	649	714
211.2	264	290	272	745	515	591	620	664	731
220.8	276	304	284	779	538	617	648	694	764
230.4	288	317	297	812	562	644	676	724	797
264	330	363	340	931	644	738	775	830	913
268.8	336	370	346	948	655	752	789	845	930
288	360	396	371	1015	702	805	845	905	996
297.6	372	409	383	1049	725	832	873	935	1029
302.4	378	416	389	1066	737	845	887	950	1045
312	390	429	402	1099	760	872	915	980	1078
316.8	396	436	408	1117	772	886	930	996	1096
336	420	462	433	1185	819	939	986	1056	1162

Physical Characteristics

MCOV	Rated Voltage	Creepage Distance	Arrester only Height	Lightning Withstand Voltage	Arrester only Weight
kV	kV	in (mm)	in (mm)	kV peak	lbs (kg)
182.4	228	256 (6500)	90.8 (2307)	1065	324 (147)
192	240	285 (7240)	98.5 (2503)	1170	338 (154)
206.4	258	315 (7990)	105 (2673)	1275	355 (161)
211.2	264	315 (7990)	105 (2673)	1275	358 (163)
220.8	276	315 (7990)	105 (2673)	1275	371 (168)
230.4	288	344 (8740)	112 (2843)	1380	386 (176)
264	330	369 (9380)	130 (3291)	1545	510 (232)
268.8	336	398 (10120)	137 (3487)	1650	513 (233)
288	360	428 (10860)	145 (3683)	1755	500 (227)
297.6	372	428 (10860)	145 (3683)	1755	505 (230)
302.4	378	428 (10860)	145 (3683)	1755	508 (231)
312	390	457 (11610)	152 (3853)	1860	523 (238)
316.8	396	457 (11610)	152 (3853)	1860	525 (239)
336	420	487 (12360)	162 (4123)	1965	545 (248)

Step 3: Select Mounting Arrangement

Line surge arresters are a highly customizable product, that is tailored to each user's specific application. One of the most important characteristics of the design is selecting an appropriate mounting style for the application. Common configurations include suspending the arrester from the tower or structure, hanging the arrester from the phase conductor or jumper and lastly mounting the arrester across an insulator. Each configuration has its own unique merits, such as the ability to install the arrester with the system energized, manage existing phase clearances or provide a streamlined visual appearance.

Tower Mount

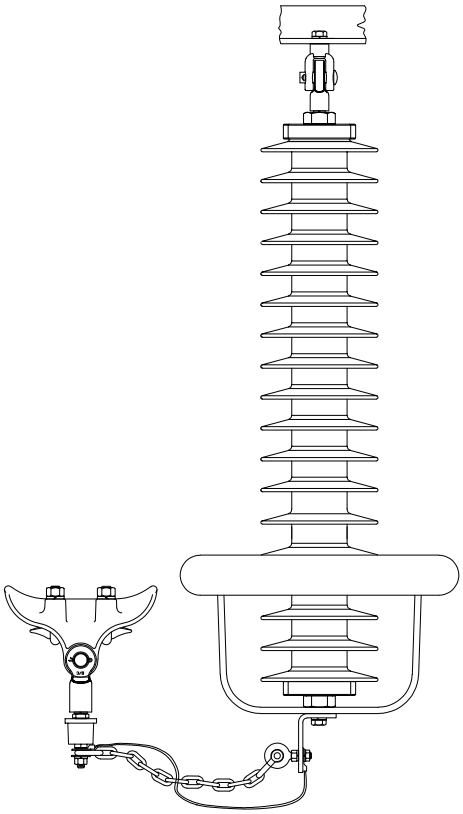
Conductor Mount

Insulator Mount

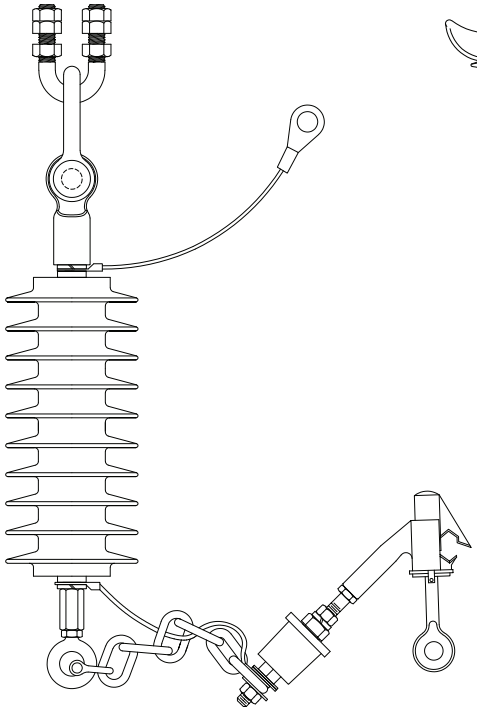
Protecta*Lite arresters are lightweight and easy to handle. When selecting a Protecta*Lite mounting arrangement it's important to consider the longevity of the installation. A detailed assessment at the time of arrester selection will ensure your Protecta*Lite arresters will protect valuable utility assets for years to come. This includes considering how the arresters will be installed, future tower maintenance and general line upkeep. Regardless of the mounting arrangement chosen there should not be excessive stress placed on the arrester, disconnector or leads. Protecta*Lite designs incorporate strain relief devices to ensure the arrester hardware does not bind or fail due to excessive wind or ice loading. The line and ground leads should additionally be sized for each application. For additional considerations contact your Hubbell representative.

Option 1: Tower Mount - NGLA

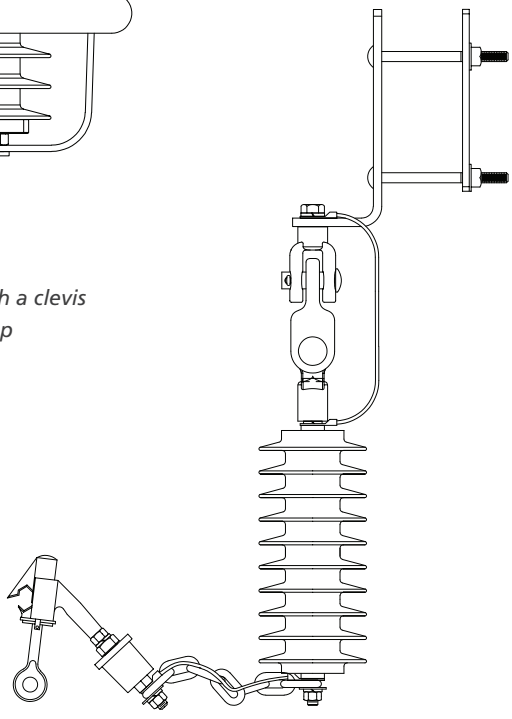
One of the most common mounting arrangements is a tower mount design, where the arrester is suspended from the structure and the lead is connected to the conductor. Below are some examples of popular tower mount configurations. Other options are available, please contact your Hubbell representative for additional support with your application.



