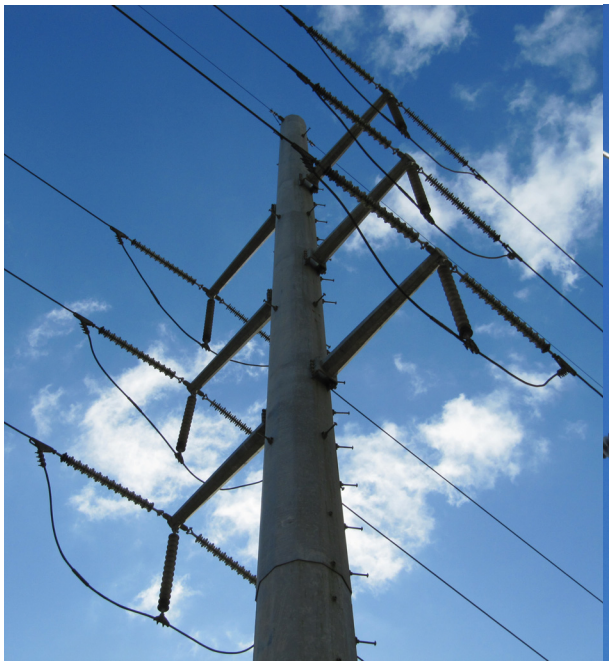
K-LINE INSULATORS LIMITED
TORONTO, ONTARIO, CANADA

Catalogue T-DS

TRANSMISSION SILICONE INSULATORS

Deadend / Suspension

69 kV to 400 kV



ISO9001
SAI GLOBAL
FILE No. 000117

Transmission Silicone Insulators
Deadend / Suspension

One of the most important items on any overhead transmission line is the insulator. This item is the backbone of the transmission system in minimizing interruptions, outages, and assuring system safety and reliability. Therefore, it is essential to have high quality and dependable insulators on the system. With **K-LINE INSULATORS LIMITED** silicone rubber transmission insulators these objectives can be easily achieved with a substantial savings in the life cycle cost.

Experience with silicone polymer insulators has proven their superiority over ceramic insulators. Today more Electric Utilities are shifting to silicone polymer insulators to improve overall performance on transmission lines.

KLI Transmission Silicone Suspension/Deadend Insulators are manufactured to meet world-class polymer insulator standards, CSA C411.4, ANSI C29.12 and IEC 61109.
K-LINE INSULATORS LIMITED is registered to ISO 9001 Quality Systems.

PERFORMANCE BENEFITS

The performance benefits of **KLI** Transmission Suspension/Deadend Insulators are listed below.

- Improves Reliability (interruptions and outages due to vandalism, pole fires, and flashovers in all types of environments are a thing of the past)
- Eliminates or Reduces Maintenance (such as washing and trouble calls) and is compatible with existing plant
- Improves Power Quality (less RI and TVI)
- Energy Efficiency (lower losses due to lower leakage currents)
- Safety (light weight for handling and installation)
- Service Life (consistent performance over its service life)
- Life Cycle Cost (savings over ceramic insulators)

APPLICATION

Transmission Suspension/Deadend Insulators are used on transmission lines operating at and above 60 kV. These insulators are installed on support structures to hold conductors longitudinally (dead-end) or vertically (suspension). The connections to the structure attachment point and line vary depending on the line design or Utilities preference.

