ALPS Series Compensation Calculations with Parallel MOV and gaps

GE Power Management No. GET-8413

If both an MOV and a gap are used in parallel for a series capacitor, the highest MOV protective/gap flashing protective level should be used for each compensation capacitor, where the gaps don't flash on minimum fault current.

For example, given the following given series capacitor and CVT values:

- Series capacitor impedance: 29.92 Ω
- Series capacitor rating current: 2360 A
- Protective level of MOV and gaps: 230 kV peak value
- CVT ratio: 500000 / 100

In this case, there is only one capacitor; thus, there is only one protective level PL_1 to be considered. We have

$$PT_m = \frac{PT_{\text{L-L sec. volts}}}{\sqrt{3}} \times \sqrt{2} = \frac{100\ \text{V}}{\sqrt{3}} \times \sqrt{2} \approx 82\ \text{V} \quad \text{(EQ 1)}$$

$$PL_1 = \frac{\text{MOV Protective Level}}{\text{PT Ratio}} = \frac{230\ \text{kV}}{500000/100} = 46\ \text{V} \quad \text{(EQ 2)}$$

Since there is only one protective level PL_1:

$$PL_t = \frac{1}{PT_m} \sum_{1}^{n} PL_n = \frac{1}{46\ \text{V}} \times 82\ \text{V} = 0.56\ \text{pu} \quad \text{(EQ 3)}$$

Therefore, the phase and ground level detector settings are:

$$\textbf{Z1PLEVDET} = \sqrt{0.15 + 1.3 PL_t^2} = \sqrt{0.15 + 1.3 \times (0.56)^2} = 0.75 \quad \text{(EQ 4)}$$

$$\textbf{Z1GLEVDET} = \sqrt{0.15 + PL_t^2} = \sqrt{0.15 + (0.56)^2} = 0.68 \quad \text{(EQ 5)}$$