



April 23, 2002

To: Valued Bushing Customer

Subject: Bushing Oil Discoloration

Introduction:

Beginning in 1996 Trench started to receive occasional reports from customers that the oil, visible through the oil level indicator, had changed from a light color to a "rust" color. Trench requested that these bushings be returned to the factory for evaluation. It was noted by customers that once the bushing had been removed from the transformer that the oil, visible through the oil level indicator, returned to its normal light color. This started a long-term investigation into the mystery of what caused this phenomenon.

The Investigation:

This phenomenon had only been reported on a few bushings, which made the samples available for evaluation, small. (Less than 5 units) In each case an oil sample was taken and sent out for test. The results from the test indicated that the oil from each bushing met all the characteristics required for new bushing oil.

Trench next evaluated the design of the oil level indicator on the bushings in question. The oil level indicator design consists of a machined interface in the head casting in which an aluminum plate is inserted, followed by a red "floater" and the clear UV viewing glass. (In 1997 the red "floater" and clear UV glass was replaced by an amber prismatic viewing glass) The entire assembly is secured in place with machine screws, washers and gaskets. This basic design has been in use on Trench bushings for many years.

Trench then contacted our bushing oil supplier to review this phenomenon and determine if they had any answers. After some time they reported to Trench that "All electrical oils and fully refined base oils that are exposed to direct light for a long periods of time will eventually get darker from UV induced oxidation". They further said "This oxidation of the oil causes color bodies to be created but they do not effect the properties of the oil". They indicated that glass has better UV absorption than acrylics and plastics and the rate of oil discoloration will be significantly less if the viewing window is made of glass.

TRENCH LIMITED

200 Station Street
Ajax, Ontario L1S 1R9
Canada

Tel: 905-426-2665
Fax: 905-426-2671

E-mail: Keithcota@aol.com
Web Site: www.trenchgroup.com



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Investigation Conclusions:

After much discussion within Trench and based on all the information gathered we have reached the conclusion that the following caused this phenomenon:

The design of the aluminum plate is such that it restricts the circulation of the oil from the space between the plate and viewing glass and the rest of the bushing during the normal thermal cycling of the bushing's oil. This small amount of stagnant oil is therefore continuously exposed to daily UV and discolors over time. As soon as the bushing is "handled" the stagnant oil mixes with the rest of the oil and then non-discolored oil is then visible through the oil level indicator.

Recommendation:

It is clear from our investigation that all oil level indicators that rely on viewing the actual oil level will cause the bushing's oil to discolor over time. This is true for the clear UV glass used in the past as well as the amber prismatic glass used by Trench COTA bushings today. It is also true for those bushing designs that use viewing bowls. The key is to limit the exposure as much as possible over the life of the bushing. Trench is doing this by using high quality UV resistant glass (No plastics or acrylics) and making the viewing window as small as possible while still allowing easy viewing from a long distance.

Based on all the technical data gathered it is clear that this discoloration presents no risk to the performance of the bushings. If discoloration is seen it should be noted for the record but no additional action is required.

If you have any questions on the above information, please let me know.

Sincerely
Trench Limited

Keith P. Ellis
Bushings Product Manager, Americas

+615-847-2157
+615-847-2462

TRENCH LIMITED

200 Station Street
Ajax, Ontario L1S 1R9
Canada

Tel: 905-426-2665
Fax: 905-426-2671

E-mail: Keithcota@aol.com
Web Site: www.trenchgroup.com