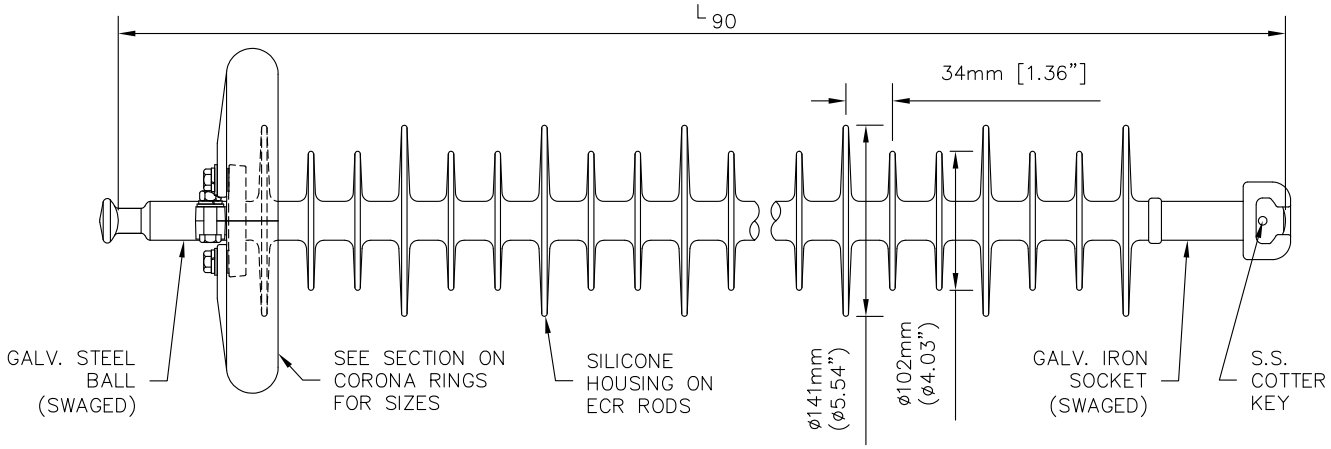
CORE ROD

The core rod of the insulator is made of a high quality, epoxy resin, ECR fiberglass rod that has been specially formulated for electrical and mechanical applications. Each and every rod is subjected to an electrical test to ensure the integrity of the core rods used in the production of all insulators. KLI's rod is a higher torsion strength rating than standard requirements to ensure safer installation and line operation.

HOUSING

The housing (includes sheath and sheds) of the insulator is one piece, high temperature vulcanized, injection molded silicone rubber that is chemically bonded to the core rod. This ensures that the interface between the rubber and rod is impenetrable against moisture ingress. **KLI** uses its own proprietary silicone rubber formula in the manufacture of its insulators. The formulation has silicone rubber as the base polymer material with additives to enhance its performance in wet and contaminated environments.

TRANSMISSION DEADEND / SUSPENSION INSULATORS - 90 kN (20,000 lbs)



TECHNICAL DATA: All values refer to insulators with the appropriate voltage class corona rings installed. (Note 1)

Catalogue Number	Voltage Class	Section Length (Note 2) L	Dry Arcing Distance	Leakage Distance	Positive Critical Impulse Flashover	Impulse Withstand	Low Frequency Dry		Low Frequency Wet		Weight (Note 3)
	kV	mm (in)	mm (in)	mm (in)	kV	kV	Flashover kV	Withstand kV	Flashover kV	Withstand kV	kg (lb)
KL69HB1S113	69	632 (24.9)	526 (20.7)	1466 (57.7)	355	335	215	205	170	150	2.0 (4.3)
KL69HB1S116		737 (29.0)	627 (24.7)	1798 (70.8)	425	400	260	245	205	180	2.4 (5.2)
KL69HB1S119		841 (33.1)	732 (28.8)	2131 (83.9)	485	460	300	285	235	215	2.7 (6.0)
KL115HB1S122	115	942 (37.1)	815 (32.1)	2461 (96.9)	535	505	335	315	265	240	3.3 (7.2)
KL115HB1S125		1046 (41.2)	917 (36.1)	2794 (110.0)	600	565	370	355	300	275	3.6 (8.0)
KL115HB1S128		1150 (45.3)	1021 (40.2)	3127 (123.1)	660	625	415	395	335	310	4.1 (8.9)
KL138HB1S131	138	1252 (49.3)	1125 (44.3)	3460 (136.2)	725	685	455	430	365	340	4.5 (9.8)
KL138HB1S134		1356 (53.4)	1227 (48.3)	3792 (149.3)	785	745	490	465	400	370	4.9 (10.7)
KL138HB1S137		1461 (57.5)	1331 (52.4)	4125 (162.4)	845	805	530	505	430	400	5.2 (11.1)
KL161HB1S140	161	1565 (61.6)	1420 (55.9)	4458 (175.5)	900	855	565	535	460	430	6.6 (14.4)
KL161HB1S143		1666 (65.6)	1521 (59.9)	4790 (188.6)	965	915	605	580	495	460	7.0 (15.3)
KL161HB1S146		1770 (69.7)	1628 (64.1)	5123 (201.7)	1030	980	650	625	535	495	7.4 (16.2)
KL230HB1S149	230	1875 (73.8)	1702 (67.0)	5456 (214.8)	1080	1025	685	660	560	520	7.7 (17.0)
KL230HB1S152		1979 (77.9)	1803 (71.0)	5789 (227.9)	1140	1085	730	705	595	555	8.1 (17.9)
KL230HB1S155		2080 (81.9)	1908 (75.1)	6121 (241.0)	1210	1145	775	750	635	590	8.6 (18.8)

Notes:

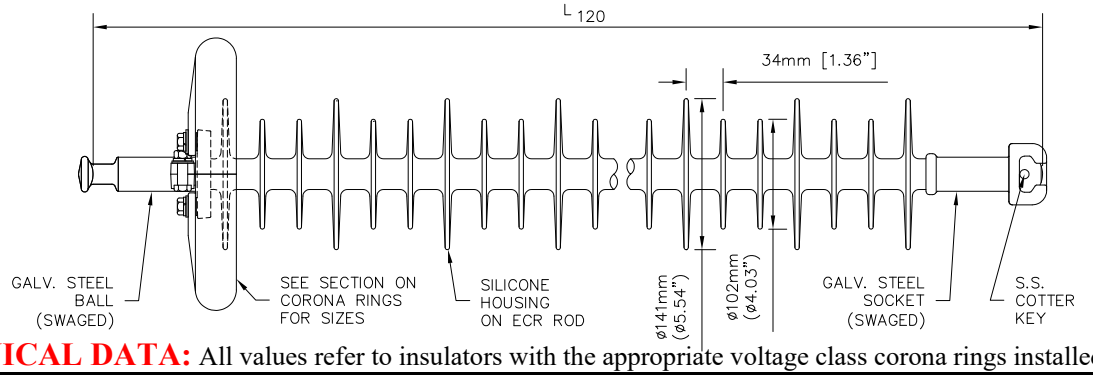
1. See page 8 for correction factors for values for insulators without corona rings.
2. Section lengths are based on ANSI ball and socket hardware and 90 kN (20,000 lbs) SML rating. For lengths of insulators with alternate end fittings combination see Section Lengths.
3. Weight includes standard rings where applicable. See section on Corona Rings

The formula for the catalogue number of a typical insulator is shown below. For specific catalogue number please contact **KLI.**

Cat. No. KL 115 H B1S1 28 X

- KL — Company ID
- 115 — Voltage Class (See Tech. Data)
- H — High Leakage
- B1S1 — End Fitting Designation (See End Fittings)
- 28 — No. of Sheds (See Tech. Data)
- X — Other Options

TRANSMISSION DEADEND / SUSPENSION INSULATORS - 120 kN (27,000 lbs)



TECHNICAL DATA: All values refer to insulators with the appropriate voltage class corona rings installed. (Note 1)

Catalogue Number	Voltage Class	Section Length (Note 2) L	Dry Arcing Distance	Leakage Distance	Positive Critical Impulse Flashover	Impulse Withstand	Low Frequency Dry		Low Frequency Wet		Weight (Note 3)
	kV	mm (in)	mm (in)	mm (in)	kV	kV	Flashover kV	Withstand kV	Flashover kV	Withstand kV	kg (lb)
KL69HBS13	69	660 (26.0)	526 (20.7)	1466 (57.7)	355	335	215	205	170	150	2.9 (6.3)
KL69HBS16		762 (30.0)	627 (24.7)	1798 (70.8)	425	400	260	245	205	180	3.3 (7.2)
KL69HBS19		866 (34.1)	732 (28.8)	2131 (83.9)	485	460	300	285	235	215	3.6 (8.0)
KL115HBS22	115	970 (38.2)	815 (32.1)	2461 (96.9)	535	505	335	315	265	240	4.2 (9.2)
KL115HBS25		1074 (42.3)	917 (36.1)	2794 (110.0)	600	565	370	355	300	275	4.5 (10.0)
KL115HBS28		1176 (46.3)	1021 (40.2)	3127 (123.1)	660	625	415	395	335	310	5.0 (10.9)
KL138HBS31	138	1280 (50.4)	1125 (44.3)	3460 (136.2)	725	685	455	430	365	340	5.4 (11.8)
KL138HBS34		1384 (54.5)	1227 (48.3)	3792 (149.3)	785	745	490	465	400	370	5.8 (12.7)
KL138HBS37		1486 (58.5)	1331 (52.4)	4125 (162.4)	845	805	530	505	430	400	6.1 (13.1)
KL161HBS40	161	1590 (62.6)	1420 (55.9)	4458 (175.5)	900	855	565	535	460	430	7.5 (16.4)
KL161HBS43		1694 (66.7)	1521 (59.9)	4790 (188.6)	965	915	605	580	495	460	7.9 (17.3)
KL161HBS46		1798 (70.8)	1628 (64.1)	5123 (201.7)	1030	980	650	625	535	495	8.3 (18.2)
KL230HBS49	230	1900 (74.8)	1702 (67.0)	5456 (214.8)	1080	1025	685	660	560	520	8.6 (19.0)
KL230HBS52		2004 (78.9)	1803 (71.0)	5789 (227.9)	1140	1085	730	705	595	555	9.0 (19.9)
KL230HBS55		2108 (83.0)	1908 (75.1)	6121 (241.0)	1210	1145	775	750	635	590	9.5 (20.8)
KL230HBS58		2212 (87.1)	2012 (79.2)	6454 (254.1)	1270	1205	815	790	665	620	9.9 (21.8)
KL345HB7S761	345	2314 (91.1)	2144 (84.4)	6787 (267.2)	1350	1285	870	840	710	660	10.3 (22.7)
KL345HB7S764		2418 (95.2)	2248 (88.5)	7120 (280.3)	1415	1345	910	885	745	695	10.7 (23.6)
KL345HB7S767		2522 (99.3)	2357 (92.8)	7452 (293.4)	1480	1410	955	925	785	730	11.5 (25.4)
KL345HB7S770		2624 (103.3)	2461 (96.9)	7785 (306.5)	1545	1470	1000	970	820	765	12.0 (26.3)
KL400HB7S773	400	2728 (107.4)	2512 (98.9)	8118 (319.6)	1580	1500	1020	990	835	780	13.8 (30.3)
KL400HB7S776		2832 (111.5)	2616 (103.0)	8451 (332.7)	1640	1560	1060	1030	870	815	14.1 (31.0)
KL400HB7S779		2935 (115.6)	2649 (104.3)	8783 (345.8)	1660	1580	1075	1045	885	825	14.4 (31.7)