*607 Series Protecta*Lite with a clevis and suspension clamp*



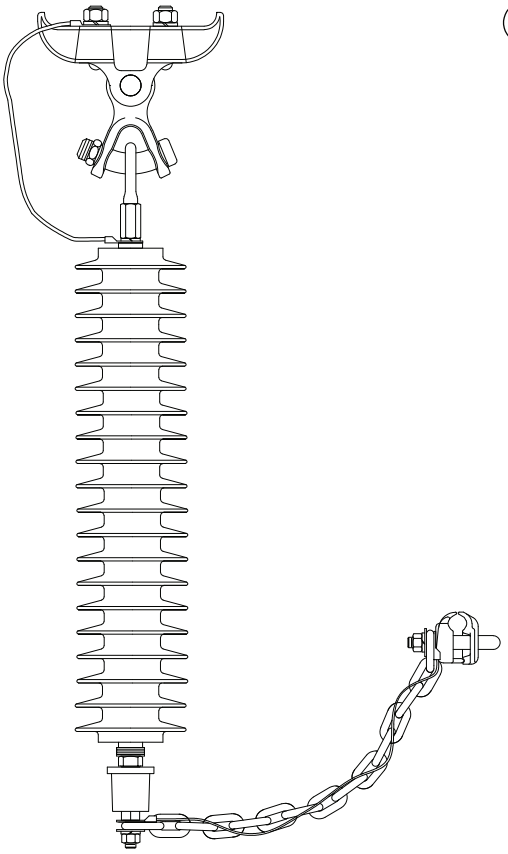
*602 Series Protecta*Lite with a U-bolt and tap clamp*



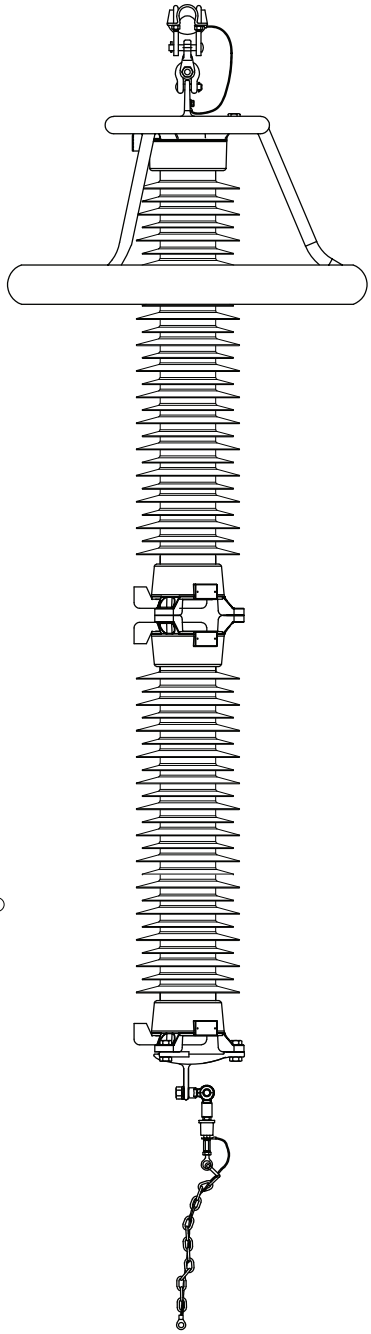
*602 Series Protecta*Lite with a NEMA Crossarm bracket and tap clamp*

Option 2: Conductor Mount - NGLA

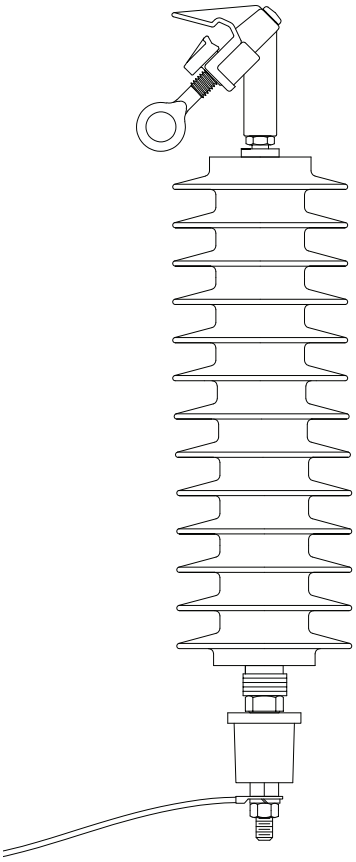
Another common mounting arrangement is a conductor mounted design where the arrester is suspended from the conductor and the ground lead is attached to the tower. Below are some examples of popular conductor mount configurations. Other options are available, please contact your Hubbell representative for additional support with your application.



*602 Series Protecta*Lite with a suspension clamp and ground clamp*



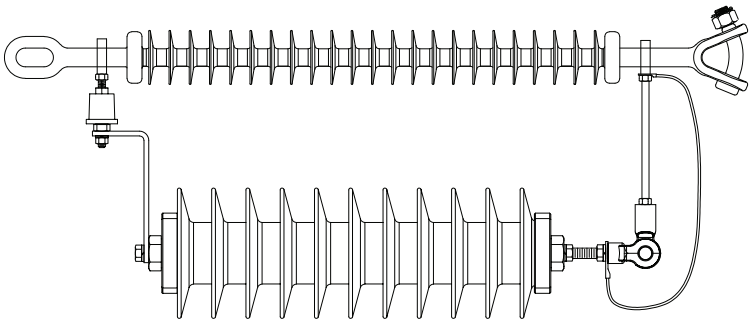
*609 Series Protecta*Lite with a corona free suspension clamp*



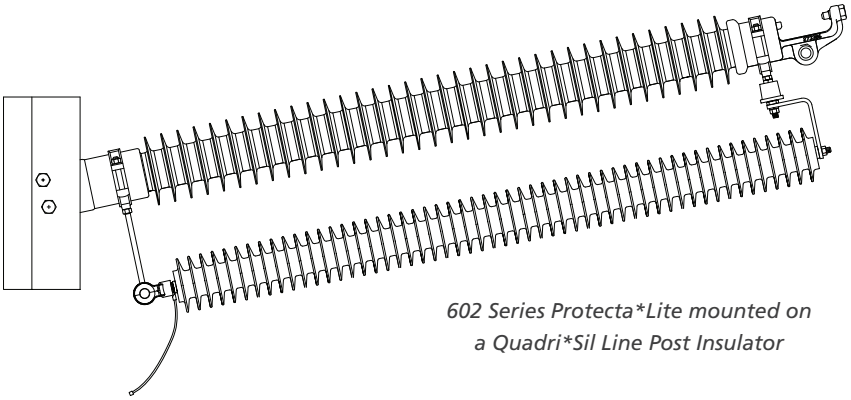
*602 Series Protecta*Lite with a tap clamp*

Option 3: Insulator Mount - NGLA

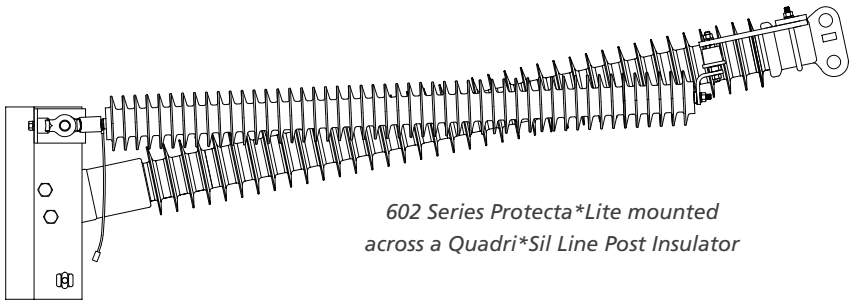
Protecta*Lite arresters can also be mounted directly on an insulator. This is a preferred option for new construction projects or when line maintenance is undertaken on existing towers. Below are some examples of common insulator mount configurations. Other options are available, please contact your Hubbell representative for additional support with your application.



