

New Transformer Procurement Engineering Best Practices

Overview:

This interactive 3-day seminar covers new transformer specifications, how to prequalify new and existing transformer manufacturers, factory inspections during manufacturing process, factory acceptance testing, transportation and installation and commissioning. Large power transformers represent a significant capital investment for any utility, industrial company or other end user. Ensuring that a good quality product is manufactured and delivered successfully should begin early in the procurement process.

According to the Institute of Asset Management, while only 5-15% of an asset's life-cycle costs are incurred at the procurement phase, more than 80% of those life-cycle costs have been committed, so good procurement processes are critical to having an effective asset management strategy. The significant majority of critical transformers receive some sort of additional surveillance by the end user. Doble has performed transformer procurement consulting services for hundreds of clients purchasing transformers from more than 50 different manufacturing factories in over 20 countries globally. Learn from Doble's extensive global experience.

Learning Outcomes:

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

- Prepare a transformer specification, which scrutinizes the most critical aspects of the transformer design and construction for a customer's specified application.
- Perform factory qualification audits, which are essential to confirm a manufacturer's ability to meet a purchaser's requirements and expectations.
- Understand importance of factory witness inspections to provide independent verification to manufacturer's design and manufacturing processes.
- Acquire knowledge essential for witnessing factory tests, preparation of test specification and reviewing certified test reports.
- Understand transportation considerations, installation and commissioning testing.

Course Audience:

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

Duration:

3 Days

Class Size:

15 Maximun

Credits:

Up to 2.4 CEUs or 24 Professional Development Hours

COURSE OUTLINE

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The course program contains the following training outline:

Transformer Design & Construction

- o Transformer theory and applications
- o Transformer design
- o Materials/Major components
- o Transformer manufacturing and construction

• **Transformer Specifications**

A clear, well-defined specification eliminates variances of interpretation by vendors and results in a proposal and product that meets the customers' intentions and specifications. Many specifications refer to IEEE or IEC Standards for definition, so it is critical to know what the current revision of these standards require. Discussed topics: core/winding arrangement; type of winding & conductors; transformer losses; short circuit forces and stresses, thermal design.

• **Transformer Vendor Prequalification**

An effective procurement system utilizes the preapproval process to identify suitable power transformer vendors and a design review to establish an agreed upon design and procurement process. This preapproval approval process should include factory qualification audits, which are essential to confirm a manufacturer's ability to meet a purchaser's requirements and expectations. Discussed topics include: Manufacturer engineering capabilities; engineering tool; factory logistics; detailed manufacturing process and equipment; testing capability and the facilities; storage, packaging and shipping area; quality management at the facility, including procurement, materials used in construction of transformers and document control; facility certifications.

• **Factory Manufacturing Witness Inspection**

Factory inspections are designed to augment the manufacturer's existing Quality Assurance or Quality Control processes at the factory. Factory inspections are not performed to replace or circumvent the internal processes established by the manufacturer, but rather these inspections are inserted into the normal and expected quality program to provide an independent verification and to establish that the supplier's quality system is functioning as designed. Discussed topics include: coils and core inspection; post-processing inspection; pre-tanking inspection.

• **Factory Acceptance Testing**

Significance of various electrical production tests with bulk of material arranged around a typical test plan covering all final factory tests as per appropriate IEEE and/or IEC standards. For each test, there will be an in-depth discussion of each measurement, physics behind the measurement, setup and test methodology and acceptance criteria. In-depth discussion of each measurement, its purpose and expected results. Discussed topics include: preliminary tests (turns ratio, winding resistance, power factor and capacitance, polarity and phase relation, bushing power factor and capacitance, winding insulation resistance); performance tests (load losses and impedance voltage, no-load losses and excitation current, zero-phase sequence impedance, audible sound test, temperature rise test); dielectric tests (induced voltage, applied potential and impulse test).

