



DESIGN INSTALLATION AND PROTECTION of Underground Cables

Course Introduction:

The electricity companies have to supply electricity to the consumers at the lowest possible cost commensurate with safety. Power cables represent a major capital asset for electricity suppliers. While in service power cables must be maintained and monitored in order to anticipate faults and possibly avert any failure.

While requirement for underground cables have been increasing, there has been a rapid development of new cable types and accessories including the use of polymeric cables (predominantly XLPE). Evaluating technical and economic aspects of new cable systems is not easy. Furthermore the installation of underground power requires unique skills and knowledge. Tasks involved cover many aspects: laying, jointing, testing and commissioning underground cables, to cable location and fault-finding. Changes in systems also bring additional costs in stores holdings, job instruction preparation and jointer training.

Faults in underground cables can occur at any time, and the causes are many and varied. When faults do occur they generally cause loss of supply to customers and loss of revenue for suppliers. So it is imperative that the fault location process is efficient and accurate to minimize excavation time, which results in reducing the inconvenience to all concerned. For fault locating to be efficient and accurate technical staff needs to have expert knowledge accompanied with experience in order to attained service reliability.

This course is designed to ensure that those responsible for the selection, laying, operation, maintenance and monitoring of power cables understand the characteristics, technical issues involved and comply with relevant specifications and requirements.

Course Objectives:

This hands-on course covers types of power cables, characteristics, construction, applications, operation and maintenance. This course provides the fundamentals, a summary of present operating practice and of new technology. Participants can use the skills and knowledge gained in this course to perform testing and preventative maintenance on power cables to ensure safety and longer equipment life.

Upon completion of the course, participants will be able to:

- ✓ -Understand the essential characteristics and requirements of underground cables
- ✓ -Appreciate the technical options for selection, laying and operation of power cables
- ✓ -Carry out jointing and termination of high voltage underground cables
- ✓ -Apply practices for fault detection and location and for power cables
- ✓ -Identify problems and failure modes of power cables

- ✓ -Perform routine and preventative maintenance, monitoring and testing of power cables

Your participation will help you understand the theory and practice of power cable and accessory engineering and applications, with particular emphasis on:

- ✓ Cable materials: conductors, insulations, shields, and jackets
- ✓ How cable is designed and manufactured
- ✓ Cable characteristics, applications, selection, and specification
- ✓ Cable ampacity ratings and calculations
- ✓ Splicing and terminating standards and practices

Who Should Attend?

Overhead line and underground cable utility tradesman, technicians and field supervisors

Course Outline:

INTRODUCTION TO OFFSHORE FIELD DEVELOPMENT ACTIVITIES

- Background and trends in offshore production
- Review of developments using fixed platforms and floating production systems
- Steps in the field development process and the range of vessels which support those activities

CHAPTER 1: HAZARDS OF ELECTRICITY

- HISTORY
- IMPORTANCE OF GROUNDING
- GROUNDING CLASSIFICATION
- EARTH, GROUND AND NEUTRAL
- DEFINITIONS
- CONDITIONS OF DANGER
- HAZARD ANALYSIS
- ELECTRIC SHOCK
- AFFECTED BODY PARTS
- WHY EARTHING?
- GROUND FAULT INTERRUPTING METHODS
- ELECTRICAL SAFETY MODEL
- IP PROTECTION

CHAPTER 2: CABLE CONSTRUCTION AND MATERIALS

- General
- Conductor materials

- Plastics
- Rubbers
- Thermoplastic elastomers (TPE)
- Other thermoplastics
- Low-smoke materials
- Safety rules and standards
- Product descriptions
- Cable dimensioning
- Economic cross-section and loss evaluation
- Hints on cable laying
- Single core cables

CHAPTER 3: CABLE ELECTRICAL CHARACTERISTICS

- Introduction
- Design features
- Manufacturing processes and materials
- Conductor resistance
- Inductive reactance
- Capacitive reactance
- Dielectric losses
- Insulation resistance
- Dielectric strength (electric breakdown strength)
- Impulse strength
- Cable rated voltage

CHAPTER 4: POWER CABLES

- Introduction
- Types of cables
- Low-tension cables
- High-tension cables
- Tension cable

CHAPTER 5: CABLE AMPACITY

- Introduction
- Air cable ampacity
- Underground cable ampacity
- Cables installed in ducts
- Short circuit
- Short circuit effect on cables

- Thermal stress
- Electromechanical stress
- Permitted voltage drop

CHAPTER 6: CABLE CONDUITS, DUCTS, TRUNKING, TRAYS, TRENCHES, JOINTING & SERVICE ENTRANCE

- Introduction
- General
- Low voltage joints
- Medium voltage
- Joints over 30 kV
- Open terminations
- Resistive stress control
- Cable termination design
- Enclosed terminations
- Crimp connection
- Pulling the cable
- Installing cable racks
- Cable jacket and sheath removal
- Cable metallic shielding removal
- Cable semi-conducting material removal
- Cable insulation removal
- Cable splice connector
- Installing taped cable insulation
- Identification of conductors
- Conduits
- Cable supports
- Trunking
- Cable tray
- Trenches
- Service entrance

CHAPTER 7: CABLE TESTS AND CABLE FAULT LOCATION

- Inspection, tests & evaluations
- Cable testing
- Cable fault causes
- Types of fault
- Steps for fault location
- Fault location methods

- A-frame
- Time domain reflectometry
- Wheatstone (resistance) bridge
- Capacitance bridge

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

