

ABSTRACT

WITHSTAND TESTS – MORE THAN MEETS THE EYE

Fall ICC Meeting 2008
Subcommittee F – Field Testing and Diagnostics

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High voltage withstand tests are employed by a large number of North American utilities as part of their reliability programs. In fact, according to a study conducted in 2006 by NEETRAC for the Cable Diagnostic Focused Initiative (CDFI), approximately 33% of the member utilities routinely employing diagnostic tests use some form of withstand. Previous work reported to ICC has described the benefits of withstand tests in terms of future freedom from failures and the added information content when the hold portion of the withstand test is monitored in some convenient way. It is, therefore, worthwhile examining the diagnostic understanding that can become available from the use of elevated voltage on cable systems, or simple Hipots. Traditionally, withstand tests have been thought of as purely the survival through the “hold” portion (Figure 1) where the Passes greatly outnumber the Fails (Figure 2). However, many utilities employing withstand tests typically record a wealth of additional information during each test that can include segment information (length), voltage, leakage current, and, most importantly, when the cable system failed (V_f or t_f – Figure 1). This presentation starts with these data (field data obtained from several large US utilities) and explores some of the useful diagnostic outcomes that can be derived.

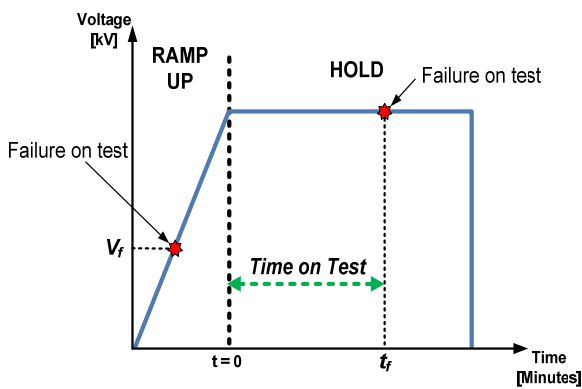


Figure 1: Withstand test “ramp up” and “hold” phases.

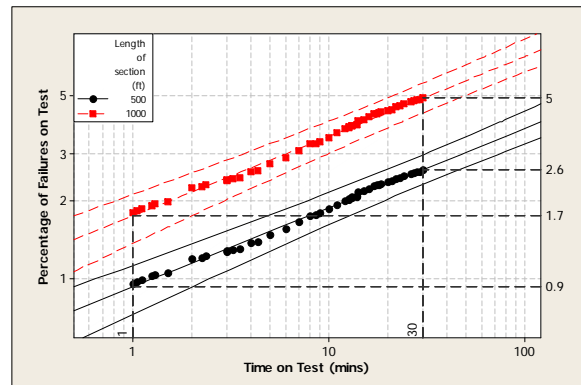


Figure 2: Failure on test rates for different segment length, for the 30 minute test recommended by IEEE400.2.

The issues that can be quantitatively examined include:

- Test time (Figure 2)
- Test voltage
- Likely outcomes for different sizes of cable system (Figure 2)
- The importance of the voltage ramp (Figure 3)
- Prioritization of different parts of the cable system for future test / actions (Figure 4)

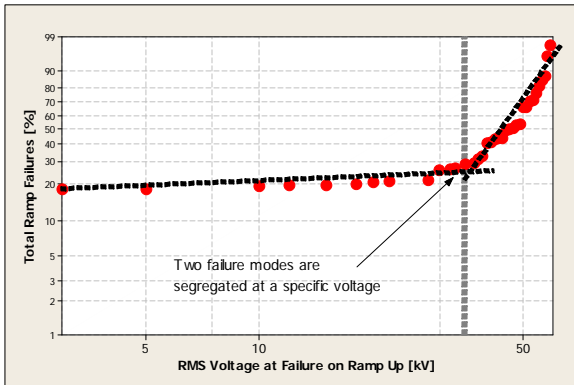


Figure 3: Weibull curves showing two modes of failure during “ramp up” phase.

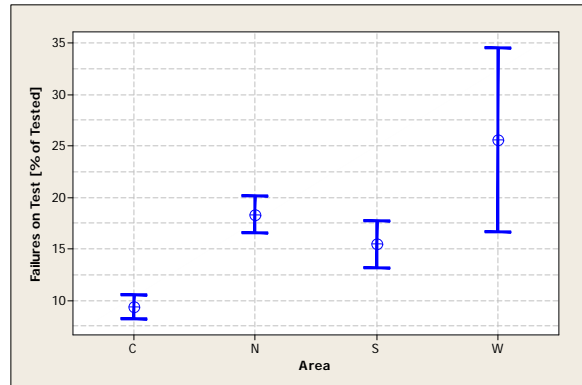


Figure 4: Separation of failure on test rates by areas, for the 30 minute test recommended by IEEE400.2.

The presentation will conclude with some suggestions as to the operating and recording protocols that will maximize the diagnostic capability of withstand tests.