Notes:

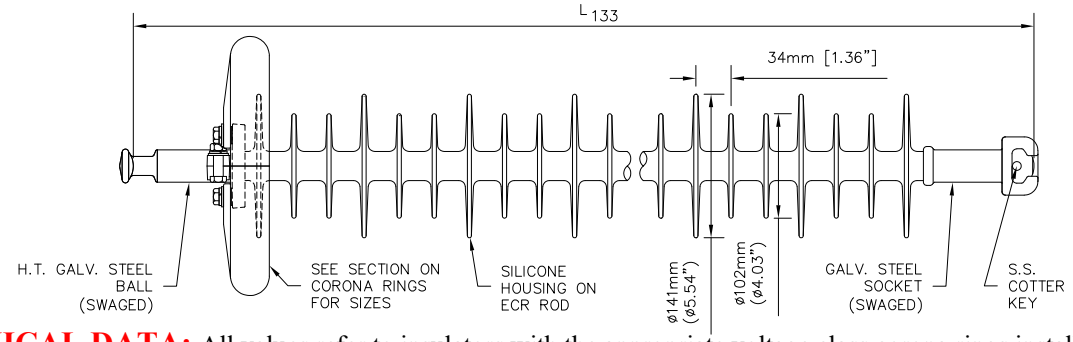
1. See page 8 for correction factors for values for insulators without corona rings.
2. Section lengths are based on ANSI ball and socket hardware and 120 kN (27,000 lbs) SML rating. For lengths of insulators with alternate end fittings combination see Section Lengths.
3. Weight includes standard rings where applicable. See section on Corona Rings.

The formula for the catalogue number of a typical insulator is shown below. For specific catalogue number please contact **KLI.**

Cat. No. KL 115 H BS 28 X

- KL — Company ID
- 115 — Voltage Class (See Tech. Data)
- H — High Leakage
- BS — End Fitting Designation (See End Fittings)
- 28 — No. of Sheds (See Tech. Data)
- X — Other Options

TRANSMISSION DEADEND / SUSPENSION INSULATORS - 133 kN (30,000 lbs)



TECHNICAL DATA: All values refer to insulators with the appropriate voltage class corona rings installed. (Note 1)

