TRANSFORMER ACADEMY

DGA Course-

A practical approach

Dissolved gas analysis for transformer liquids

The current most reliable and essential transformer maintenance methodology

Course author: Marius Grisaru

Illustrations by: Energo Complex

The main difference between this course and many others that exist in the web market today is the holistic perspective without any commercial bias.

The author - **Marius Grisaru** - is a chemist with expertise in insulating oil domain, focusing on dissolved gas analysis from sampling to diagnosing. Marius has a vast and worldwide experience on sampling, testing, order, diagnosing, and debating among fellow experts around the globe.

The course is intended for:

1.
Utility engineers, both junior and senior, especially those responsible for tests and diagnoses through collaboration with global or local laboratories.

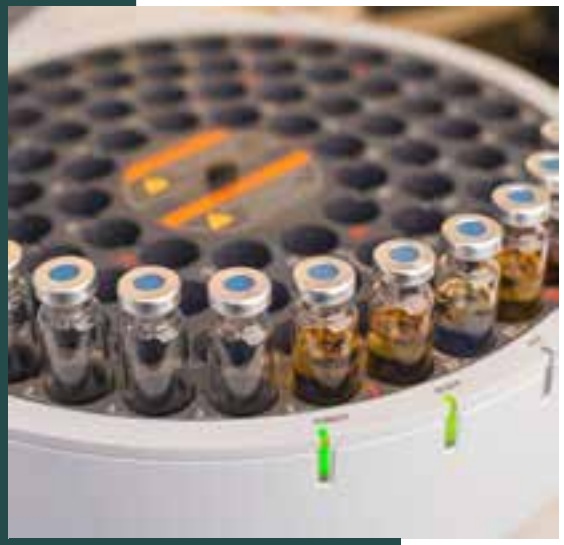
2.
Manufacturers of transformers, transformer components, monitoring systems, sensors, etc.

3.
Students and everyone who wishes to understand the scientific foundation of DGA and reasons for its popularity.

4.
Anyone interested in a deeper awareness of DGA limitations and weaknesses.

5.
Staff who are responsible for transformers and want them to be more operational and efficient in the cooperation with DGA and oil service providers.

Course details and key lesson points



Course outline and main entries

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This course will be held on three levels: basic, intermediate and master's level. The lessons for each level are listed as follows:

Basic level

E-lesson #1: DGA - The most efficient transformer maintenance method

Main takeaways:

1. Planning DGA - recommended frequency for DGA testing
2. Sampling principles for DGA, a survey of available methods
3. The best candidates for installing online DGA devices
4. A brief review of the existing online DGA devices

E-lesson #2: Sampling oil for DGA, consideration on frequencies and sampling vessels

Main takeaways:

1. DGA frequency considerations
2. Briefly on sampling vessels and sampling location

Intermediate level

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E-lesson #3: Sampling oil for DGA, the most critical and sensitive stage of DGA

Main takeaways:

1. Sampling impact on overall DGA accuracy
2. Sampling vessels and technology correlation with transformer and test device parameters

E-lesson #4: Critical description of leading modern techniques for separation and measurements in offline DGA measurements

Main takeaways:

1. A brief description of DGA separation and measurement techniques available today
2. A comparison and evaluation of major strengths and weakness - productivity, confidence, malleability

E-lesson #5: Theories and practice of modern DGA diagnoses, standards, guides, schemes and HI models.

Main takeaways:

1. An introduction to principles of DGA diagnosis
2. Main current guides and standards for DGA diagnosis
3. Primary methods for DGA diagnosis used in the industry today
4. Performance comparison tables and schemes of DGA diagnosis: advantages and disadvantages

E-lesson #6: Save time and money by improving DGA and oil tests bids requirements for oil offline tests

Main takeaways:

1. Synchronise DGA tests with transformer operation and other tests
2. Tips for preparing the most adequate DGA & oil tests bid for oil

Master's level

E-lesson #7: A critical analysis of modern techniques for offline and online DGA measurements
Duration - 1 hr 4 min

Main takeaways:

1. A brief description of DGA measurement techniques available today for offline and online DGA devices
2. A comparison and evaluation of major strengths and weaknesses - productivity, confidence, malleability

E-lesson #8: Selecting and using the proper DGA online device for your transformer; How to avoid headaches after acquiring DGA online devices. Updated in Oct 2022

Main takeaways:

1. A comparison and important guidelines for preparing tenders for DGA online devices
2. A correlation between DGA online devices and the number of offline tests

E-lesson #9: Recipes for preparing in-house gas in oil standards; Pros and cons of using different solubility coefficients versus gas in oil standards (GIO) - in-house and commercial

Main takeaways:

1. Gas in oil standards, importance, in-house preparation and usage; chemical aspects of DGA in different insulating oils (liquids)
2. Ostwald coefficients versus calibration curves and other calculation methods

E-lesson #10: The Big Question: When should one recommend taking a transformer out of service? Based on a paper presented at ASTM Conference, 1999

Main takeaways:

1. Transformer fault severity from DGA evaluation, real cases avoid fault alarms and disconnected transformers just before the critical failure
2. Total combustion gases - levels and trends versus fault severity; Advanced diagnostic approach emerging from particular individual experience

E-lesson #11: Dissolved gas analysis – a brief history of the future, based on Keynote speech from IEEMA 2018; advanced approach to DGA diagnosis based on AI and ML

Main takeaways:

1. A brief history of DGA: theoretical reviews of DGA history and the impact on present DGA state
2. Future perspective of DGA alternative methodologies for transformer maintenance

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E-lesson #12: Special session on one of the most important and influential pillars of DGA and transformer tests: Dr. Michel Duval. Survey of its important contributions reviewed by Dr. Michel Duval.

Main takeaways:

- the correct usage of Duval's diagnostic methodology.

E-lesson #13: Special DGA diagnoses; conclusions and attendees' feedback, discussions and remarks

Main takeaways:

1. Develop a unique tailored DGA diagnosis based on the field specification and accumulated knowledge for all individual attendees
2. Q&A as per demand

Testimonials

Thank you for this lesson. I am keen to participate in the future ones.

Great content and brilliant presentation.

Thank you for the interesting and very useful presentation from a top notch author!

It was really interesting... glad that we have the opportunity to follow you...

Very practical and useful information for everyone involved in the transformer's industry.

I like very much your presentation and the way topics are covered. Thank you for sharing your knowledge and contributing to us socially.

Very informative and enlightening through the course I now understand what the test is all about and the significance of the test.

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