Electric Vehicle Power Solutions

power to perform
Transformers are increasingly being used to power electric vehicle (EV) charging stations. HPS offers a broad line of electric vehicle magnetic solutions to meet the needs of level 1, 2 or 3 charging installations (see table below).

Several considerations apply when integrating transformers and EV chargers. EV chargers act as non-linear loads to the power grid which cause current and voltage harmonics and distortion. These harmonics make the proper selection of a transformer critical to the operation of both the transformer and the overall system.

### Types Of Electric Vehicle Chargers:

<table>
<thead>
<tr>
<th></th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Load Per Unit</td>
<td>1 to 2 kVA</td>
<td>3 to 8 kVA</td>
<td>200 to 500 kVA</td>
</tr>
<tr>
<td>Typical Feed Voltage</td>
<td>120 to 240</td>
<td>208, 240 to 480, 600</td>
<td>480, 600 or medium voltage</td>
</tr>
<tr>
<td>Phase</td>
<td>Single phase</td>
<td>Single or Three phase</td>
<td>Three phase</td>
</tr>
</tbody>
</table>

### Typical HPS Electric Vehicle Charging Magnetic Products

<table>
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<tbody>
<tr>
<td>Single Phase, Low Voltage</td>
<td>HPS Fortress</td>
<td>HPS Fortress</td>
<td>HPS Sentinel G</td>
</tr>
<tr>
<td></td>
<td>HPS PowerPlus</td>
<td>HPS PowerPlus</td>
<td></td>
</tr>
<tr>
<td>Three Phase, Low Voltage</td>
<td>HPS Fortress</td>
<td>HPS Sentinel K</td>
<td>HPS Sentinel K</td>
</tr>
<tr>
<td></td>
<td>HPS Sentinel G</td>
<td>HPS Sentinel H</td>
<td>HPS Sentinel H</td>
</tr>
<tr>
<td></td>
<td>HPS Sentinel K</td>
<td>HPS Autotransformer</td>
<td>HPS Autotransformer</td>
</tr>
<tr>
<td>Three Phase, Medium Voltage</td>
<td>N/A</td>
<td>HPS Millennium Series</td>
<td>HPS Millennium Series</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HPS EnduraCoil</td>
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</tr>
</tbody>
</table>

**Encapsulated Transformers - HPS Fortress & HPS Titan**

For smaller level 1 and 2 installations using single phase loads, HPS offers a broad line of solutions including our non-ventilated, encapsulated HPS Fortress Series. For locations requiring a hazardous location rating HPS offers the HPS Titan Series.

**Mini Power Centers - HPS PowerPlus**

The HPS PowerPlus Mini Power Center can offer a securable power distribution point with a primary disconnect, single phase transformer and secondary panel to power one or more level 1 and 2 EV chargers.
Electric Vehicle Power Solutions

**Level 1 & 2**

- **Chargers per Transformer**: 1 to 2
- **Transformer**: Single Phase
- **Allowance for Harmonic Distortion**: kVA increased for harmonic heating
- **Voltage Transient Damage**: Consider snubber protection
- **Inside Location**: 150°C Temperature rise
- **Outside Location**: 150°C Temperature rise if avg. <30°C
  Otherwise consider 130°C or 115°C
  Tamperproof
  Type 3RE enclosure

**Level 2**

- **Chargers per Transformer**: 3+
- **Transformer**: Three Phase
- **Allowance for Harmonic Distortion**: K = 4 minimum
  K = 9 better
  Harmonic Mitigating best
- **Voltage Transient Damage**: Consider Harmonic Mitigating if 2 or more
- **Inside Location**: 150°C Temperature rise
- **Outside Location**: 150°C Temperature rise if avg. <30°C
  Otherwise consider 130°C or 115°C
  Tamperproof
  Type 3RE enclosure

**Level 3**

- **Chargers per Transformer**: 1 or more
- **Transformer**: Three Phase
- **Allowance for Harmonic Distortion**: K = 9
- **Voltage Transient Damage**: Consider Harmonic Mitigating if 2 or more
- **Inside Location**: 150°C Temperature rise
- **Outside Location**: 150°C Temperature rise if avg. <30°C
  Otherwise consider 130°C or 115°C
  Tamperproof
  Type 3RE enclosure

**EV Transformer Specification Considerations**

<table>
<thead>
<tr>
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</table>
| **Allowance for Harmonic Distortion** | kVA increased for harmonic heating | K = 4 minimum | K = 9 better
  Harmonic Mitigating best |
| **Voltage Transient Damage** | Consider snubber protection |
| **Inside Location** | 150°C Temperature rise |
| **Outside Location** | 150°C Temperature rise if avg. <30°C
  Otherwise consider 130°C or 115°C
  Tamperproof
  Type 3RE enclosure |

This chart provides recommendations for a transformer’s k-factor to overcome the extra heating from the EV charger’s harmonic distortion. In addition, consider low temperature rise transformers if the ambient temperature regularly exceeds a 30°C average during a 24 hour period.