



CERTIFIED HV/MV

Cable Splicing, Jointing & Termination

Course Introduction:

The range of voltage and capacity of power transmitted through cables is showing a steady increase over the years. Environmental concerns, aesthetic issues, lack of transmission corridors and difficulty in routing overhead lines in crowded human habitats are some of the reasons for the explosive growth of cable technology well into the new voltage range. Due to physical limits on cable lengths for manufacturing and packaging, joints in cable become inevitable, particularly in the context of the utility sector. The cables need to be also terminated at sending and receiving end equipment, a very wide variety of them, in utility as well as industry applications and these calls for appropriate cable termination accessories.

Cable terminations and joints form the weakest link in any distribution system. Also, a failed joint in an underground distribution system is much more difficult to locate and repair compared to any similar problem in overhead distribution systems. This means that we should do our utmost to achieve a good joint or termination, which can give years of trouble-free service. The quality of a joint or termination depends to a large extent on the skill of cable jointer/splicer. The aim of a cable jointer/splicer must therefore be to obtain a joint which electrical properties are as good as the original cable both in electrical and mechanical terms. The design of cable splicing, jointing and termination accessories is based on this perception. Dependence on operator-skill is sought to be reduced to the extent possible by good choice and quality of jointing materials, though such dependence cannot be totally eliminated.

We will discuss these issues in this course by looking at the fundamental theoretical aspects involved so that the importance of the correct cable splicing, termination and jointing will be brought home to those who attend the course.

The course includes hands-on practical sessions where participants carry out HV/MV cable jointing, termination, splicing and testing.

Course Objectives:

Towards the end of the training, the participants will be able to:

- ✓ Apply the latest techniques in HV/MV cable splicing, jointing, terminating and testing
- ✓ Discuss cable jointing and the different types of cables, insulation materials, terminations and joints
- ✓ Describe the construction of cables, conductor materials and configurations, the different applications and voltages of cables
- ✓ Identify the various types of cable connectors, materials and method of connection
- ✓ Apply the theory of joints and terminations
- ✓ Calculate stress control and determine the effect of joints and terminations on stress

- gradients and the areas requiring stress control
 - ✓ Practice cable jointing, splicing, testing and terminating
 - ✓ Implement the applicable standards, the types of tests, routine tests and its limitations and the training and certification of personnel involved
 - ✓ Find reasons for cable failures and perform analysis of failures with a predictive approach
- Apply new trends and technologies utilized in the industry

Who Should Attend?

This course is valuable for electrical engineers, electrical staff, instrumentation & control engineers and staff, project engineers, maintenance engineers, power system protection and control engineers, building service designers, data systems planners and managers, electrical and instrumentation technicians.

Course Outline:

- **PRE-TEST**
- **Introduction**
- **Course Overview**
 - Need for Cable Joints and Terminations
 - Cables- Historic Perspective
 - Types of Cables
 - Types of Insulation Materials
 - Basic Types of Terminations and Joints
 - Installation Aspects; Reducing the Number of Joints by Proper Planning
 - Standards, Testing and Failures
- **Cables**
 - Basic Construction
 - Conductor Materials and Configurations
 - Insulation Materials for Different Applications and Voltages
 - Use of Screen in HV Cables
 - Use of Armor for Ground Continuity and Mechanical Protection
 - Special Aspects of Single Core Cables
 - Voltage Rating of Cables and Impact of System Grounding Method on Voltage Rating
 - Stress Distribution in Single Core and Multi-Core Power Cables
 - Electrical Breakdown of Insulating Materials
 - MV Cables
 - HV Cables Using XLPE Insulation
 - Treeing in XLPE and Need for End Sealing of Cables in Storage
 - Basic Manufacturing Process

- **Cable Connectors**
 - Materials
 - Types of Connectors for Cable Terminations and Joints
 - Current Path
 - Method of Connections
 - Comparison
 - Contact Resistance
 - Preferred Methods in Practice for Different Cable Ratings Contact of Dissimilar Materials and Galvanic Effects; Use of Bi-Metal Accessories
- **Joints and Terminations-Theory**
 - Basic Approaches
 - Broad Classification of Joints/Termination Approach
 - Comparative Merits
 - Prefabricated
 - Site Fabricated
 - Additional Requirements of Outdoor Terminations
 - Reconstitution of Cable Properties
 - Connectivity for Cable Screen and Armor
 - Mechanical Protection of Joints and Terminations
- **Stress Control**
 - Effect of Joints and Terminations on Stress Gradients
 - Areas Requiring Stress Control
 - Basics of Stress Control Approach
- **Jointing and Termination Practice**
 - Kits for Joints and Terminations
 - Shelf Life Issues
 - Importance of Matching Diameter of Insulated Conductor with Kit Specifications in Pre-Fabricated Kits
 - Preparation of Cable for Termination and Jointing
 - Connection
 - Reconstitution of Cable Properties
 - Continuity and Grounding Aspects
 - Sealing
 - Healthiness of Joint/Termination
 - Installation Aspects for Joints
 - Access for Repairs
- **Standards and Testing**
 - International/National Standards

- Type Tests
- Limitations
- Routine Tests
- Training and Certification of Personnel
- **Terminations to Equipment**
 - Terminations to Indoor Switchgear
 - Terminations to Electrical Machines
 - Termination of Outdoor HV Installations
 - Terminations to GIS Installations
 - Importance of Correct Orientation of Terminations
- **Failures and Analysis**
 - Reasons for Failures
 - Documentation of Work
 - Documentation of Failures
 - Analysis of Failures
 - Predictive Approach
- **New Trends**
 - Reasons for Increasing Preference to Underground Cables
 - New Technologies for Very High Capacities and Voltages
 - EHV XLPE
 - High Temperature Superconductivity in Cables and Likely Impact on Current Practices
- **POST-TEST**
- **Presentation of Course Certificates**

Course Methodology:

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

Course Certificate:

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

Course Fees:

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

Course Timings:

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

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