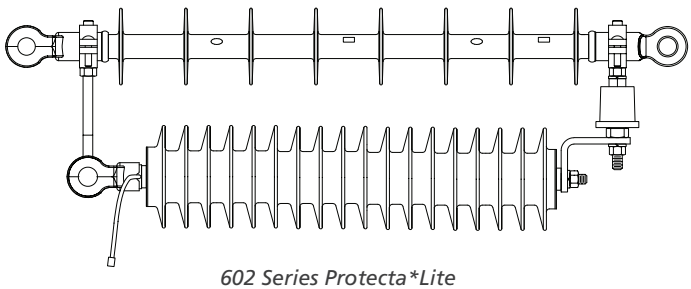
*607 Series Protecta*Lite mounted on a Quadri*Sil Suspension Insulator*



*602 Series Protecta*Lite mounted on a Quadri*Sil Line Post Insulator*



*602 Series Protecta*Lite mounted across a Quadri*Sil Line Post Insulator*

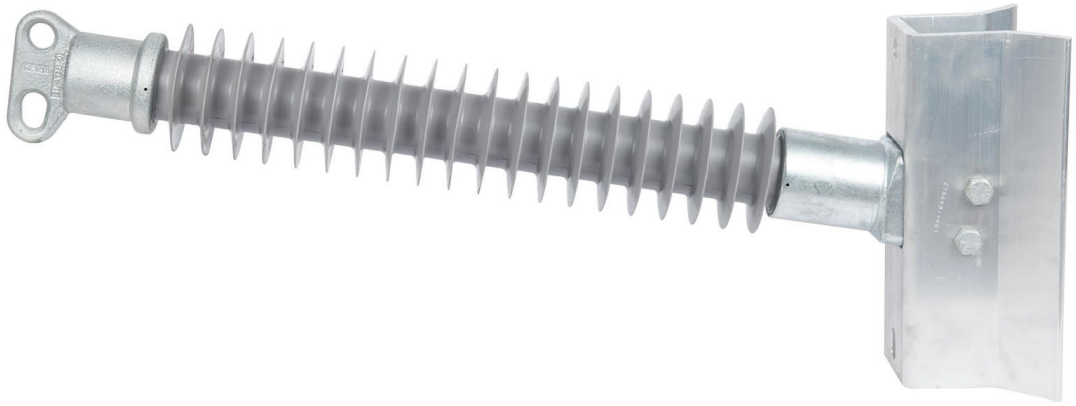


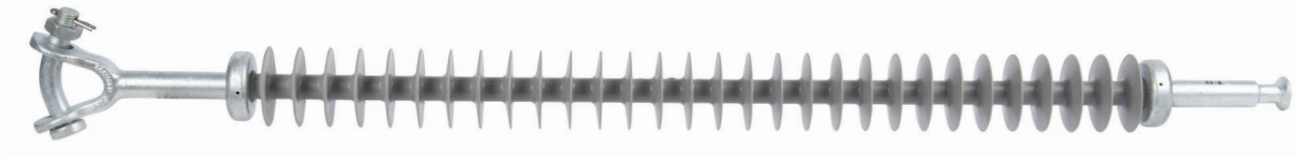
*602 Series Protecta*Lite mounted on a PDI Insulator*

Insulator Options

Hubbell Protecta*Lite arresters can be designed to attach to Hubbell insulators for new or retrofit installations. Designs can also be configured for use with competitor insulators. A summary table is provided below for Hubbell insulator options. Please refer to Catalog CA08051E for additional information and assistance specifying a Hubbell insulator.

Product Line	Application	System Voltage (kV rms)	Housing Material	Rod Diameter - Inches (mm)
PDI	Deadend and Suspension	15 - 69	ESP™ Polymer Silicone Polymer	5/8 (16)
Veri*Lite	Line Post	15 - 69	Silicone Polymer	1.5 (38) and 1.75 (44)
Quadri*Sil	Deadend and Suspension	69 - 765	Silicone Polymer	5/8 (16), 7/8 (22) and 1.25 (32)
Quadri*Sil	Line Post	69 - 400	Silicone Polymer	2.5 (63.5), 3.0 (76.2) and 3.5 (88.9)
Quadri*Sil	Braced Line Post	69 - 400	Silicone Polymer	Various





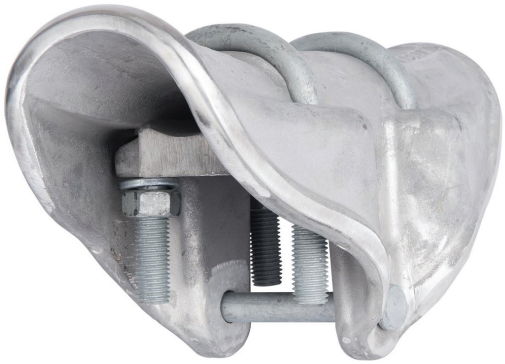
Step 4: Select Hardware

Hubbell Protecta*Lite arresters can use a wide variety of hardware. Tap or suspension clamps are common components in each assembly. The use of either clamp is largely user dependent, but each one has advantages. Tap clamps are commonly used to facilitate installing line arresters with the system energized, however they do cover a limited conductor range based on applicable system voltages. Suspension clamps are more versatile, but typically cannot be installed with a hot line tool. These clamps are also more rigid and can be viewed as a more permanent option. Hubbell has been using a wide variety of suspension and tap clamps on Protecta*Lite arresters for over 30 years.

