TRANSMISSION SILICONE INSULATORS
Deadend / Suspension
69 kV to 400 kV
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)

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<th>Catalogue Number</th>
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<th>Dry Arcing Distance</th>
<th>Leakage Distance</th>
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<th>Impulse Withstand</th>
<th>Low Frequency Dry</th>
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<th>Weight (Note 3)</th>
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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.
**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)

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**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**

- **Company ID**
- **Voltage Class (See Tech. Data)**
- **High Leakage**
- **Other Options**
  - **No. of Sheds (See Tech. Data)**
  - **End Fitting Designation (See End Fittings)**

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*Note 1: See page 8 for correction factors for values for insulators without corona rings.*

*Note 2: See Section on Corona Rings for sizes.*

*Note 3: See section on Corona Rings.*
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)

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<th>Leakage Distance (mm)</th>
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<th>Impulse Withstand (kV)</th>
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<td>635</td>
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<td>2012 (79.2)</td>
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<td>1205</td>
<td>815</td>
<td>790</td>
<td>665</td>
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</tr>
<tr>
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<td>2314 (91.1)</td>
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<td>1285</td>
<td>870</td>
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<td>885</td>
<td>745</td>
<td>10.7 (23.6)</td>
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<td>1410</td>
<td>955</td>
<td>925</td>
<td>785</td>
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<td>1000</td>
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<td>12.0 (26.3)</td>
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<td>990</td>
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<td>1060</td>
<td>1030</td>
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<td>14.1 (31.0)</td>
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<td>1580</td>
<td>1075</td>
<td>1045</td>
<td>885</td>
<td>14.4 (31.7)</td>
</tr>
</tbody>
</table>

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

Company ID
Voltage Class (See Tech. Data)
High Leakage
Other Options
No. of Sheds (See Tech. Data)
End Fitting Designation (See End Fittings)
TECHNICAL DATA: All values refer to insulators with the appropriate voltage class corona rings installed. (Note 1)

<table>
<thead>
<tr>
<th>Catalogue Number</th>
<th>Voltage Class</th>
<th>Section Length (Note 2)</th>
<th>Dry Arcing Distance</th>
<th>Leakage Distance</th>
<th>Positive Critical Impulse Flashover</th>
<th>Impulse Withstand</th>
<th>Low Frequency Dry</th>
<th>Low Frequency Wet</th>
<th>Weight (Note 3)</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>L</td>
<td>(mm)</td>
<td>(mm)</td>
<td>(kV)</td>
<td>(kV)</td>
<td>(kV)</td>
<td>(kV)</td>
<td>(kg (lb))</td>
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<tr>
<td>KL161HBS40</td>
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<td>1638 (64.5)</td>
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<td>4458 (175.5)</td>
<td>900</td>
<td>855</td>
<td>565</td>
<td>535</td>
<td>460 (430)</td>
</tr>
<tr>
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<td>1521 (59.9)</td>
<td>4790 (188.6)</td>
<td>965</td>
<td>915</td>
<td>605</td>
<td>580</td>
<td>495</td>
<td>460 (400)</td>
</tr>
<tr>
<td>KL161HBS46</td>
<td>1847 (72.7)</td>
<td>1626 (64.0)</td>
<td>5123 (201.7)</td>
<td>1030</td>
<td>980</td>
<td>650</td>
<td>625</td>
<td>535</td>
<td>495 (450)</td>
</tr>
<tr>
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<td>1951 (76.8)</td>
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<td>1080</td>
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<td>685</td>
<td>660</td>
<td>560</td>
<td>520 (480)</td>
</tr>
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<td>1140</td>
<td>1085</td>
<td>730</td>
<td>705</td>
<td>595</td>
<td>555 (515)</td>
</tr>
<tr>
<td>KL230HBS55</td>
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<td>1908 (75.1)</td>
<td>6121 (241.0)</td>
<td>1210</td>
<td>1145</td>
<td>775</td>
<td>750</td>
<td>635</td>
<td>590 (550)</td>
</tr>
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<td>KL230HBS58</td>
<td>2261 (89.0)</td>
<td>2012 (79.2)</td>
<td>6454 (254.1)</td>
<td>1270</td>
<td>1205</td>
<td>815</td>
<td>790</td>
<td>665</td>
<td>620 (580)</td>
</tr>
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<td>2362 (93.0)</td>
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<td>6787 (267.2)</td>
<td>1350</td>
<td>1285</td>
<td>870</td>
<td>840</td>
<td>710</td>
<td>660 (620)</td>
</tr>
<tr>
<td>KL345HBS64</td>
<td>2466 (97.1)</td>
<td>2248 (88.5)</td>
<td>7120 (280.3)</td>
<td>1415</td>
<td>1345</td>
<td>910</td>
<td>885</td>
<td>745</td>
<td>695 (655)</td>
</tr>
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<td>KL345HBS67</td>
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<td>7452 (293.4)</td>
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<td>1410</td>
<td>955</td>
<td>925</td>
<td>785</td>
<td>730 (690)</td>
</tr>
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<td>KL345HBS70</td>
<td>2677 (105.4)</td>
<td>2461 (96.9)</td>
<td>7785 (306.5)</td>
<td>1545</td>
<td>1470</td>
<td>1000</td>
<td>970</td>
<td>820</td>
<td>765 (725)</td>
</tr>
<tr>
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<td>2781 (109.5)</td>
<td>2512 (98.9)</td>
<td>8118 (319.6)</td>
<td>1580</td>
<td>1500</td>
<td>1500</td>
<td>990</td>
<td>835</td>
<td>780 (740)</td>
</tr>
<tr>
<td>KL400HBS76</td>
<td>2883 (113.5)</td>
<td>2616 (103.0)</td>
<td>8451 (332.7)</td>
<td>1640</td>
<td>1560</td>
<td>1060</td>
<td>1030</td>
<td>870</td>
<td>815 (775)</td>
</tr>
<tr>
<td>KL400HBS79</td>
<td>2987 (117.6)</td>
<td>2753 (108.4)</td>
<td>8783 (345.8)</td>
<td>1725</td>
<td>1640</td>
<td>1115</td>
<td>1085</td>
<td>920</td>
<td>855 (815)</td>
</tr>
</tbody>
</table>