Catalogue Number	Voltage Class	Section Length (Note 2) L	Dry Arcing Distance	Leakage Distance	Positive Critical Impulse Flashover	Impulse Withstand	Low Frequency Dry		Low Frequency Wet		Weight (Note 3)
	kV	mm (in)	mm (in)	mm (in)	kV	kV	Flashover kV	Withstand kV	Flashover kV	Withstand kV	kg (lb)
KL69HBS13D	69	660 (26.0)	523 (20.6)	1466 (57.7)	355	335	215	205	170	150	2.9 (6.3)
KL69HBS16D		762 (30.0)	627 (24.7)	1798 (70.8)	425	400	260	245	205	180	3.3 (7.2)
KL69HBS19D		866 (34.1)	732 (28.8)	2131 (83.9)	485	460	300	285	235	215	3.6 (8.0)
KL115HBS22D	115	970 (38.2)	815 (32.1)	2461 (96.9)	535	505	335	315	265	240	4.2 (9.2)
KL115HBS25D		1074 (42.3)	917 (36.1)	2794 (110.0)	600	565	370	355	300	275	4.5 (10.0)
KL115HBS28D		1176 (46.3)	1021 (40.2)	3127 (123.1)	660	625	415	395	335	310	5.0 (10.9)
KL138HBS31D	138	1280 (50.4)	1128 (44.4)	3460 (136.2)	725	685	455	430	365	340	5.4 (11.8)
KL138HBS34D		1384 (54.5)	1229 (48.4)	3792 (149.3)	785	745	490	465	400	370	5.8 (12.7)
KL138HBS37D		1486 (58.6)	1331 (52.4)	4125 (162.4)	845	805	530	505	430	400	6.1 (13.1)
KL161HBS40D	161	1590 (62.6)	1410 (55.5)	4458 (175.5)	900	855	565	535	460	430	7.5 (16.4)
KL161HBS43D		1694 (66.7)	1514 (59.6)	4790 (188.6)	965	915	605	580	495	460	7.9 (17.3)
KL161HBS46D		1798 (70.8)	1628 (64.1)	5123 (201.7)	1030	980	650	625	535	495	8.3 (18.2)
KL230HBS49D	230	1900 (74.8)	1702 (67.0)	5456 (214.8)	1080	1025	685	660	560	520	8.6 (19.0)
KL230HBS52D		2004 (78.9)	1803 (71.0)	5789 (227.9)	1140	1085	730	705	595	555	9.0 (19.9)
KL230HBS55D		2108 (83.0)	1908 (75.1)	6121 (241.0)	1210	1145	775	750	635	590	9.5 (20.8)
KL230HBS58D		2212 (87.1)	2012 (79.2)	6454 (254.1)	1270	1205	815	790	665	620	9.9 (21.8)
KL345HB7S761D	345	2314 (91.1)	2144 (84.4)	6787 (267.2)	1350	1285	870	840	710	660	10.3 (22.7)
KL345HB7S764D		2418 (95.2)	2248 (88.5)	7122 (280.4)	1415	1345	910	885	745	695	10.7 (23.6)
KL345HB7S767D		2522 (99.3)	2357 (92.8)	7452 (293.4)	1480	1410	955	925	785	730	11.5 (25.4)
KL345HB7S770D		2624 (103.3)	2461 (96.9)	7785 (306.5)	1545	1470	1000	970	820	765	12.0 (26.3)
KL400HB7S773D	400	2728 (107.4)	2512 (98.9)	8118 (319.6)	1580	1500	1020	990	835	780	13.8 (30.3)
KL400HB7S776D		2832 (111.5)	2616 (103.0)	8451 (332.7)	1640	1560	1060	1030	870	815	14.1 (31.0)
KL400HB7S779D		2935 (115.6)	2649 (104.3)	8783 (345.8)	1660	1580	1075	1045	885	825	14.4 (31.7)

Notes:

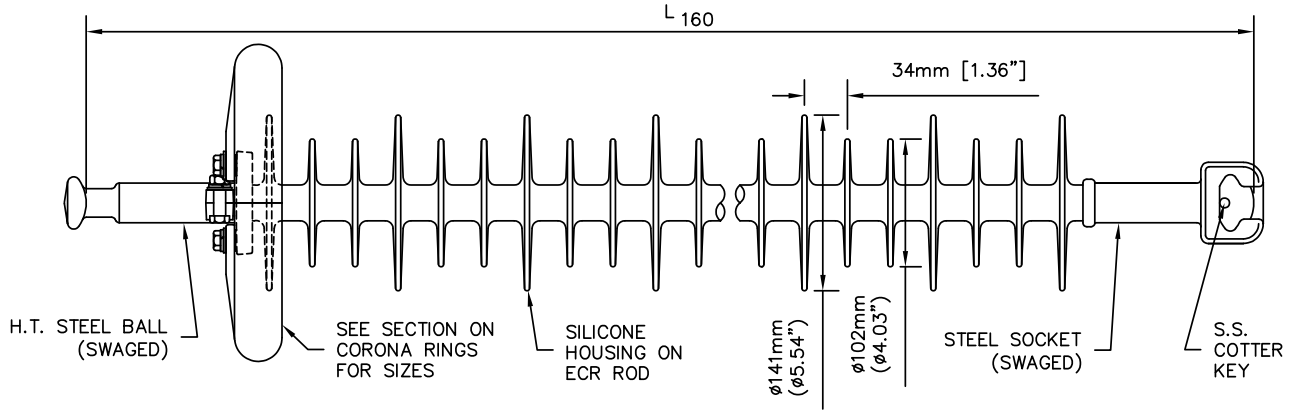
1. See page 8 for correction factors for values for insulators without corona rings.
2. Section lengths are based on ANSI ball and socket hardware and 133 kN (30,000 lbs) SML rating. For lengths of insulators with alternate end fittings combination see Section Lengths.
3. Weight includes standard rings where applicable. See section on Corona Rings.

