C37.04 TF on 3 Phase Line Faults and Critical Currents Synopsis of Meeting on 2011 11 October Nashville TN

Attendance: 19 Members and 26 Guests

3 Phase Line Faults

After a brief review of the 3 phase line fault TRV concern, an intense discussion ensued around 3 options to include in C37.04:

1) Do Nothing: This includes a note on the higher TRV first peak and slightly lower slope of the 3 phase line fault TRV and reference to CIGRE Brochure 408.

   Devise a new 3phase line fault TRV requirement and test and:

2) Make it mandatory
3) Make it optional

Variations to the options were discussed, the most notable being to validate a CFD (Computational Fluid Dynamics) model at existing L90 and L75 test conditions, and apply the 3 phase line fault TRV parameters to the model to verify performance. This would take the place of additional laboratory testing.

The sense of the group seemed divided between options 1 and 3, with only one favoring option 2. A further point was brought out that even making an optional rating/test might give the whole subject more visibility than might be prudent, given the fact that it is at this time an "academic" issue with no proven practical significance.

After much "hand wringing" a straw poll of the attendees was taken with the following results: option 1 19; option 2 1, option 3 12 not voting 13. Option 1 has a clear plurality. Given the large field of important issues demanding our attention, the Three Phase Line fault TRV issue ranks much lower than others, and it seems most prudent to move on.

Below is a suggested note developed by the chair for possible inclusion into C37.04:

"Note: *Three Phase Line Fault TRVs*

CIGRE Brochure 408 deals with this subject in detail. The Summary pp. 8,9; Risk Tolerance pg. 99; Long Line Fault conclusions pg. 106; and General Conclusions pg. 109 give a good view of industry expert opinion.

Synopsis: The Standard SLF (Short Line Fault) test protocol is based on single line to ground faults. However, keeping fault current constant, a 3 phase line fault will exhibit a TRV first peak (peak value of the sawtooth wave) about 1.5 times higher than a single phase line fault. The slope of the TRV (dV/dt) will be only about 80% of the phase to ground fault TRV. For various reasons presented in CIGRE Brochure 408, the slope of the TRV is considered a more onerous requirement than the magnitude of the first peak. Many experts believe the higher first peak is of little consequence, and no direct test is necessary demonstrate that this is so.

The probability of getting the worst case line fault TRV first peak is small because

1) *3 phase line faults are less likely than 3phase faults by at least an order of magnitude.*
2) *Having a 3 phase line fault with more than 80% of the rated short circuit at the supply bus is highly unlikely.*

There are no known cases of circuit breaker failure ,where inability to withstand a 3 phase line fault TRV is the cause of the failure.

The high TRV peak due to long line faults is considered to be adequately covered by the T10 test (which requires a 1.5 first pole to clear factor) and for higher currents the OOP test with the shorter time to peak. (A T30 with a 1.5 first pole to clear factor would also cover most all long line fault TRV peaks.)"

Critical Currents

Critical current requirements and tests are an attempt to prevent circuit breakers which have "holes" in their interrupting capabilities over the full range of faults, from entering the market place.

WE discussed adding more test increments (picket fence) or having one artificially high SLF test (big top tent) to cover the likely critical current areas.

The proposed course is to adapt the IEC approach for identifying breakers with possible "holes" and then add an SLF or ITRV test at the identified critical current.

Respectfully Submitted,
and offering the reader Grace & Peace

Roy Alexander
Chair 3phase line fault and Critical currents TF