Tap Clamps

Catalog Number	Description	Conductor Range - Inches (mm)
GH201D	Bronze hot line tap clamp	0.128 (3.25) - 0.414 (10.5)
GH201DP	Bronze hot line tap clamp, tin plated	
GH202AD	Aluminum hot line tap clamp	0.522 (13.2) - 1.028 (26.1)

Suspension Clamps



Catalog Number	Description	Conductor Range - Inches (mm)
AAC104N	Aluminum angle clamp	0.50 (12.7) - 1.10 (27.94)
AAC10490N	Aluminum angle clamp, 90 deg	
HAS62N	Aluminum suspension clamp	0.20 (5.08) - 0.62 (15.75)
HAS85N	Aluminum suspension clamp	0.40 (10.16) - 0.85 (21.59)
HAS104N	Aluminum suspension clamp	0.50 (12.7) - 1.04 (26.42)
HAS118N	Aluminum suspension clamp	0.70 (17.78) - 1.18 (29.97)
HAS139N	Aluminum suspension clamp	0.90 (22.86) - 1.39 (35.31)
HAS147N	Aluminum suspension clamp	1.00 (25.4) - 1.47 (37.34)
HAS162N	Aluminum suspension clamp	1.10 (27.94) - 1.62 (41.15)
HAS182N	Aluminum suspension clamp	1.25 (31.75) - 1.82 (46.23)
HAS204N	Aluminum suspension clamp	1.40 (35.56) - 2.13 (54.1)
CFS182N	Aluminum corona free suspension clamp	1.55 (39.4) - 1.82 (46.2)
CFS204N	Aluminum corona free suspension clamp	1.73 (43.94) - 2.04 (51.82)
HAST2118N	Aluminum double groove clamp	0.398 (10.1) - 0.502 (12.75)
HAST2139N	Aluminum double groove clamp	0.522 (13.26) - 0.642 (16.31)
HAST2182N	Aluminum double groove clamp	0.684 (17.37) - 0.814 (20.68)
HAST2204N	Aluminum double groove clamp	0.858 (21.79) - 0.927 (23.55)
HAST2252N	Aluminum double groove clamp	0.977 (24.82) - 1.165 (29.59)
CFST288N	Aluminum double groove corona free clamp	0.753 (19.13) - 0.883 (22.43)
CFST2130N	Aluminum double groove corona free clamp	0.88 (22.35) - 1.30 (33.0)

Selecting Protecta*Lite® - EGLA

An EGLA consists of a Series Varistor Unit (SVU) and a series gap. The gap is designed to only sparkover in the event of a lightning discharge. The metal-oxide varistor blocks inside the SVU operate in turn to limit the follow current and allow the external arc to be interrupted. This design does not require a direct line-to-ground connection or a disconnector. The EGLA design can be especially advantageous for compact towers and EHV or UHV networks.

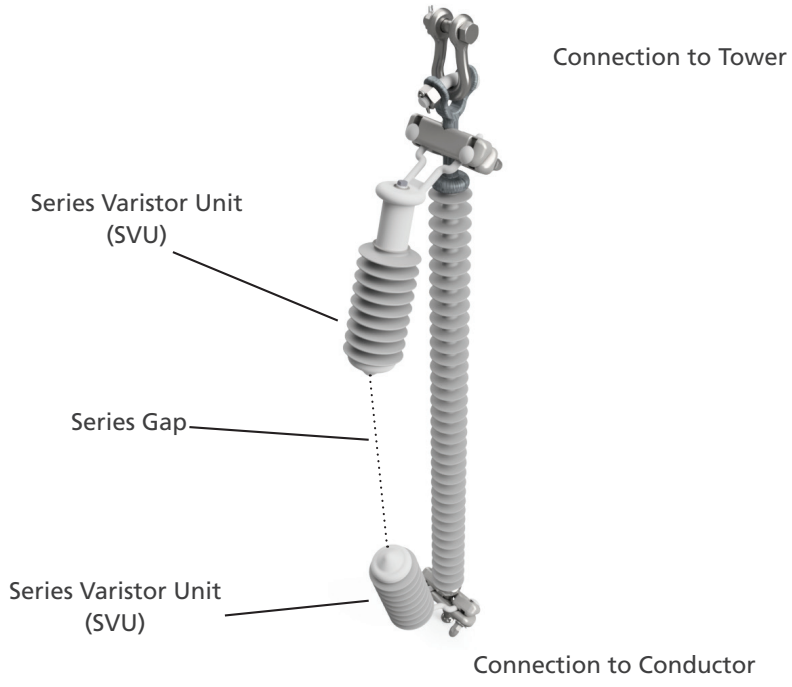
Hubbell offers EGLA designs for both tower and insulator mounting arrangements. Each design is rather unique and requires a detailed understanding of the application. The SVU in an EGLA design can consist of one or two units depending on the system voltage and mounting style. All Hubbell EGLAs are designed and tested in accordance with IEC 60099-8.

Selecting an EGLA will follow a similar concept to an NGLA with exceptions noted below.

Step 1: Select MCOV. Because the series gap reduces the size of the SVU Hubbell will determine the appropriate rating.

Step 2: Select mounting arrangement. Tower and insulator mounting configurations are offered.

For EGLA designs, our engineers are ready to assist with your unique needs. We will work to tailor a custom design to incorporate target line outage rates, clearances, mounting arrangements and any required hardware.