The formula for the catalogue number of a typical insulator is shown below. For specific catalogue number please contact **KLI.**

Cat. No. KL 115 H BS 28D X

- KL — Company ID
- 115 — Voltage Class (See Tech. Data)
- H — High Leakage
- BS — End Fitting Designation (See End Fittings)
- 28D — No. of Sheds (See Tech. Data)
- X — Other Options

TRANSMISSION DEADEND / SUSPENSION INSULATORS - 160 kN (36,000 lbs)



TECHNICAL DATA: All values refer to insulators with the appropriate voltage class corona rings installed. (Note 1)

Catalogue Number	Voltage Class	Section Length (Note 2) L	Dry Arcing Distance	Leakage Distance	Positive Critical Impulse Flashover	Impulse Withstand	Low Frequency Dry		Low Frequency Wet		Weight (Note 3)
	kV	mm (in)	mm (in)	mm (in)	kV	kV	Flashover kV	Withstand kV	Flashover kV	Withstand kV	kg (lb)
KL161H1BS40	161	1638 (64.5)	1420 (55.9)	4458 (175.5)	900	855	565	535	460	430	7.6 (16.7)
KL161H1BS43		1742 (68.6)	1521 (59.9)	4790 (188.6)	965	915	605	580	495	460	8.0 (17.6)
KL161H1BS46		1847 (72.7)	1626 (64.0)	5123 (201.7)	1030	980	650	625	535	495	8.4 (18.5)
KL230H1BS49	230	1951 (76.8)	1702 (67.0)	5456 (214.8)	1080	1025	685	660	560	520	8.8 (19.3)
KL230H1BS52		2052 (80.8)	1803 (71.0)	5789 (227.9)	1140	1085	730	705	595	555	9.2 (20.2)
KL230H1BS55		2156 (84.9)	1908 (75.1)	6121 (241.0)	1210	1145	775	750	635	590	9.6 (21.1)
KL230H1BS58		2261 (89.0)	2012 (79.2)	6454 (254.1)	1270	1205	815	790	665	620	10.0 (22.0)
KL345HBS61	345	2362 (93.0)	2144 (84.4)	6787 (267.2)	1350	1285	870	840	710	660	10.4 (22.9)
KL345HBS64		2466 (97.1)	2248 (88.5)	7120 (280.3)	1415	1345	910	885	745	695	10.8 (23.8)
KL345HBS67		2573 (101.3)	2357 (92.8)	7452 (293.4)	1480	1410	955	925	785	730	11.5 (25.4)
KL345HBS70		2677 (105.4)	2461 (96.9)	7785 (306.5)	1545	1470	1000	970	820	765	12.0 (26.3)
KL400HBS73	400	2781 (109.5)	2512 (98.9)	8118 (319.6)	1580	1500	1020	990	835	780	13.4 (29.4)
KL400HBS76		2883 (113.5)	2616 (103.0)	8451 (332.7)	1640	1560	1060	1030	870	815	13.8 (30.3)
KL400HBS79		2987 (117.6)	2753 (108.4)	8783 (345.8)	1725	1640	1115	1085	920	855	14.1 (31.0)

Notes:

1. See page 8 for correction factors for values for insulators without corona rings.
2. Section lengths are based on ANSI ball and socket hardware and 160 kN (36,000 lbs) SML rating. For lengths of insulators with alternate end fittings combination see Section Lengths.
3. Weight includes standard rings where applicable. See section on Corona Rings.

The formula for the catalogue number of a typical insulator is shown below. For specific catalogue number please contact **KLI**.

Cat. No. KL 161 H BS 40 X

- KL — Company ID
- 161 — Voltage Class (See Tech. Data)
- H — High Leakage
- BS — End Fitting Designation (See End Fittings)
- 40 — No. of Sheds (See Tech. Data)
- X — Other Options

SECTION LENGTHS

The section lengths, (L) published on the Technical Data sheet, are of insulators with the ANSI Ball and Socket end fittings. For alternate combinations of end fittings, use the following table to establish section lengths.

SECTION LENGTH ADJUSTMENT

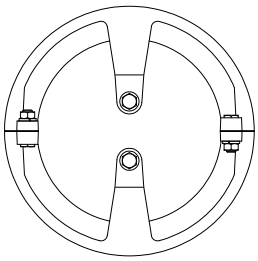
End Fitting	End Fitting Designation		Section Length		
	90 kN	120 kN, 133 kN, & 160 kN	For 90 kN Fittings	For 120 kN & 133 kN Fittings	For 160 kN Fittings
ANSI Ball / Socket	B1S1	BS	L_{90} (page 3)	L_{120} (page 4 or 5)	L_{160} (page 6)
ANSI Ball / Y-clevis	B1Y1	BY	L_{90} + 29mm (1.1”)	L_{120} + 34mm (1.3”)	L_{160} + 74mm (3.0”)
ANSI Ball / Oval Eye	B1E1	BE	L_{90} + 45mm (1.8”)	L_{120} + 39mm (1.5”)	L_{160} + 65mm (2.6”)
Oval Eye / Oval Eye	E1E1	EE	L_{90} + 100mm (4.0”)	L_{120} + 84mm (3.3”)	L_{160} + 52mm (2.1”)
Clevis / Tongue	C3T8	CT	L_{90} – 0.3mm (0.1”)	L_{120} + 21mm (0.8”)	-

CORONA RINGS

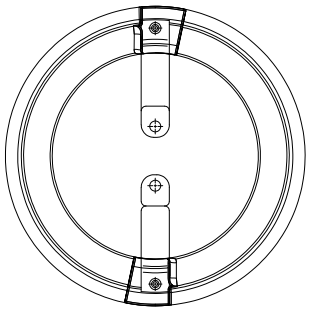
High voltage lines above 88 kV phase-to-phase can generate unnecessary noise (RI and TVI) and corona due to the high electrical stress concentration. To minimize these effects, Gradient or Corona Rings are installed on the end fitting of the insulator. Guidelines used in the application of these rings are noted below.

