TRAINING ON TRANSFORMER DESIGN & MANUFACTURING PROCESS





OUR VISION

Africa's key power sector support partner.

OUR MISSION

Empowering our partners by the provision of innovative and sustainable solutions in the power sector through the design, manufacture and delivery of quality products and services.

REGIONAL PRESENCE & MARKET



TANELEC UGANDA LTD: Trading and Service Centre, repair capacity of 60 Tx per month.

TANELEC KENYA LTD: Trading and Service Centre, repair capacity of 60 Tx per month.

TANELEC TANZANIA LTD (HQ) New Tx manufacturing Facility (14,000 Tx per Year).

TANELEC ZAMBIA LTD: Trading and Service Centre, repair capacity of 30 Tx per month

KEY





Training on Transformer Design & Manufacturing Process

TANELEC Limited commenced its operations in Arusha, Tanzania in 1981. It is well equipped to provide full customer support through a wide range of products through comprehensive repair and service capabilities.

At TANELEC we work hard to promote a team spirit within all levels of the company. We believe our employees are our greatest resource and as such strive to provide occupational health and safety and ensure safe working conditions by constantly auditing our internal processes and making improvements as we identify them.

Training on Transformer Design & Manufacturing Process 4

Introduction

Transformer is a static device with two or more windings that are linked to each other by means of a strong magnetic field. Transformers are designed for specific purposes. The design requirements of transformers depend on the application.

Training Content

The training covers design processes, both electrical and mechanical; fabrication; insulation; paper lapping; core cutting; core stacking, winding manufacture; winding assembly; quality assurance and control; active part assembly, drying, oil processing and tanking; protection components, factory testing and dispatch of the transformers.

Distribution transformers mainly consists of windings arranged concentrically around a high grain magnetic core. The combination of the windings, core and associated harness structure is called the active part. The electrical designer is responsible for dimensioning of the active part by running various calculations and simulations.

Once the active part design is completed, the mechanical designer will design the structural tank that contains the active part. The purpose of the tank is to contain the cooling and insulating medium for the active part. The tank also structurally protects the active part against the environmental conditions the distribution transformer will be exposed to.

A. Manufacturing of Distribution Transformers.

The topic involves all aspects of the overall manufacture of distributions transformers.

Design and processing of distribution transformers

This topic comprises the importance of writing standardized specifications as well as technical schedules. Also covered is the basic layout of a transformer and the design processes

Manufacture of winding for different applications

This topic comprises the different types of windings which can be designed for various applications.

Mechanical fabrication

This topic encompasses all aspects of the transformer tank which is primarily the container for the oil and a physical protection of the active part. It also serves as a support structure for the accessories and control equipment.



Training on Transformer Design & Manufacturing Process

B. Insulation Structures and Cooling.

This topic covers mechanical and dielectric strength of materials, oil impregnation and the specifications regarding moisture. Different types of cooling systems available i.e. ONAN, ONAF, OFAN, OFAF, OFWF as well as ODAF Mechanical design covers the following topics:

- Mechanical Design Process Flowchart
- Design Procedure
- Automated design Tools
- Mechanical Design System
- Active part, core, cleats and leads, tanking and design verification.

C. Quality Assurance and Control

Quality control (QC) is a process by which the manufacturing quality of all factors involved in production is checked against set design requirements and manufacturing tolerances. Quality control focuses on in process testing of products to uncover defects and report to management.

Quality Assurance (QA) attempts to improve and stabilize production and associate process to avoid, or at least minimize, issues which led to the defects in the first place. The focus from QA is on process improvement through trend analysis of reported defects. Also QA cover the following:

- Documented procedures and documentation development process
- Internal audits.
- Incoming and on-the-job inspections
- Customer complaints
- Testing of transformers.

The purpose is to provide a guideline for customer representatives, as well as other interested parties, on routine and type tests. This covers test methods and sequences normally used, the factory routine tests includes:

- Transformer turn ratio test
- Winding resistance test
- Load loss and impedance voltage
- No load loss test
- Induced over voltage test
- Separate source high voltage and low voltage test
- DC insulation resistance test
- Pressure leak test
- Oil BDV test





Training on Transformer Design & Manufacturing Process

D. Dispatch of the Distribution Transformer from Factory to Site.

Transport, installation and commissioning is an important part in the supply chain of distribution transformer. After the Factory Acceptance Test (FAT), the transformer is made ready for transporting. Power system protection deals with the protection of electrical power systems from faults through the isolation of faulted parts from the rest of electrical network. Thus, protection schemes must apply a very pragmatic and pessimistic approach to clearing system faults.

Protection components includes the following:

- Pressure relief valve
- Buchholz relay
- Breathers
- Marshalling kiosk
- Oil level indicator
- Temperature indicators

Commissioning tests covers when and under what circumstances transformers should be tested, the terminology as well as the recommended field tests that need to be performed and the reasoning behind the tests.

E. Preventive Maintenance and Periodic Inspection/Checkup.

Maintenance is aimed at operations technicians with purpose to train them in the basic maintenance tasks related to transformers in service. The training entails applicable product knowledge and the maintenance tasks that operator can perform themselves to proactively identify abnormal conditions and measure deterioration before it affects the transformer or leads to a failure. During operations, periodic physical checkup of the transformer needs to be maintained to monitor its condition going forward.

Periodic inspection or checkup includes the following:

- Insulation resistance tests may need to be carried out on site after one year to monitor insulation condition.
- Oil sample will need to be taken and tested after one year to monitor the breakdown voltage by then.
- For the fitted dehydrating breather needs to be checked and observing the color of the silica gel crystals.
- Also oil level indicator observations should be carried out for oil leaks detection and topping up.





Training on Transformer Design & Manufacturing Process

ISO Certification (2008)



Training on Transformer Design & Manufacturing Process

ISO Certification (2004)

BUREAU VERITAS Certification **TANELEC LIMITED** THEMI INDUSTRIAL AREA P.O. BOX 7156 ARUSHA, TANZANIA Bureau Veritas Certification Holding SAS - UK Branch certify that the Management System of the above organisation has been audited and found to be in accordance with the requirements of the management system standards detailed below Standards ISO 14001:2004 Scope of certification MANUFACTURE AND DISTRIBUTION OF TRANSFORMERS IN THE RANGE OF 15KVA TO 3000KVA, SERVICE AND REPAIR OF DISTRIBUTION AND POWER TRANSFORMERS, MANUFACTURE OF LOW VOLTAGE AND MEDIUM **VOLTAGE SWITCH GEARS** Certification cycle start date: 14TH JULY 2015 Subject to the continued satisfactory operation of the organisation's Management System, this certificate expires on: $13^{TH}\,JULY\,2018$ Original certification date: 29TH OCTOBER 2004 Version 01, Revision date: 13/07/2015 Certificate No. IND 15.6412 U/E Signed on behalf of BVCH SAS UK Branch 008 Certification body address: 66 Prescot Street, London, E1 8HG Local office: Bureau Veritas Certification (Kenya) Ltd, Box 34378 Nairobi, Kenya ns regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organisation To check this certificate validity please call: (+254 20 4450560)



10

O

Always at your service

Key Regional Customers



HEAD OFFICE

TANELEC Ltd, Themi Industrial Area, P. O. Box 7156, Arusha, Tanzania. Tel: +255 27 250 7892 /4, 250 8027, 250 3950 info@tanelec.co.tz

www.tanelec.co.tz