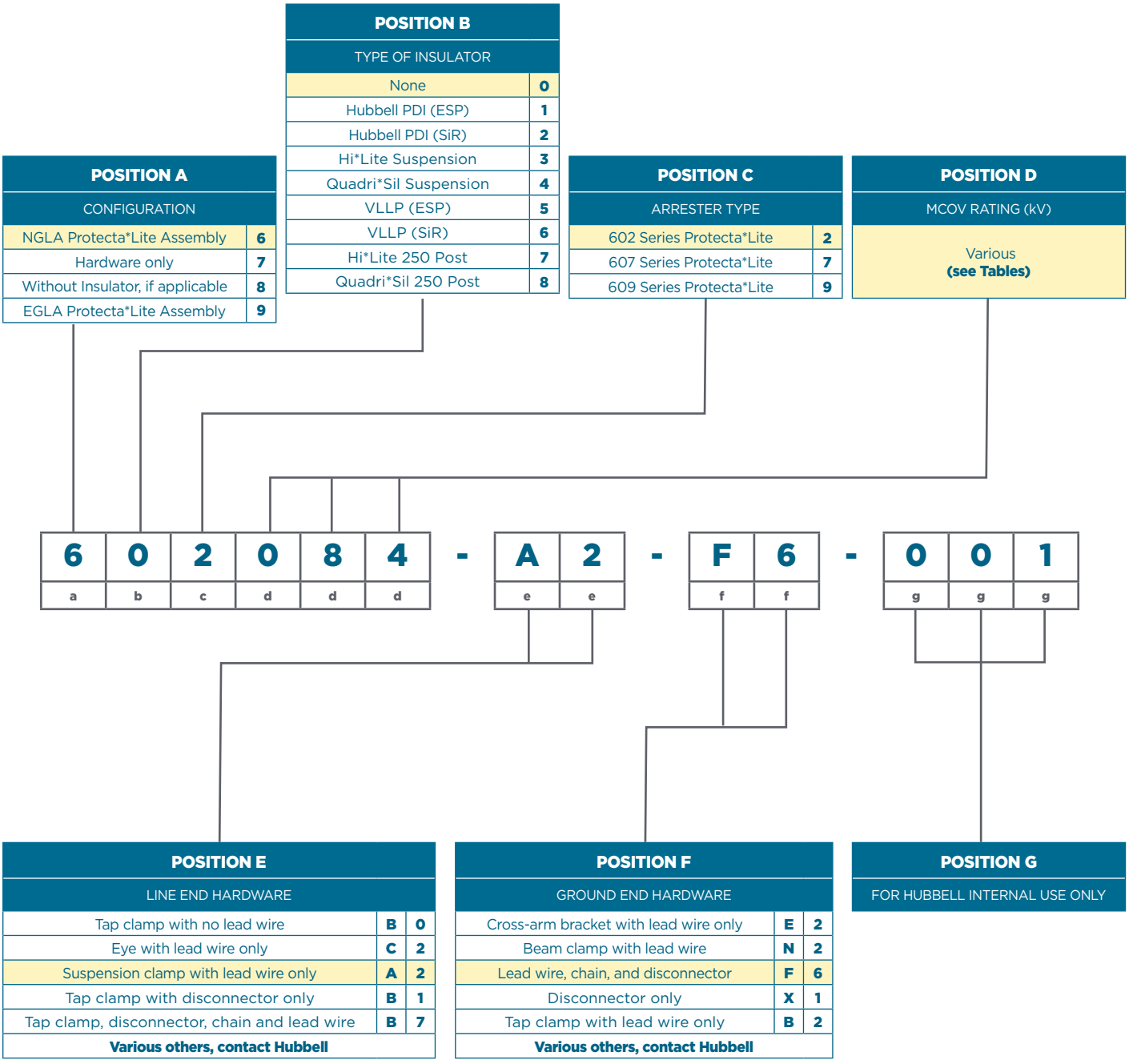
Selecting Protecta*Lite® - EGLA

Example EGLA designs for both tower and insulator mounting options are provided. Each design is type tested according to IEC 60099-8 to ensure the product meets published design characteristics. Please contact your Hubbell representative for help developing an EGLA solution for your application.

EGLA - Independent insulator with SVU for tower mount

EGLA - Insulator SVU Assembly

Part Number Example



Part Number Example

a CONFIGURATION

The first digit represents the configuration. Most will use the standard Protecta*Lite Assembly configuration, but other options are available as well.

6 = NGLA Protecta*Lite assembly
7 = Protecta*Lite hardware only
8 = Protecta*Lite assembly without insulator (if applicable)
9 = EGLA Protecta*Lite assembly

In this example we entered "6" into the box for "a", for a standard Protecta*Lite Assembly.

6						-			-			-			
a	b	c	d	d	d		e	e		f	f		g	g	g

b INSULATOR TYPE

The second number in the sequence represents the insulator type that the Protecta*Lite assembly is designed for.

Using the Part Numbering Guide, find the insulator code for your application and enter it into section "b". For this example, we choose "0" for a Protecta*Lite assembly not designed to be mounted on an insulator.

6	0					-			-			-			
a	b	c	d	d	d		e	e		f	f		g	g	g

c ARRESTER TYPE

The arrester type will be determined by the system voltage as well as the expected lightning and switching activity on the line. Use the Protecta*Lite Arrester Designs table to choose the arrester type and enter the code into box "c".

For this example, "2" was entered for 602 Series arrester type.

6	0	2				-			-			-			
a	b	c	d	d	d		e	e		f	f		g	g	g

d MCOV RATING

The Maximum Continuous Operating Voltage (MCOV) of an arrester is the equal to or greater than the maximum system voltage (line-to-ground). Use the MCOV Selection table to choose the correct MCOV and enter it into box "d".

For this example, "084" was entered for an 84 kV MCOV arrester.

6	0	2	0	8	4	-						-			
a	b	c	d	d	d		e	e		f	f		g	g	g

e LINE END HARDWARE

The two characters in block "e" describe the line end hardware. There are many different variations, with a few common examples noted in the Part Numbering Guide.

In this example, we entered "A2" into the block to describe a suspension clamp with lead wire configuration.

6	0	2	0	8	4	-	A	2	-			-			
a	b	c	d	d	d		e	e		f	f		g	g	g

f GROUND END HARDWARE

The two characters in block "f" describe the ground end hardware. There are many different variations, with a few common examples noted in the Part Numbering Cipher.

In this example, we entered "F6" into the block to describe a lead wire, chain, and disconnector configuration.

6	0	2	0	8	4	-	A	2	-	F	6	-			
a	b	c	d	d	d		e	e		f	f		g	g	g

g INTERNAL USE

The last three numbers in the string are for Hubbell internal use only. Traditionally this is a sequential number to address each variation.

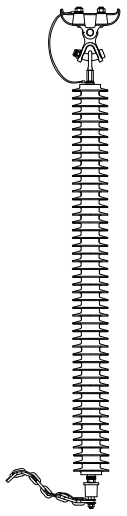
6	0	2	0	8	4	-	A	2	-	F	6	-	0	0	1
a	b	c	d	d	d		e	e		f	f		g	g	g

example

Series 602 Protecta*Lite assembly not mounted on an insulator, rated for 84 kV MCOV, a suspension clamp and lead wire assembled on the line end, with lead wire, chain, and disconnector on the ground end.

602084-A2-F6-001

Please contact Hubbell for additional assistance in selecting a Protecta*Lite arrester and determining the part number for your specific application.



Case Study

Pennsylvania Power & Light (PPL) Electric Utilities serves 1.4 million customers across the state of Pennsylvania. PPL operates and maintains 5,300 miles of transmission lines with voltages ranging from 69 to 500 kV. In 2013, PPL initiated a transmission reliability and performance improvement campaign on their 69 kV and 138 kV lines. To accomplish this, the utility understood reducing their Momentary Average Interruption Frequency Index (MAIFI) would be a critical step to help serve customers better and improve system reliability. Several options to improve transmission line reliability were explored, such as:

- Implementation of an OHSW
- Upgrading an existing OHSW shield angle
- Increasing line insulation
- Improving ground footing resistance
- Completely rebuild the line to incorporate the aforementioned concepts

In PPL's case, many of their transmission lines used an OHSW that didn't meet modern specifications. During evaluation, PPL considered completely rebuilding some of the problematic lines which would be a significant investment. PPL also discovered ground footing resistance at many of their older structures to be much higher than their current standards mandate. While ground footing resistance can be decreased with the quantity and depth of ground rods, that improvement can vary with time. Therefore, the utility decided to install line surge arresters to achieve the protection and reliability they required without a costly overhaul of their transmission lines.

