

SYMPOSIUM ON INSULATING OIL

INTRODUCTION

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A very important responsibility of the transformer oil producers, the electrical manufacturers, and the utilities is the development of test methods and the evaluation of test results to be used as criteria of serviceability of new and used oil, and the related problem of extending the service life span of such oil. Subcommittee IV on Liquid Insulation, of A.S.T.M. Committee D-9, has always taken an active part in encouraging and directing such developmental activities pointed toward improvement of test methods and studies of performance which ultimately and inevitably result in improved quality of insulating liquids.

Early in 1944 a comprehensive questionnaire was sent out to ninety-two of the larger utilities to establish just which tests were made by the various companies as criteria of serviceability for transformer oils in service. The cooperative replies and good response to this provided the basis for a comprehensive report on the questionnaire results, printed in A.S.T.M. *Proceedings*, Vol. 45, p. 302 (1945).

One significant observation in studying the questionnaire returns was the apparent general concensus that oil deterioration had not been considered a very serious problem in the past, chiefly because of the usual practice to operate transformers, excepting the most modern

designs, below full load capacity to hold oil temperatures down to values which would not allow rapid degradation of the oil. This seemed to indicate that one of the main factors in limiting the load which a transformer could withstand was not so much the transformer itself or any part of its solid insulation, but rather the liquid component of the insulation. With present-day developments of more and more heat-resistant and chemically stable forms of solid insulation in new transformers, together with the present general practice to "up-rate" old equipment retained in service, the limiting feature of the oil is still further exaggerated. Thus, the general conclusion was derived that an urgent demand exists for a liquid insulation of comparable cost which would be relatively more stable than present-day oils.

The wide interest shown by producers and users of insulating oil in the over-all results of this questionnaire has been projected into a supplementary program of insulating oil symposia sponsored by Subcommittee IV. The plan was formulated in 1946 to hold an insulating oil symposium of several sessions in sequence at appropriate intervals in conjunction with scheduled meetings of Committee D-9 and its subcommittees.

The first program was held in October, 1946, in Atlantic City when the following four papers were presented:

- Steam-Emulsion Number as an Index of Transformer Oil Serviceability—M. D. Baker
- The Interfacial Tension Test and Its

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Significance in Appraising Performance of an Insulating Oil—G. W. Gerell
Application of the Interfacial Tension Test in Grading Transformers Relative to Serviceability—E. F. Walsh
Refresher on Statistical Analysis Applied to Two A.S.T.M. Oil Dielectric Strength Test Procedures—E. W. Greenfield

The papers by Messrs. Baker, Gerell, and Walsh were printed in the May, 1947, issue of the *ASTM BULLETIN*; the paper by Mr. Greenfield in the December 1947 *ASTM BULLETIN*.³

The second symposium was presented in June 1947, in conjunction with the Fiftieth Annual Meeting of the Society in Atlantic City, and the following four papers were included in this program:

Advantages of an Inhibited Transformer Oil—T. E. Reamer and R. G. Larsen
Oxidation Inhibitors in Electrical Insulating Oils—Leo J. Berberich
Power Factor of Insulating Oils, Its Significance and Methods of Testing Stability—J. C. Balsbaugh
Serviceability Tests on Transformer Oil from the Viewpoint of the Maintenance Engineer—Frank J. Pohnan

All of these papers and the discussions were published in the December, 1947, issue of the *ASTM BULLETIN*.³

In the following pages the record is presented of the third and latest symposium, which includes three papers. The first deals with the comparatively new type of fireproof, explosion-proof, synthetic insulating liquids commonly known as the askarels, and is a very comprehensive treatment of what they are, their quality control testing, and their general properties and performance characteristics.

The second paper deals with the more practical problem of oil quality maintenance to be dealt with by the utilities. It indicates the mode of procedure used by one large utility power system in carrying out their program of testing

and maintenance of oil in service transformers. While there is a general tendency toward the standardization of such procedures, the practice developed by various utilities varies somewhat and often involves some features of a controversial nature.

The third paper deals with the particularly live question as to the possible merits of an inhibited transformer oil. Some methods of accelerated aging tests indicate a possible advantage both practically and economically in the use of inhibited insulating oils. This indication has been given by some types of oxidation tests in the laboratory and also on simulated service aging tests on both inhibited and uninhibited oils in transformers, as discussed in this paper. This is recognized as quite a controversial subject, particularly when referring to interpretation of test data in terms of predicted field performance of various types of oils. Subcommittee IV has taken cognizance of the controversial nature of this subject, and is at present engaged in work directed towards the development of a test method for inhibited oils which will be adequate to determine its merits for use in electrical apparatus.

It is the intended purpose of all these symposia that all those concerned with the production and the practical use of insulating liquids will be aided in the rationalization of the problems relating to improvement in quality and the means of evaluating performance of these materials.

On behalf of Subcommittee IV, we wish to express a sincere appreciation of the generous efforts of all the participants in these programs and the assistance given by A.S.T.M. Headquarters Staff and O. E. Anderson and H. A. Eysenbach of Committee D-9 in preparing and presenting these symposia. The invaluable cooperation of the authors of the various papers is especially to be commended in making these programs so valuable and successful.

³ These first two symposiums are also available in separate pamphlet form.