The Bare Minimum - Discharge Voltage & MCOV

Example

Substation BIL: 650kV
Nominal Voltage: 138kV Ph-Ph
Grounding: Low impedance

Specify arrester using below table

<table>
<thead>
<tr>
<th>Nominal Voltage (Ph-G)</th>
<th>TEMPORARY OVERVOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.25 x Vnom</td>
<td></td>
</tr>
<tr>
<td>1.4 x Vnom</td>
<td></td>
</tr>
<tr>
<td>1.73 x Vnom</td>
<td></td>
</tr>
</tbody>
</table>

**System or Equipment BIL**

*Ageing of insulation (-10%)*

*Design margin (-10%)*

*+5% of Vnom*

**Temporary Overvoltage**

*Pick arrester with discharge or residual voltage rating below this limit*

**Maximum Voltage (Ph-G)**

**Nominal Voltage (Ph-G)**

**THE DETAILS - TOV & ENERGY CLASS**

<table>
<thead>
<tr>
<th>Maximum System Voltage</th>
<th>Rated Voltage</th>
<th>Max. continuous operating voltage (Ph-PH)</th>
<th>TOV capability R</th>
<th>Max. residual voltage with current wave 30/60 µs</th>
<th>8/20 µs</th>
</tr>
</thead>
<tbody>
<tr>
<td>145</td>
<td>108 Id</td>
<td>90.0 x 124</td>
<td>118</td>
<td>223 231 242 254 260 270 280 290 300 310 320</td>
<td>330</td>
</tr>
<tr>
<td>132</td>
<td>92 Id</td>
<td>88.0 x 126</td>
<td>132</td>
<td>245 257 269 274 279 284 294 304 311 316 326</td>
<td>336</td>
</tr>
<tr>
<td>138</td>
<td>92 Id</td>
<td>90.0 x 111</td>
<td>151</td>
<td>259 265 280 293 298 304 310 316 322 330 340</td>
<td>348</td>
</tr>
<tr>
<td>144</td>
<td>92 Id</td>
<td>90.0 x 115</td>
<td>158</td>
<td>297 308 323 332 335 342 347 352 363 373 384</td>
<td>387</td>
</tr>
</tbody>
</table>

**MCOV Calculations**

Maximum voltage (Ph-Ph): 138 x 1.05 = 145kV
Maximum voltage (Ph - G): 145/Sqrt(3) = 84kV

**Discharge voltage calculations**

Removing 20% from 650 yields - 520kV BIL

**Using table, an adequate arrester has**

86kV MCOV and 280kV discharge voltage @10kA

**SPECIFYING LIGHTNING ARRESTER FOR SUBSTATIONS**

Based on IEEE standards

**During arrester operation, primarily due to a switching surge, the surge current generates heat.**

**If the heat produced > heat dissipated, even after system restoration, the arrester fails.**

IEEE C62.11 defines classes A thru N, with N having the highest energy rating.

Are you installing arresters in a system with excessive switching operation? Specify one with a higher energy class.

Additional Details At PEguru.com