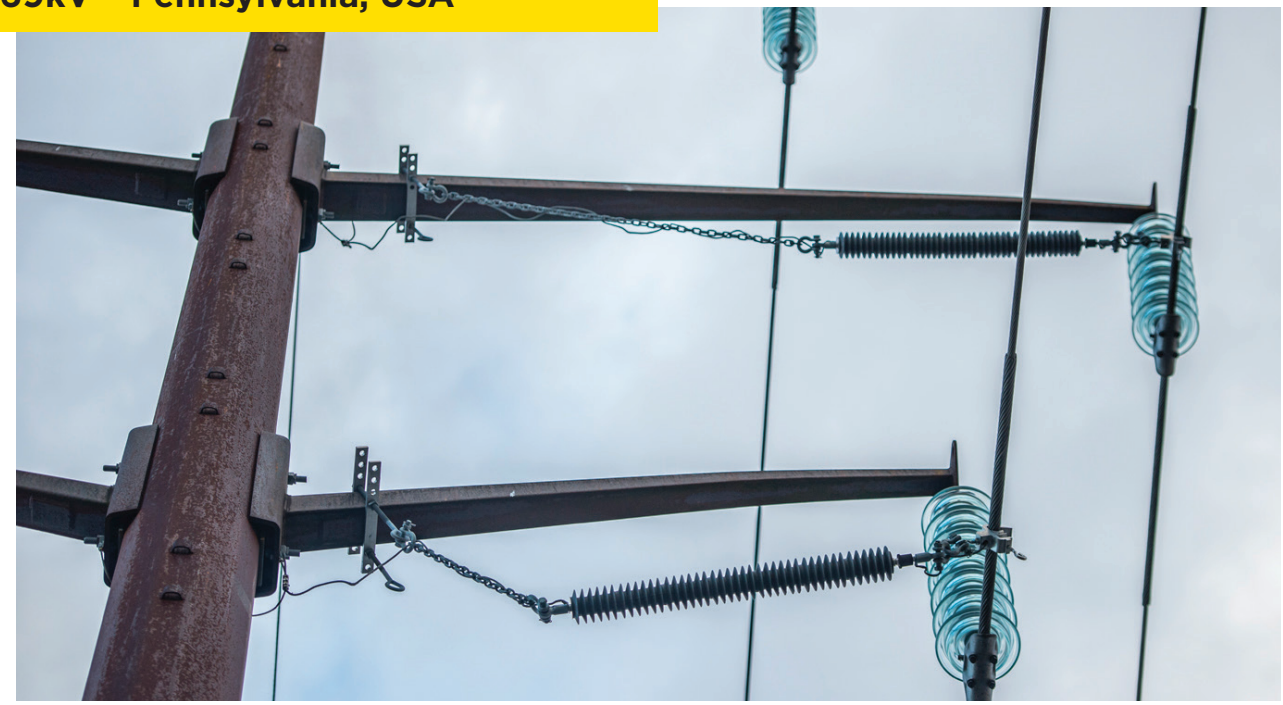
Based on prior use of line surge arresters, PPL dictated the design needed to be versatile to allow use on multiple structure configurations. Arrester protection was required on wood poles, steel lattice towers and steel monopoles. PPL engineers worked directly with HPS to create a custom Protecta*Lite system arrester for their application. PPL chose a design with high level of product adaptability to increase productivity during installation, while also minimizing inventory management. The flexibility ensured each arrester was appropriately configured for the given application.

The 69 kV arresters were installed with the system energized to ensure a minimal impact to customers. PPL incorporated a hotline clamp in the design to complete the installation. However, on the 138 kV systems available clearances and weight of the line surge arresters mandated these arresters were installed with the system de-energized. Since installing the arresters in 2013, momentary interruptions due to lightning have been completely eliminated on transmission systems protected with line surge arresters. The reduced interruptions allowed PPL to provide their customers with better quality, reliable power as well as significantly decrease wear and tear on their equipment.

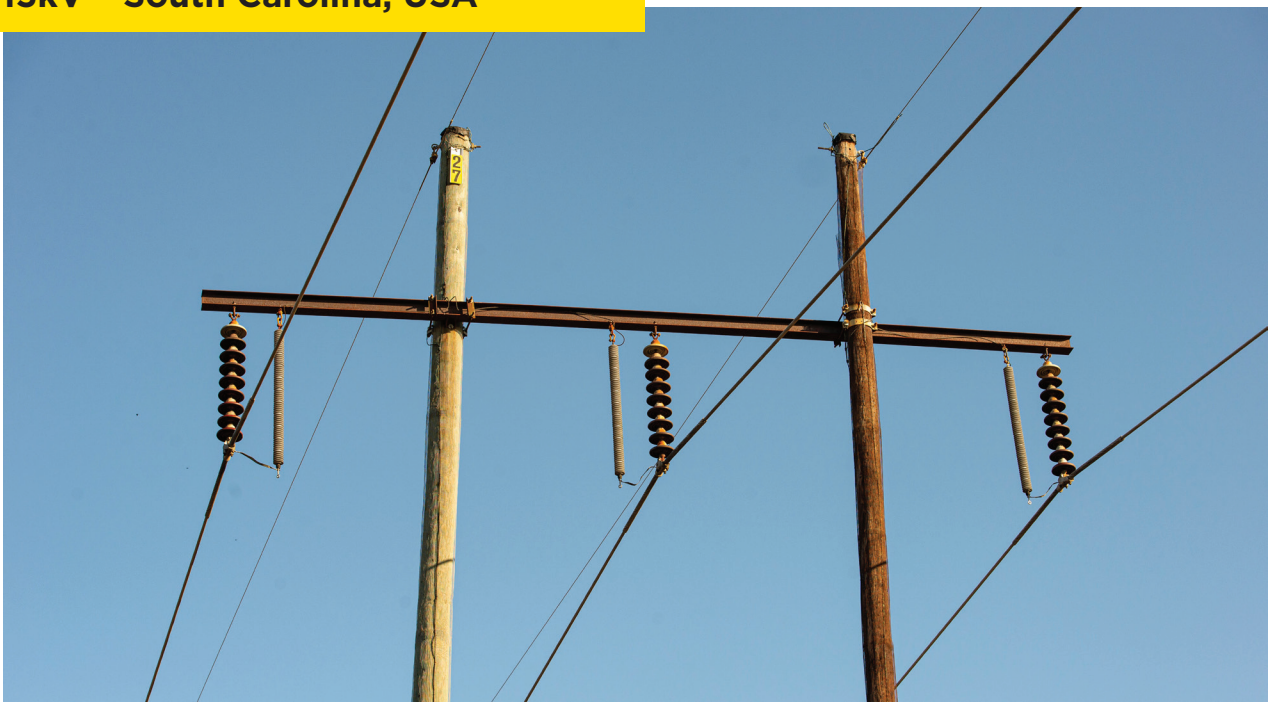
The full case study, ***Performance & Revenue Enhancements Utilizing Line Surge Arresters***, can be viewed online at hubbell.com