Insulators that are used on system voltages above 88 kV and below 150 kV are supplied with a built-in Gradient Ring. Insulators that are used on system voltages from 150 kV to 275 kV are supplied with a separate Corona Ring for assembly in the field before installation. Above 275 kV an additional ring is required on the ground end fitting. The large rings are designed for installation in only one orientation and location to prevent misapplication. These rings are made from aluminum making them light weight and corrosion resistant.

Ø3-1/4” Gradient Ring
88 kV to 150 kV



Ø10” Corona Ring
150 kV to 230 kV

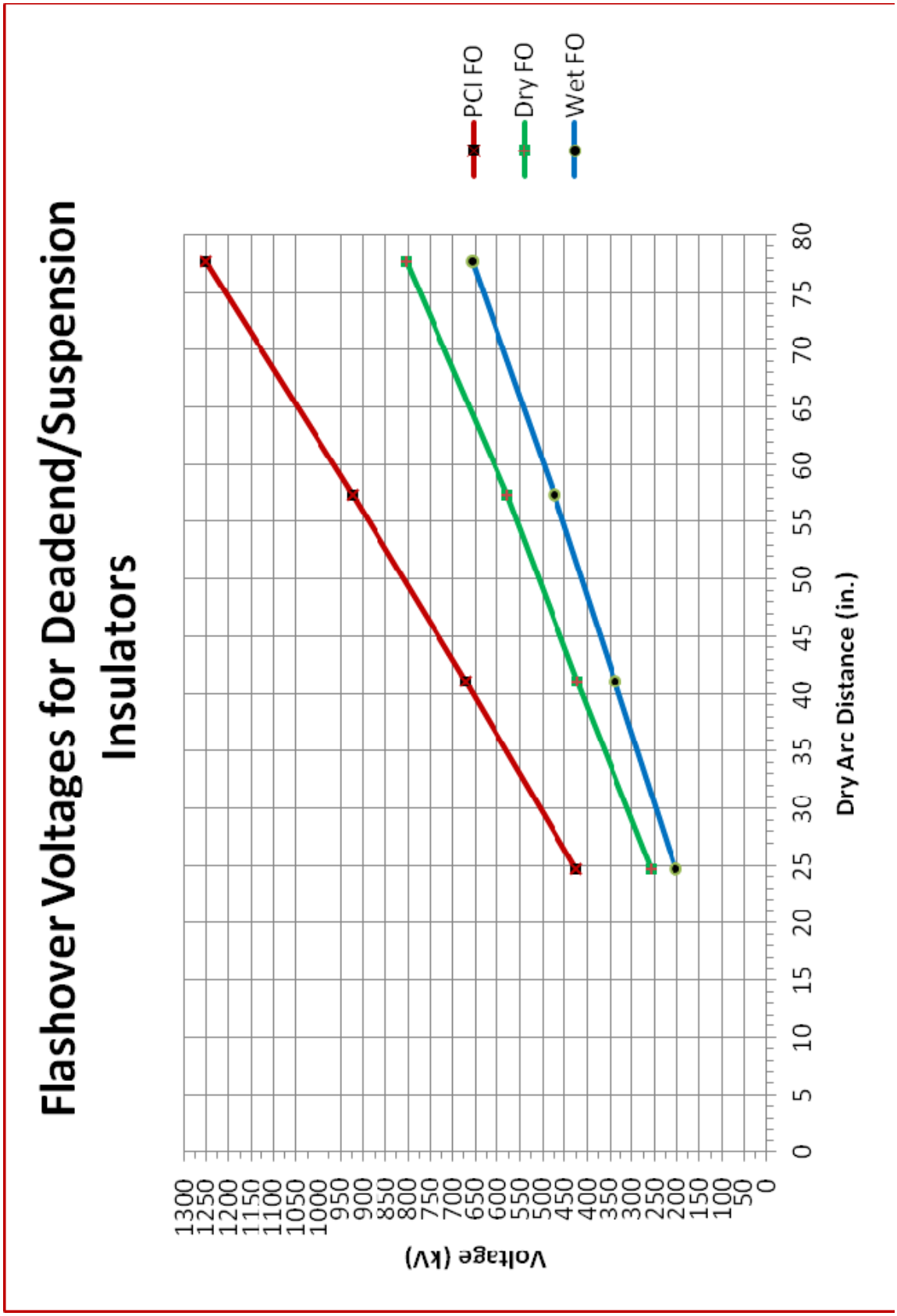


Ø12” Corona Ring
345 kV to 400 kV

System Voltage (kV)	Energized End		Ground End	
	Ring Needed	Ring Size	Ring Needed	Ring Size
69	No	-	No	-
115	Yes	Φ3¼”	No	-
138	Yes	Φ 3¼”	No	-
161	Yes	Φ 10”	No	-
230	Yes	Φ 10”	No	-
275	Yes	Φ 10”	Yes	Φ 3¼”
345	Yes	Φ 12”	Yes	Φ 3¼”
400	Yes	Φ 12”	Yes	Φ 10”

The values given in the tables on page 3 through 6 refer to insulators complete with the appropriate Corona Rings for the voltage class indicated in the tables.

Corona Rings necessarily reduce the dry arc distance for a given insulator and give lower electrical values than could be anticipated for the insulator without rings as shown in the following figure.



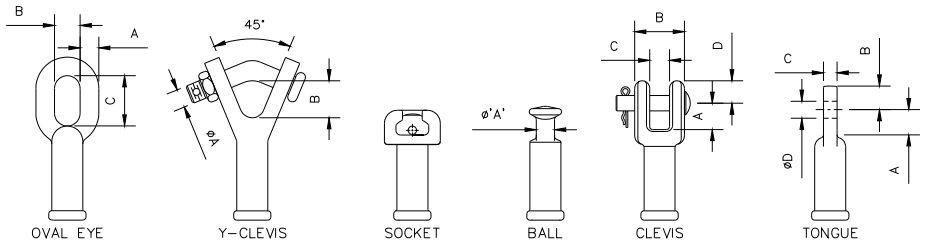
END FITTINGS

The end fittings on the transmission insulator are made of high strength, forged steel or cast iron. The insulators have a specified mechanical load (SML) rating of 90 kN (20,000 lbs.), 120 kN (27,000 lbs.), 133 kN (30,000 lbs.), or 160 kN (36,000 lbs.). The insulators are routine tension tested to 45 kN (10,000 lbs.), 60 kN (13,500 lbs.), 67 kN (15,000 lbs.) or 80 kN (18,000 lbs.), respectively.

