

Condition Assessment Through Laboratory Diagnostics

Overview:

This interactive seminar combines theoretical background with practical experience to provide engineers, chemists and others who review data with the vital knowledge and hands-on examples – including case studies – needed to interpret laboratory results to detect and identify problems with oil-filled transformers, load tap changers and circuit breakers. Doble encourages participants to bring their unique real-world problems for discussion.

Learning Outcomes:

Upon completion of this course, the participant will be able to:

- Understand how to determine the condition of electrical apparatus using laboratory tests.
- Discover how knowing about aging characteristics of insulating materials can help extend asset life.
- Learn how to take oil samples, avoid common pitfalls and save time and money by sampling only once.
- Detect the presence of incipient-fault conditions and categorize them.
- Find out how to assess the condition of the paper insulation.
- Establish the correct method of analyzing moisture-in-oil results.
- Study the significance of dissolved and particulate metals and other particle contamination.
- Learn about the quality of new and service aged oils.
- Learn how to identify and mitigate issues with corrosive oils.

Course Audience:

Electrical engineers, managers and chemists working in operations, maintenance, engineering, or other service field in which knowledge of asset design, insulating liquid analysis or electrical testing methods and evaluation is required part of job responsibility.

Duration:

8 Hours

Credits:

0.8 CEUs or 8 Professional Development Hours

Seminar Fees:

- Self-paced eLearning Course: \$345 USD per person

This 8-hour course is based on the instructor-led course that Doble has offered for decades. This course can be completed at a pace that is right for you. You will have access to this course for 180days to complete your learning. You can take the course in modules or all in one session. The system will remember where you left off for a break, and you can repeat your learning as often as you like. And within each module, there are knowledge checks to test your comprehension as you progress.

- Online Instructor Led Course: \$395 USD per person
- One Day Instructor Led Seminar: \$495 USD per person
- Scheduled Course at Customer Location: Please inquire

COURSE OUTLINE

Condition Assessment Through Laboratory Diagnostics

The course program contains the following training outline:

- **Dissolved Gases in Oil** – This is the single most important diagnostic test for transformers. This presentation reviews how the test is performed, how to distinguish between normal gassing behavior and problems, and how to evaluate trends. Practical case studies and examples are used to illustrate theoretical concepts. Seminar participants will be quizzed as a group in diagnosing cases.
- **Explosive gas concentrations** – The formation of combustible gases is fortuitous in that it allows for a key diagnostic of transformer health. However, if there are excessive amounts of combustible gases in a gas space it is possible to have an explosion. Learn how to determine if there is excessive combustible gases and preventive measures to avoid explosions.
- **Water in Oil** – Assessing how dry a transformer is requires more than testing the water content of the oil. Learn how to assess the wetness of the transformer insulation system and why you need to know the operating temperature at the time of sampling. This session discusses water migration in transformers and how water affects the ability to overload them. Examples are provided.
- **Aging Characteristics of Cellulosic Insulating Materials** – The analysis of the condition of the paper insulation has changed quite a bit in the past decade. Learn how the solid insulation ages and how to assess the condition of the paper and pressboard insulation and the remaining insulation life. Case studies are given to illustrate the distribution of paper aging in transformers and how operation and maintenance can influence it.
- **Metals in Oil** – This presentation provides an understanding of the importance of metal-in-oil tests as a diagnostic tool. To be able to use the information, the correct test must be specified – learn the difference between dissolved and particulate metals and when to choose each test. Case studies are given.
- **Quality of New and Service Aged Oils** – Background information is provided on the properties of transformer oil. The presentation includes how to specify and evaluate new oils, what tests to perform and how to evaluate in-service oils. Discussion on aging of oil and factors that accelerate the aging of the insulation system that can be controlled. This session provides information on when to reclaim or replace oil and provides specifications for reclaimed oil.
- **Sampling** – Oil maintenance starts here, but expensive decisions can be made on the back of poor results that are often are down to a badly taken sample. This presentation discusses proper sampling techniques and what common pitfalls to avoid, including utilizing the correct equipment.
- **Corrosive Sulfur** – Corrosive sulfur has resulted in failures of large transformers and reactors. This presentation will cover the sources of corrosive sulfur, test methods for corrosive sulfur, failure mechanisms, transformers at highest risk and possible mitigation strategies.
- **Testing and diagnostics for LTCs** – This presentation gives the latest information on diagnostics for load tap changers (LTCs) using dissolved gas-in-oil and other tests. Case studies are provided.
- **Workshop on Student Examples** – Student data will be reviewed in class room style with discussion by participants. Time is provided to review the presentations and discuss in more detail any questions.

Presenter(s):

Lance Lewand - Director, Doble Material Laboratories
Eileen Finnan - Senior Director, Doble Professional Services
Melissa Carmine-Zajac - Director, Laboratory Services
David Koehler - Technical Manager, Doble Material Laboratories
Dr. Richard Heywood - General Manager, Doble PowerTest, UK
Andy Davies - Transformer Oil Services Engineer, Doble PowerTest, UK

Division of Responsibilities:

If the course is hosted at a customer location, to ensure smooth training course delivery, Doble requests the following division of responsibilities:

Doble will provide:

- Confirmed training dates upon receipt of a purchase order.
- Technical agenda for program.
- One experienced instructor including their travel/living expenses.
- Training manual (soft copy) to each participant.
- Training certificate for each participant.
- If applicable, all required measurement test equipment and tools for class and site training.
- All personnel safety equipment for Doble's instructor.

Customer will provide:

- Confirmed training schedule at least 60 days in advance.
- Training coordinator through whom all contractor requests will be coordinated.
- Training facility, AV equipment and any offered food and beverage as appropriate.
- Printing hard copy training material as required.