Protecta*Lite Installations

69kV – Pennsylvania, USA



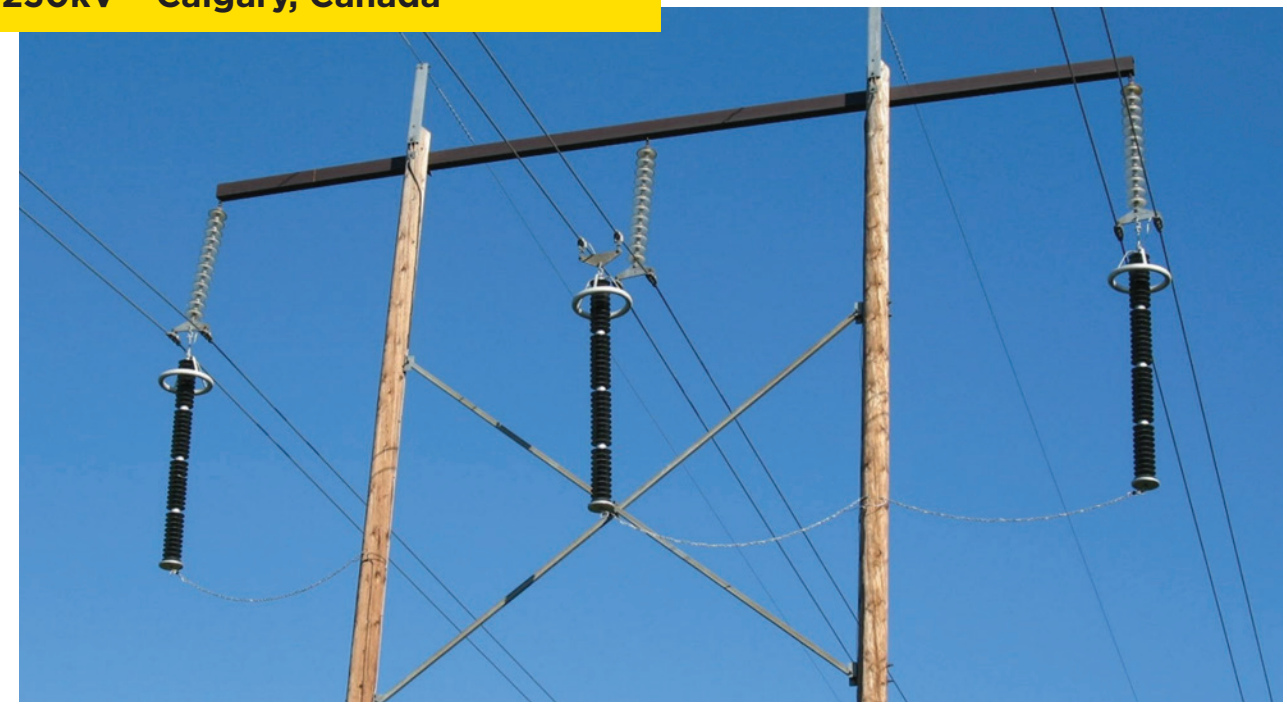
115kV – South Carolina, USA



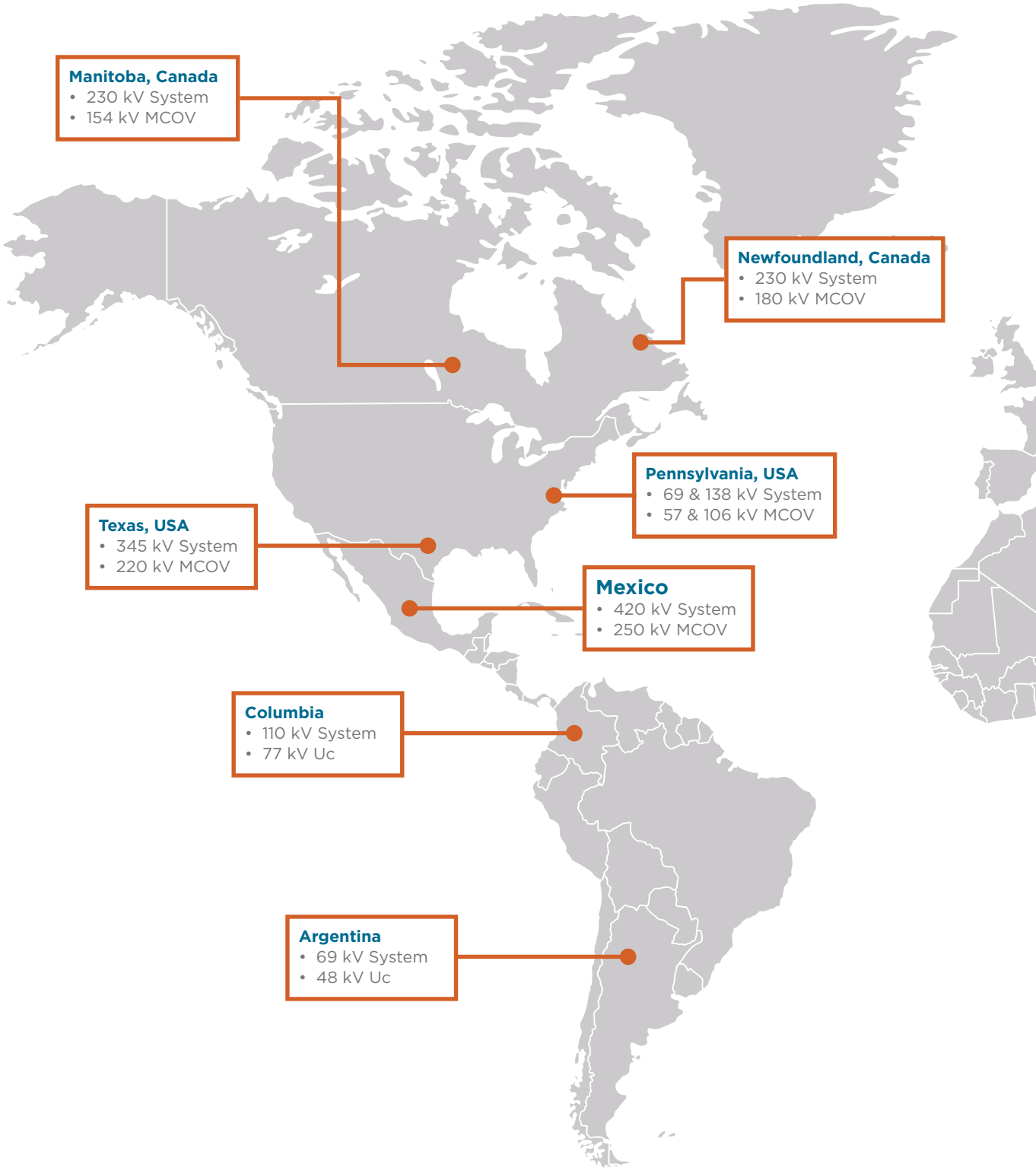
Protecta*Lite Installations

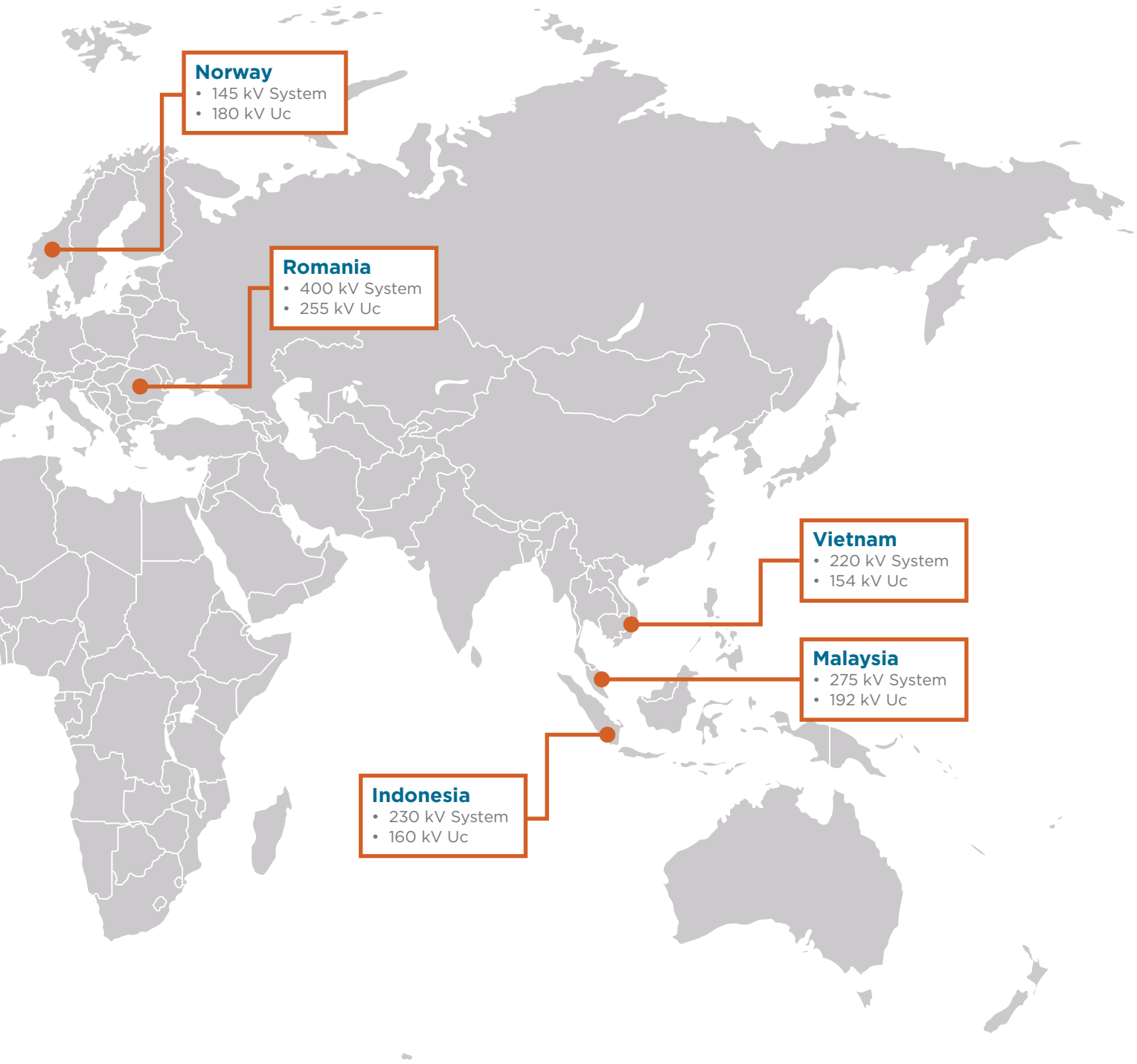
138kV – New England, USA

230kV – Calgary, Canada



Protecta*Lite Installations

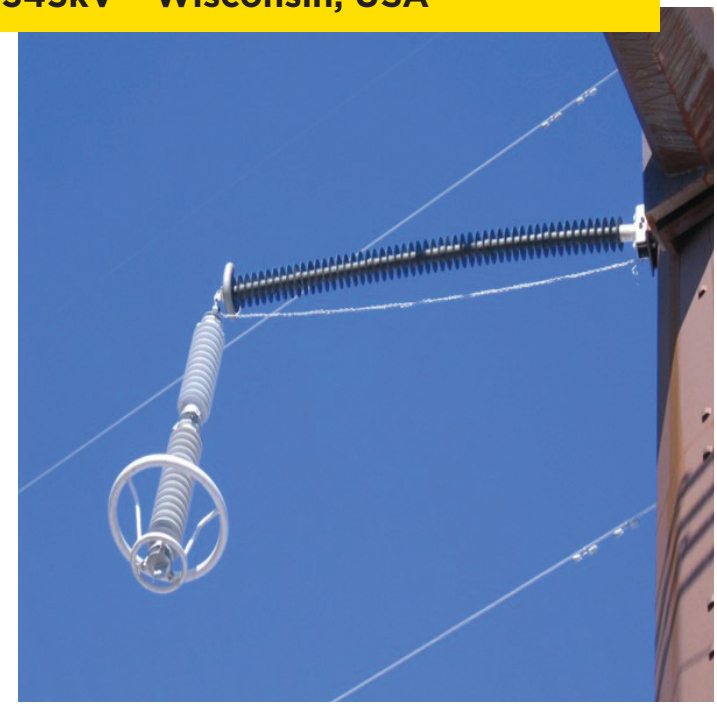



Norway
• 145 kV System
• 180 kV Uc
Romania
• 400 kV System
• 255 kV Uc
Vietnam
• 220 kV System
• 154 kV Uc
Malaysia
• 275 kV System
• 192 kV Uc
Indonesia
• 230 kV System
• 160 kV Uc

Protecta*Lite Installations

230kV – Manitoba, Canada

345kV – Wisconsin, USA



Technical Terms Reference Guide

Back Flashover: A flashover of insulation resulting from a lightning strike to part of a network or electric installation that is normally at ground potential.

Discharge Voltage: The voltage level that the arrester clamps to during a surge in kV. Sometimes referred to as IR.

Duty Cycle: The designated maximum permissible voltage between its terminals at which an arrester is designed to perform its duty cycle.

Flashover: An electrical disruptive discharge around or over the surface of an insulator. This typically results in the operation of an over-current device.

EGLA (Externally Gapped Line Arrester): Arrester designed for installation on overhead lines to protect an insulator assembly from lightning-caused fast front over-voltages.

Keraunic Level: The number of active thunderstorm days annually.

MCOV (Maximum Continuous Operating Voltage): The maximum designated root-mean-square (rms) value of power-frequency voltage that may be applied continuously between the terminals of the arrester.