The end fittings are swaged on the core rod to provide the mechanical performance and reduce stress concentration. Our proprietary design ensures a watertight seal between the rubber and end fitting interface. This special silicone rubber to metal fittings to rod sealing process prevents moisture ingress to the fiberglass core rod.

Hot-dip galvanizing to CSA G164 or ASTM A153 Standard provides corrosion protection of the end fittings. The cotter key is made from stainless steel.

The standard end fittings available are listed and detailed below. For other special end fittings, such as Charpy V-notch tested fittings contact **KLI**.



END FITTING RATINGS AND DIMENSIONS

End Fitting	End Fitting Designation	SML kN (lbs)	Class	Dimensions (in)				
				A	B	C	D	E
Oval Eye	E	90 (20,000)	-	0.75	1.03	2.03	-	-
		120 (27,000) 133 (30,000)	-	0.75	1.03	2.03	-	-
		160 (36,000)	-	0.78	1.02	2.00		
Y-Clevis	Y	90 (20,000)	-	0.75	1.49	-	-	-
		120 (27,000) 133 (30,000)	-	0.75	1.49	-	-	-
		160 (36,000)	-	0.75	1.89			
Socket	S	90 (20,000)	ANSI 52-5	-	-	-	-	-
		120 (27,000) 133 (30,000)	ANSI 52-5	-	-	-	-	-
		160 (36,000)	ANSI 52-8	-	-	-	-	-
IEC Ball	B_A	90 (20,000)	IEC 16A	16 mm	-	-	-	-
		120 (27,000) 133 (30,000)	IEC 16A	16 mm	-	-	-	-
		160 (36,000)	IEC 20	20 mm	-	-	-	-
ANSI Ball	B	90 (20,000)	ANSI 52-5	0.72	-	-	-	-
		120 (27,000) 133 (30,000)	ANSI 52-5	0.72	-	-	-	-
		160 (36,000)	ANSI 52-8	0.88	-	-	-	-
Clevis	C	90 (20,000)	ANSI 52-6	1.11	1.69	0.81	0.87	0.63
		120 (27,000) 133 (30,000)	ANSI 52-6	1.06	2.00	0.80	0.90	0.63
		160 (36,000)	ANSI 52-10					
Tongue	T	90 (20,000)	-	1.11	0.88	0.62	0.69	-
		120 (27,000) 133 (30,000)	-	1.01	0.96	0.53	0.69	-
		160 (36,000)						

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