



# EE147

## (LV & MV) Electric Switchboards Design for Electrical Engineers

## Course Introduction:

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Switchgear (and circuit breakers) are obviously critical components in electrical distribution systems and their operation significantly affects the overall operation of the system. This five-day course will discuss application, installation, maintenance and testing issues relating to medium and high voltage switchgear and circuit breakers. There will also be a coverage of low voltage switchgear. Delegates will receive a thorough grounding in switchgear theory and standards. You will gain a solid understanding of the issues associated with the proper application, installation and maintenance of these critical items of equipment with an overriding emphasis on safety. This comprehensive course emphasizes medium voltage switchgear which represents most of the switchgear installed on electrical distribution systems. The focus here is on air blast, oil, SF6 and vacuum circuit breakers. Case studies covering the main manufacturer's equipment will illustrate the important practical principles. Other power system protection components will be discussed as well to ensure that switchgear is understood in the correct context.

## Course Objectives:

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**Upon successful completion of this course, the delegates will be able to:**

- Apply and in-depth knowledge and skills on LV/HV circuit breakers and switchgears
- Have a proper selection of appropriate type and rating of circuit breakers and switchgear
- Explain fundamentals of operation of switchgear
- Discuss Switchgear components (CTs, VTs, relays, cable terminations)
- Apply safe operational policies including safety rules and safety documents
- Able to discuss different LV/MV for of separations
- Fully understand how to size and select different type of motor starters
- Diagnostic tools and test equipment for switchgears
- Apply safe maintenance policies including safe working in switch rooms, indoor and outdoor substation

## Who Should Attend?

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This course provides an overview of all significant aspects and considerations of Switchgears and Circuit Breakers for engineers and other technical staff who need a sound understanding of Low Voltage, Medium and High Voltage Switchgear and Circuit Breaker design.

# Course Outline:

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## Day 1:

- Introduction to LV & HV Switchgear
- Breaking of AC currents
- Transient restrike recovery voltage (TRRV)
- Surge arresters
- Metal clad & metal enclosed switchboards

## Day 2:

- LV forms of separation
- Load flow studies (rated current)
- Calculation of fault currents (simplified methods, PU, MVA & Symmetrical components)
- Breaking & Making Capacities
- Different types of LV Circuit breakers/contactors (ratings & tripping units/curves)
- Sizing of motor starters (DOL, Star/Delta, Auto transformer & soft starters)

## Day 3:

- Fuse sizing for distribution transformers & motors
- Type 1 & type 2 co-ordination for motor starters
- Dimensioning of LV switchboards (MCC & power centers)
- Different types of HV Circuit breakers (Oil, Vacuum, Gas & Air type)
- Merits & demerits of each type of HV breakers

## Day 4:

- Different de-rating factors (temperature, altitude, etc ...)
- Breaking capacity de-ratings according to IEC/ANSI C37.010
- Bus bar sizing/cross sectional area/current density & skin effect
- Specifications for switchboards

## Day 5:

- Overview of protection & measuring units
- Different types electrical diagrams
- Panel scheduling
- Type & routine tests on switchgear

## Course Certificate:

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**International Center for Training & Development (ICTD)** will award an internationally recognized certificate(s) for each delegate on completion of training.

## Course Methodology:

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**A variety of methodologies will be used during the course that includes:**

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods
- Lectures
- Case Studies and Self Questionnaires
- Group Work
- Discussion
- Presentation

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## Course Fees:

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**To be advised as per the course location.** This rate includes participant's manual, and-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

## Course Timings:

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### Daily Course Timings:

08:00 - 08:20	Morning Coffee / Tea
08:20 - 10:00	First Session
10:00 - 10:20	Coffee / Tea / Snacks

10:20 - 12:20	Second Session
12:20 - 13:30	Lunch Break & Prayer Break
13:30 - 15:00	Last Session