Metal-Oxide Surge Arrester (MOSA): A surge arrester utilizing valve elements fabricated from nonlinear resistance metal-oxide materials.

MOV (Metal Oxide Varistor): The power semiconductor that limits the surge voltage, allowing the arrester to perform its protection function.

NGLA (Non-Gapped Line Arrester): Arrester without internal or external series gap intended for installation in overhead lines in parallel to the line insulators in order to prevent flashovers.

SVU (Series Varistor Unit): Non-linear metal-oxide resistor part, contained in a housing, which must be connected with an external series gap to construct the complete arrester.

Technical Terms Reference Guide

Shield Angle: The angle between the vertical line through the Over Head Ground Wire and a line connecting the Over Head Ground Wire with ground.

Structure Footing Resistance: The resistance between the tower grounding system and true ground.

Surge Arrester: A protective device for limiting surge voltages on equipment by diverting surge current and returning the device to its original status. It is capable of repeating these functions multiple times.

TLA: Transmission Line Arrester

TOV (Temporary Over-Voltage): A power frequency voltage in excess of normal line-to-ground voltage. A TOV is typically system-generated. The magnitude and duration are a function of the power system parameters.

NOTE: Because Hubbell has a policy of continuous product improvement, we reserve the right to change design and specifications without notice.

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