



**Transformers**  
ACADEMY

# POWER TRANSFORMER SPECIFICATIONS

**COURSE AUTHORS:**  
**MARCOS FERREIRA AND JUAN ALBIGER**





# MARCOS FERREIRA

Marcos Ferreira is an Electrical Engineer with 30 years of diversified corporate experience in designing, managing, and coordinating projects in transmission, distribution, communications, in the State of Massachusetts, Texas, Ohio, Oregon, Washington and California as well as all Canadian Provinces. Working on substation HV equipment new installation and replacement (e.g., transformers, circuit breakers, etc.) based on standard design including system protection, and commissioning. During his career he worked as senior maintenance engineer for Bonneville Power Administration and senior field engineer for Doble Engineering specialized on testing substation HV equipment and provided technical support. Recently, Marcos Ferreira was taken role as project manager of United States Beale Air Force Base, North of California, as part of Civil Engineer Squadron team.

Marcos Ferreira have been involved at IEEE Transformer Standards Committee Meetings for the last 20 years. In 2019, he was appointed as Chair for the working group of Std. C57.152 (IEEE Guide for Diagnostic Field Testing of Fluid-Filled Power Transformers, Regulator, and Reactors). Most recently, he took the role as Vice-Chair of Standards Subcommittee.



*Marcos Ferreira*



*Juan Albiger*

# JUAN ALBIGER

Juan Albiger is an electrical engineer with over ten years of experience in power transformer procurement process.

He is specialized in HV substation equipment: preparing technical specifications, performing factory inspections, and managing commissioning and maintenance.

Mr. Albiger is the Head of Department responsible for ensuring the procurement and commissioning of high voltage substation equipment, power transformers and reactors that are fit for purpose.





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## WHAT MAKES THIS COURSE UNIQUE?

*Knowledge & information exceeding electrical engineering books.*

*Our authors will provide instructions for becoming a true expert, regardless of your previous level of experience; all you need to have is the will to learn.*



# TARGET AUDIENCE

- Utility engineers, both young and senior, especially those responsible for the power transformers design, specification, procurement, maintenance, and operations
- Power transformer manufacturers, technical sales personnel and sales representatives, testing and service companies of power transformer and its accessories, including on-line monitoring systems





# BASIC LEVEL

## LESSON 1

Define specifications and understand table of contents breakdown

- Theory of Methodology to Define Specifications
- Table of Contents of Transformer General Specification Breakdown

## LESSON 2

Prepare and issue technical specifications for power transformers

- Transformer Procurement Process
- Preparing and Issuing Technical Specifications





# INTERMEDIATE LEVEL

## LESSON 1

### Transformer special technical requirements based on the application

- Recommended reference drawings
- Design requirements
- Online monitoring devices, sensors & DGA
- Noise control
- Guaranteed performances

## LESSON 2

### Quality management, inspections and testing

- Quality assurance plan
- Inspections & tests plan
- Factory and site acceptance tests
- Reports considerations

## LESSON 3

### Power Transformer Specification Requirements based on Applications and Standards

- How to apply a 'Scope' based on applications and standards (e.g. IEEE, IEC, and Cigré)
- Important things as part of building specifications: (e.g., environment conditions and special considerations)
- Documents that should be part of specifications: (e.g., nameplate, instruction manuals, physical dimensions drawings, and factory testing reports)

## LESSON 4

### Technical Requirements for Power Transformers

- Ratings (e.g., phases, frequency, windings, impedance, short-circuit characteristics, sound levels, angular displacement, total losses – load and no-load, insulation levels, temperature rise, load conditions, and cooling classes)
- Construction (e.g., tank types, high & low voltage bushings, OLTC, DETC, and surge arresters)
- Accessories (e.g., pressure relief devices, winding & liquid temperature gauges, liquid insulation types, grounding, and sudden pressure relay)

# MASTER'S LEVEL

## LESSON 1

### Power transformer technical specifications fundamental rules

- How to create a 'scope' based on applications, environment conditions, special considerations, and standards (e.g., IEEE, IEC, and Cigré)?
- The difference between the documentation (e.g., nameplate, instruction manual, physical dimensions drawing, and factory testing reports) to be provided by the transformer manufacturer

## LESSON 2

### Classification of technical requirements – 'essential versus optional'

#### ESSENTIAL

- Ratings (e.g., phases, frequency, windings, impedance, short-circuit characteristic, sound levels, angular displacement, total losses – load

- and no-load, insulation levels, temperature rise, load conditions, and cooling classes)
- Construction (e.g., tank types, high & low voltage bushings, OLTC, DETC, and surge arresters)
- Accessories (e.g., pressure relief devices, winding & liquid temperature gauges, liquid insulation types, grounding, and sudden pressure relay)

#### OPTIONAL

- Choose liquid insulation
- Choose LTC
- Choose accessories: time-based maintenance (conventional) versus condition-based maintenance (maintenance-free)
- When to consider adding DGA / bushings / OLTC online monitoring?
- What is the main difference between OLTC and DETC and when are OLTC versus DETC specified?
- What is the main difference between OLTC and VR (voltage regulator)?



### LESSON 3

#### Specification of processes (services) for power transformers specifications

- Factory capability assessment for power transformers
- Power transformer transportation & handling specification
- Commissioning and assembling field testing specification

### LESSON 4

#### Tender assessment and specifications

- Technical datasheet, guaranteed performances
- Economic loss evaluation
- Total ownership cost (TOC) of transformers







[info@merit-media.com](mailto:info@merit-media.com)



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