Further Improvements in Rejuvenation Technology

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***Abstract*: Since the next generation of fluid injection technologies was introduced in 2004, methods and materials have been modified to further enhance post-treatment performance. This paper provides an update on performance in 1000 hour tests.**

INTRODUCTION

In 2004 a new generation of high performance methods and materials were introduced. Additional refinements are summarized here to improve post-treatment performance over the medium and long term. Longer term results will be published at a later date.

In a separate paper [2] to be presented tomorrow in Subcommittee A the meaning of "long term" will be defined in some detail. An even deeper understanding will become clear when Part II of [2] is published later this year. For the purposes of this brief paper the author will avoid defining "long term" and stick with acceleration supposed since 1999. The reader is warned that the revelations of [2] are necessary to adequately interpret these results.

NEW DATA

Process improvements applied to the previously reported formulation, U221, and a new formulation, U732 were submitted to Cable Technology Laboratories for accelerated aging. The cables were the same as those previously described in [1], but had an additional 13 months of aging in water at $2.5U_0$ and ambient temperature prior to treatment. The cables were treated and the water bath was warmed to 50°C. $2.5U_0$ was maintained for 1000 hours before each coil was sacrificed to partial discharge testing and AC breakdown analysis.

There were no partial discharges at or above 5pC at 35kV. The 63.3% probability AC breakdown results for U221 and U732 were 39.5 kV/mm (1004 v/mil) and 38.2 kV/mm (971 v/mil) respectively.

Figure 1 provides a graphical representation of this data benchmarked along with data reported for the previous generation of technology referred to as '841. (Note: '841 is short for U.S. Patent 5,372,841). A "not" symbol (⃠) is drawn over the older data point which has been replaced with a new data point for the same U221 formulation as reported in [1] and previously referred to as "Fluid U". In addition a new data point is provided for the new U732 formulation.

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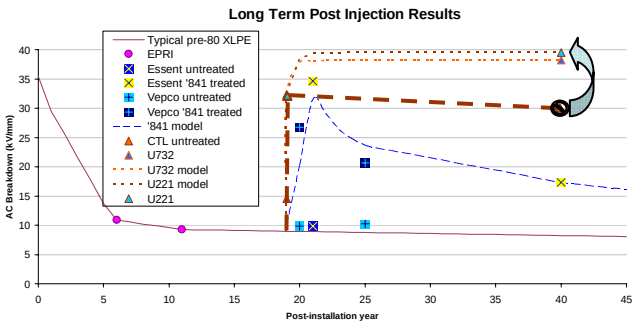

Figure 1. "Long term" results of U221 & U732 technology benchmarked along with reported performances of legacy '841 technology.

SUMMARY

The advantages of the new generation of fluid injection methods and fluids U221 and U732 have been further expanded over the '841 technology invented and commercialized by the author over a dozen year ago.

From [1] the increase in AC breakdown performance is 87X faster than that of the '841 technology. This means that even cables which have recently failed in service can be reliably treated.

With three times less worker exposure to energized equipment and a flash point in excess of 82°C (vs. -5.5°C) the chances of electrical contact incidents and fire and explosion incidents are substantially reduced.

Also in contrast to the previous generations of technology including the '841 technology and that described by U.S. Patent 4,766,011, the U221 and U732 fluids have no chance of methanol corrosion of aluminum conductor.

"Long term" AC breakdown performance is over twice as high as the '841 technology and is at levels equivalent to those of new cables.

REFERENCES

1. Bertini, "New Developments in Solid Dielectric Life Extension Technology", IEEE ISEI, Sept. 2004.

2. Bertini, "Accelerated Aging of Rejuvenated Cables – Part I", ICC – Subcommittee A, April 19, 2005.