

## Harmonics, Power Quality & its effects on Gas Insulated Switchgears (GIS)

Date

05 May -09 May 2024

CAIRO

(\$)Fees

3200

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### Why Choose this Training Course?

This course focuses mainly on the effects and presence of harmonics in power system, with reference to auxiliary equipment such as variable speed drives, uninterruptible power supplies and others.

When more electronic devices are connected to our power systems, the '*quality*' of the power becomes more important. Stable voltages and undistorted waveforms are two characteristics which are very desirable. Grounding affects voltage stability, and more importantly, is critical to personal safety. Harmonics distortions will result in nuisance tripping of electrical systems. The advantages, components, characteristics and operations of a gas insulated switchgears substations are also discussed in this course.

#### This course will feature:

- Understanding types of power quality issues and harmonics
- Operation principle and construction of gas insulated switchgears
- Identification of the various types of waveforms
- Mitigation of harmonics and K-Factor
- Grounding of gas insulated switchgear substations

### What are the Goals?

By the end of this course, participants will be able to:

- Understand the various types of power quality issues
- Determine causes of wave form distortion
- Explain the effects of harmonics, filters and K-factor
- Analyse the common voltage disturbances
- Design the protection of gas insulated switchgear substations

### Who is this Training Course for?

This course will benefit all levels of professional in an electrical installation. It will enable them to understand power quality issues, causes of harmonics and operation of gas insulated switchgears.

**This course is suitable to a wide range of technical professionals but will greatly benefit:**

- Electricians
- Electrical supervisors
- Plant electricians
- Operations & maintenance engineers, supervisors & technicians
- Maintenance technicians

## **How will this Training Course be Presented?**

This course will utilise a variety of proven adult training techniques to ensure maximum understanding, comprehension and retention of the information presented. This includes presentation and discussion of latest videos and technologies on the power quality issues, harmonics and gas insulated switchgears.

Questions are encouraged throughout, particularly at the daily wrap up sessions. This provides opportunities for participants to discuss with the Presenter specific issues and, if possible, find appropriate solutions. Specific goals of each participant will be discussed to ensure that their needs are fulfilled whenever practicable.

## **The Course Content**

### **Day One: Introduction to Power Quality Analysis and Harmonics**

- What is power quality and definitions?
- Need for improving power quality
- Effects of disturbances on equipment and processes
- Sources of harmonics, symptoms and effect on equipment
- Harmonic limitations (IEEE Standard 519)
- Series resonance, filter design and third harmonic neutral current

### **Day Two: Fundamentals of Power System Harmonics and Calculations**

- Basic concept of harmonics and interharmonics
- Harmonic indices and its effects
- Harmonic resonance, filters and their characteristics
- System Harmonic Models
- The Current Injection Method
- Frequency Response Modelling

### **Day Three: Grounding, Voltage Disturbances, Measurement and Mitigation Techniques**

- Types of grounding, symptoms of ineffective grounding
- Arcing ground faults effects and control
- Impact of lightning, system switching, system faults, sags and swells
- Disturbance and grounding Measurements
- Waveform signatures and importance of K-Factors
- Power line conditioners operations

### **Day Four: Element of Gas Insulated Switchgear (GIS)**

- Description of GIS main components

- Switching components functions and applications
- Technical evolution of GIS
- Gas circuit breakers arc extinction
- Disconnectors and earth switches construction and operation
- Structural Components, bus-bars and support insulators

## **Day Five: High voltage GIS Substations and Grounding**

- Air insulated switchgear (AIS) versus GIS substations
- Basic GIS substation layouts
- Indoor and outdoor GIS
- Particularities of grounding in GIS
- Low frequency grounding
- High frequency grounding, Transient Ground Potential Rise (TGPR)



00971504646499



info@britishtc.org



<http://britishtc.org/>