Chapter 3
Underground Cables Layout

ABSTRACT

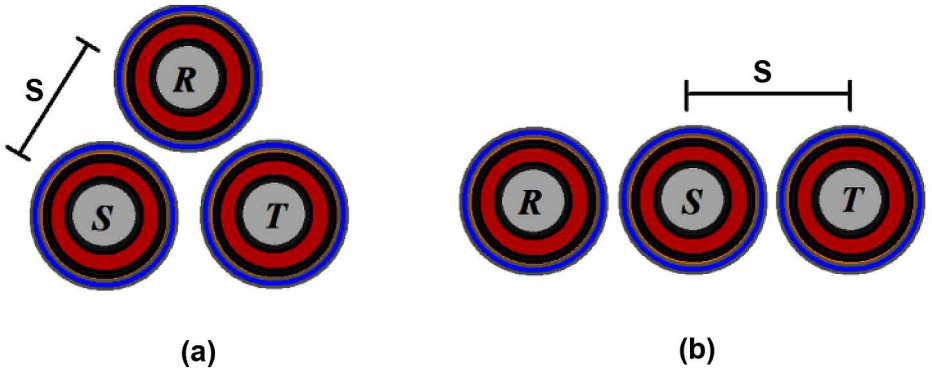
This chapter discusses the different ways of cables installation such as open wire, aerial cable, above-ground conduits, underground ducts and underwater (Submarine) cables. The chapter explains the precautions to protect cables from moisture, general drum handling, power cable Installation guide and after installation field tests

3.1 TREFOIL AND FLAT FORMATION CABLES LAYOUT

Two types of cable layouts formation usually used in practice are studied in this book:

1. A trefoil arrangement of three single-core cables, where the cables are laid as at the corners of an equilateral triangle. In this formation two single-core cables are laid close together with one cable forming an upward, (Figure 1a).
2. A flat arrangement of three single-core cables, where the three cables are laid in the same horizontal plane with the middle cable equidistant from two outer cables, Figure 1(b).

Figure 1. Single-core cable layouts



DOI: 10.4018/978-1-4666-6509-5.ch003

Copyright © 2016, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

There are a variety of ways to install power distribution cables. Each method ensures distribution of power with a unique degree of reliability, safety, economy, and quality for any specific set of conditions. These conditions include the electrical characteristics of the power system, the distance and terrain of distribution, and the expected mechanical and environmental conditions.

1. **Open Wire:** Open-wire construction consists of un-insulated conductors on insulators which are mounted on poles or structures. The conductor may be bare or it may have a thin covering for protection from corrosion or abrasion. The attractive features of this method are its low initial cost and the fact that damage can be detected and repaired quickly. On the other hand, the insulated conductors are a safety hazard and are also highly susceptible to mechanical damage and electrical outages resulting from short circuits caused by birds or animals. Proper vertical clearances over roadways, walkways, and structures are critical. Exposed open-wire circuits are also more susceptible to the effects of lightning than other circuits, however, these effects may be minimized by the use of overhead ground wires and lightning arresters. In addition, there is an increased hazard where crane or boom truck use may be involved. In some areas contamination on insulators and conductor corrosion can result in high maintenance costs.
2. **Aerial Cable:** Aerial cable consists of fully insulated conductors suspended above the ground. This type of installation is used increasingly, generally for replacing open wiring, where it provides greater safety and reliability and requires less space. Properly protected cables are not a safety hazard and are not easily damaged by casual contact. They do, however, have the same disadvantage as open-wire construction, requiring proper vertical clearances over roadways, walkways, and structures.
3. **Above-Ground Conduits:** Rigid steel conduit systems afford the highest degree of mechanical protection available in above-ground conduit systems. Unfortunately, this is also a relatively high-cost system. For this reason their use is being superseded, where possible, by other types of conduit and wiring systems. Where applicable, rigid aluminum, intermediate-grade steel conduit, thin-wall EMT, intermediate-grade metal conduit, plastic, fiber and asbestos-cement ducts are being used.
4. **Underground Ducts:** Underground ducts are used where it is necessary to provide a high degree of safety and mechanical protection, or where above-ground conductors would be unattractive. Underground ducts use rigid steel, plastic, fiber, and asbestos-cement conduits encased in concrete, or recast multi-hole concrete with close fitting joints. Clay tile is also used to some extent. Where the added mechanical protection of concrete is not required, heavy wall versions of fiber and asbestos-cement and rigid steel and plastic conduits are direct buried Cables. Cables used in underground conduits must be suitable for use in wet areas, and protected against abrasion during installation. Direct Burial Cables may be buried directly in the ground where permitted by codes and only in areas that are rarely disturbed. The cables used must be suitable for this purpose, that is, resistant to moisture, crushing, soil contaminants, and insect and rodent damage. While direct-buried cable cannot be readily added to or maintained, the current carrying capacity is usually greater than that of cables in ducts. Buried cable must have selected backfill. It must be used only where the chance of disturbance is unlikely. The cable must be suitably protected, however, if used where the chance of disturbance is more likely to occur. Relatively recent advances in the design and operating characteristics of cable fault location equipment and subsequent repair methods and material have diminished the maintenance problem.
5. **Underwater (Submarine) Cable:** Submarine cable is used only when no other cable system can be used. It supplies circuits that must cross expanses of water or swampy terrain.

26 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:
www.igi-global.com/chapter/underground-cables-layout/143622

Related Content

Invasive Methods to Diagnose Stator Winding and Bearing Defects of an Induction Motors
Muhammad Aman Sheikh, Nordin B. Saad, Nursyarizal Mohd Nor, Sheikh Tahir Bakhshand Muhammad Irfan (2019). *Advanced Condition Monitoring and Fault Diagnosis of Electric Machines (pp. 122-130).*
www.irma-international.org/chapter/invasive-methods-to-diagnose-stator-winding-and-bearing-defects-of-an-induction-motors/212309

Synchronized Operation of Grid Power, Solar Power, and Battery for Smart Energy Management
Pawan Kumarand Dip V. Thanki (2018). *Handbook of Research on Power and Energy System Optimization (pp. 255-291).*
www.irma-international.org/chapter/synchronized-operation-of-grid-power-solar-power-and-battery-for-smart-energy-management/205431

Cyber-Physical Security in Healthcare
Vasiliki Mantzana, Eleni Darraand Ilias Gkotsis (2020). *Safety and Security Issues in Technical Infrastructures (pp. 63-87).*
www.irma-international.org/chapter/cyber-physical-security-in-healthcare/253354

Seamless Control and Unified Dynamic Energy Management in a Renewable/Clean Energy Integrated Self-Reliant DC Microgrid: Integration of Renewable Sources With High-Gain Power Processing Stages
Vulisi Narendra Kumar, Gayadhar Pandaand Bonu Ramesh Naidu (2018). *Handbook of Research on Power and Energy System Optimization (pp. 511-551).*
www.irma-international.org/chapter/seamless-control-and-unified-dynamic-energy-management-in-a-renewableclean-energy-integrated-self-reliant-dc-microgrid/205439

Power Quality Improvement in Distribution System Using Dynamic Voltage Restorer
Tesfahun Molla (2020). *Handbook of Research on New Solutions and Technologies in Electrical Distribution Networks (pp. 48-63).*
www.irma-international.org/chapter/power-quality-improvement-in-distribution-system-using-dynamic-voltage-restorer/245637