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.
### 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

<table>
<thead>
<tr>
<th>End Fitting</th>
<th>End Fitting Designation</th>
<th>Section Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>90 kN 120 kN, 133 kN, &amp; 160 kN</td>
<td>For 90 kN Fittings</td>
</tr>
<tr>
<td>ANSI Ball / Socket</td>
<td>B1S1 BS</td>
<td>L₉₀ (page 3)</td>
</tr>
<tr>
<td>ANSI Ball / Y-clevis</td>
<td>B1Y1 BY</td>
<td>L₉₀ + 29mm (1.1&quot;)</td>
</tr>
<tr>
<td>ANSI Ball / Oval Eye</td>
<td>B1E1 BE</td>
<td>L₉₀ + 45mm (1.8&quot;)</td>
</tr>
<tr>
<td>Oval Eye / Oval Eye</td>
<td>E1E1 EE</td>
<td>L₉₀ + 100mm (4.0&quot;)</td>
</tr>
<tr>
<td>Clevis / Tongue</td>
<td>C3T8 CT</td>
<td>L₉₀ – 0.3mm (0.1&quot;)</td>
</tr>
</tbody>
</table>

#### 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.

<table>
<thead>
<tr>
<th>System Voltage (kV)</th>
<th>Energized End</th>
<th>Ground End</th>
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<tbody>
<tr>
<td></td>
<td>Ring Needed</td>
<td>Ring Size</td>
</tr>
<tr>
<td>69</td>
<td>No</td>
<td>-</td>
</tr>
<tr>
<td>115</td>
<td>Yes</td>
<td>Ф3¼&quot;</td>
</tr>
<tr>
<td>138</td>
<td>Yes</td>
<td>Ф3¼&quot;</td>
</tr>
<tr>
<td>161</td>
<td>Yes</td>
<td>Ф10&quot;</td>
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<tr>
<td>230</td>
<td>Yes</td>
<td>Ф10&quot;</td>
</tr>
<tr>
<td>275</td>
<td>Yes</td>
<td>Ф10&quot;</td>
</tr>
<tr>
<td>345</td>
<td>Yes</td>
<td>Ф12&quot;</td>
</tr>
<tr>
<td>400</td>
<td>Yes</td>
<td>Ф12&quot;</td>
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</tbody>
</table>
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.
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.

<table>
<thead>
<tr>
<th>End Fitting</th>
<th>End Fitting Designation</th>
<th>SML kN (lbs)</th>
<th>Class</th>
<th>Dimensions (in)</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>Class</td>
<td>A</td>
<td>B</td>
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<tr>
<td>Oval Eye</td>
<td>E</td>
<td>90 (20,000)</td>
<td>-</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120 (27,000)</td>
<td>-</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>133 (30,000)</td>
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<td>0.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>160 (36,000)</td>
<td>-</td>
<td>0.75</td>
</tr>
<tr>
<td>Y-Clevis</td>
<td>Y</td>
<td>90 (20,000)</td>
<td>-</td>
<td>0.75</td>
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<td></td>
<td></td>
<td>120 (27,000)</td>
<td>-</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>133 (30,000)</td>
<td>-</td>
<td>0.75</td>
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<tr>
<td></td>
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<td>160 (36,000)</td>
<td>-</td>
<td>0.75</td>
</tr>
<tr>
<td>Socket</td>
<td>S</td>
<td>90 (20,000)</td>
<td>ANSI 52-5</td>
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<td></td>
<td>120 (27,000)</td>
<td>ANSI 52-5</td>
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</tr>
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<td>133 (30,000)</td>
<td>ANSI 52-8</td>
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<td></td>
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<td>160 (36,000)</td>
<td>IEC 16A</td>
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<tr>
<td>IEC Ball</td>
<td>B_A</td>
<td>120 (27,000)</td>
<td>IEC 16A</td>
<td>16 mm</td>
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<td>133 (30,000)</td>
<td>IEC 20</td>
<td>20 mm</td>
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<td>160 (36,000)</td>
<td>IEC 20</td>
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</tr>
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<td>120 (27,000)</td>
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<td>1.01</td>
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