• **Transport**

The transportation of large, heavy, and oversize transformers has always been fascinating and mysterious for those who have witnessed a large loaded trailer pass by, seen a crane lift at a port or just been amazed by the sheer size of the units. Some think it must be incredibly difficult while others say it is simple. This presentation is designed to provide Logistic Solutions and to better understand the challenges of moving transformers at all levels. This presentation will provide real life examples and case studies to illustrate all modes of transport and rigging used in the transformer industry as well as provide logistical considerations and applications for moves, whether an internal movement of a spare within a utility or receiving a new transformer from factory to pad.

Presentation material courtesy of Edwards Moving and Rigging who moves over 300 large transformers annually.

COURSE OUTLINE

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The course program contains the following training outline:

- **Installation & Pre-commissioning**

This presentation will highlight recommendations for the proper receipt, inspection, field assembly, oil processing, and acceptance testing of large liquid immersed power transformers. Transformer field installation processes and standards will be reviewed to include impact recorders, equipment requirements, assembly operations, field dry out techniques, determination of insulation moisture concentration, provisions for cold ambient temperature processing, vacuum filling processes, and acceptance testing.

Presentation material courtesy of SPX Transformer Solutions, Inc.

For more information, download our detailed course brochure or submit a training inquiry. Get EMPOWERED with Doble.



Presenter(s):

Bill Griesacker – Senior Principal/ Transformer Consulting Engineer

Mr. Griesacker specializes on projects that include factory inspections, condition assessment, design reviews, failure analysis and general consulting. He previously worked for Pennsylvania Transformer Technology Inc., where he held various positions including Engineering Manager. His work included high voltage insulation design, transient voltage modeling of power transformer windings and various LTC and DETC switch development projects. Prior to this, he was employed by the Westinghouse Electric Company, working on synchronous generator projects as a member of the Generator Engineering Department. Mr. Griesacker started his career with Cooper Power Systems in large power transformers and later worked in the Kyle Switchgear, Vacuum Interrupter Department. He has earned a MS in electric power engineering from the Rensselaer Polytechnic Institute and a BS in electrical engineering from Gannon University. Mr. Griesacker is an active member of the IEEE, PES Transformers Committee where he holds positions in several working groups and subcommittees.

Dom Corsi – Senior Principal/ Transformer Consulting Engineer

Mr. Corsi has 27 years of experience in the manufacturing and electrical design of large power transformers. This experience includes both core and shell form designs. Mr. Corsi joined Doble in 2004 as a Transformer Consulting Engineer for Doble Global Power Services. In the last 12 years, he has concentrated on transformer procurement consulting, condition assessment, and forensics. Additionally, he has designed transformers up to 400 kV and 570 MVA and reviewed or supervised transformer designs to 525 kV and 1100 MVA. His main interests are in the fields of power transformer design, and power transformer applications. A frequent presenter, Dom Corsi trains participants on many transformer related topics including Transformer Repair, Remanufacturing and Replacement, Transformer Design Review, Transformer Factory Inspections.

Simon Ryder – Senior Principal/ Transformer Consulting Engineer

Mr Ryder graduated from Oxford University in 1996 with a MEng in Engineering Science. From 1997 to 2003 worked for GEC Alstom T&D at Stafford, England and St Ouen, France, as Design and Development Engineers and Research Programme Manager. In 2003 joined Doble PowerTest Ltd, and has worked on condition assessment and failure analysis of transformers, including independent expert work, and more recently various procurement aspects, including factory capability assessment, tender evaluations, design reviews and progress inspections. Simon is currently chairman of Cigre SC A2 on Transformers which focuses on transformer design and manufacture, application of material, utilization (maintenance and operation, condition monitoring, life management, repair and refurbishment, disposal, safety and environmental aspects, quality assurance and testing.

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

Customer will provide:

- Confirmed training schedule at least 60 days in advance.
- Training coordinator through whom all contractor requests will be coordinated.
- Training facility for up to 20 participants, AV equipment, whiteboard and pens.
- Printing hard copy training material as required.

