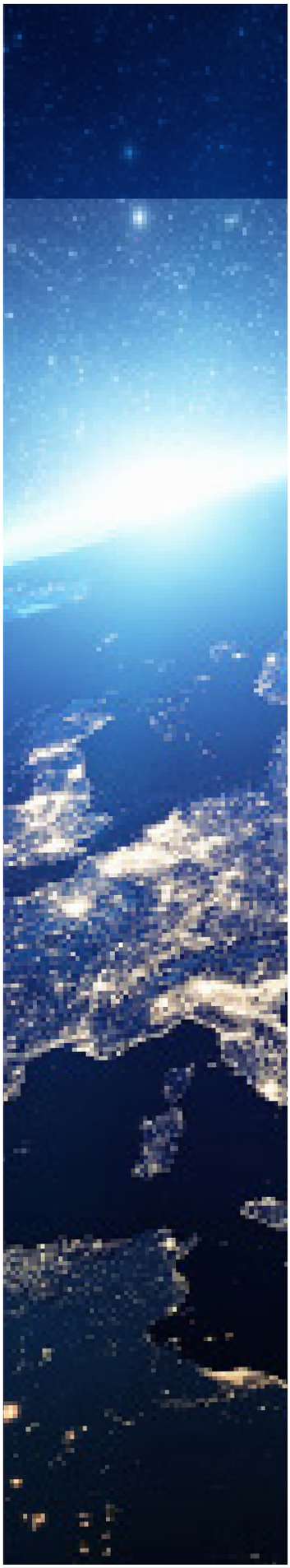


DOBLE TRAINING & EDUCATION COURSES

# Transformer Fundamentals

## Overview:

This interactive course combines theoretical background with practical field experience to provide engineers, managers and technicians with fundamental knowledge regarding how transformers are designed and manufactured, major transformer components, installation and commissioning, in-service and off-line electrical testing and insulating oil laboratory diagnostic testing. Doble specialists will train you to review test results so that they are clear and easy to understand. Doble encourages participants to bring their unique real-world problems for discussion.

Learn from Doble's collective experience from working with 1000's of transmission, distribution, generation and industrial clients globally.

## Learning Outcomes:

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

- Understand transformer design and manufacturing process.
- Learn about major transformer components such as insulating material, bushings, cooling systems, tap changers and controls.
- Understand when to perform specific electrical off-line routine tests, off-line diagnostic tests and in-service diagnostic tests (factory acceptance, transportation, installation and over asset life-cycle).
- Establish benchmark results to significantly increase diagnostic value of future tests.
- Understand how to determine the condition of electrical apparatus using laboratory tests.
- Learn how to take oil samples, avoid common pitfalls and save time and money by sampling only once.
- Correlate electrical test result with insulating test results.
- Interpret test results, case studies and numerous field examples.

## Course Audience:

Electrical engineers, managers and technicians working in operations, maintenance, engineering, or other service field in which knowledge of diagnostic testing methods and evaluation is required part of job responsibility.

## Duration:

Three Days (In-person Instructor Led Training)

Five Days (2 2-hour sessions per day, Remote On-line Training)

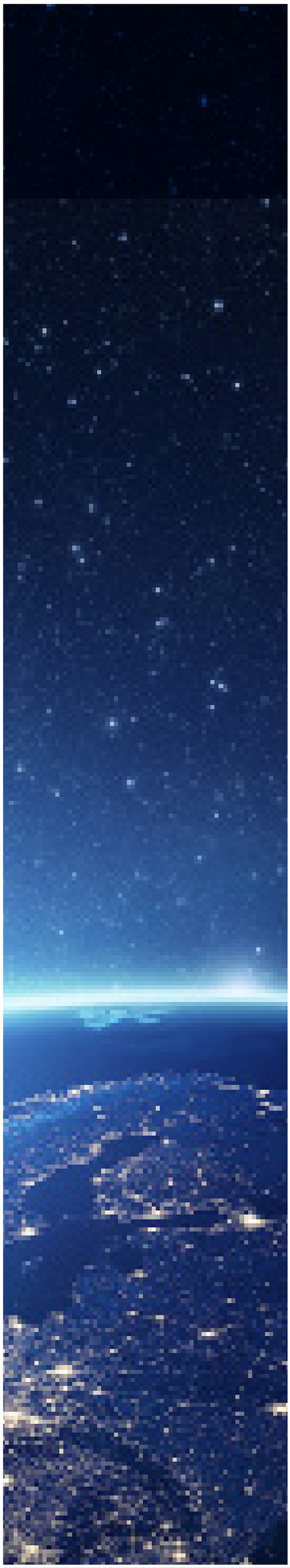
## Class Size:

Up to 20 Attendees (In-person Instructor Led Training)

## Credits:

Up to 2.4 CEUs or 24 Professional Development Hours (In-person Instructor Led Training)

Up to 2.0 CEUs or 20 Professional Development Hours (Remote On-line Training)



COURSE OUTLINE

# Transformer Fundamentals

The course program contains the following training outline:

**Transformer Design & Construction**
- Transformer Fundamentals
- Transformer Design
- Transformer Manufacturing
- Factory Acceptance Testing
- Major Components
    - o Insulating Materials
    - o Bushings
    - o Cooling Systems
    - o Tap Changers
    - o Controls

**Off-line Electrical Testing**
- Dielectric Theory & Application
- Safety During Testing
- Off-line Electrical Testing
    - o Bushing Testing
    - o Power Factor & Capacitance Measurements
    - o Turns Ratio
    - o Leakage Reactance
    - o SFRA
- In-service Electrical Testing (partial discharge)
- Interactive Case Studies

**Transformer Condition Assessment Through Laboratory Diagnostics**
- Insulating Fluid Basics and How to Take a Proper Oil Sample
- Dissolved Gases in Oil
- Explosive Gas Concentrations
- Oil Quality
- Water in Oil
- Aging Characteristics of Cellulosic Insulating Materials
- Interactive Case Studies

Presenter(s):

Experienced Doble Client Service Engineer, Technical Application Engineer and/or Laboratory Specialist