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Beck, P.A.

Underground cables

National Research Tomsk Polytechnic University.

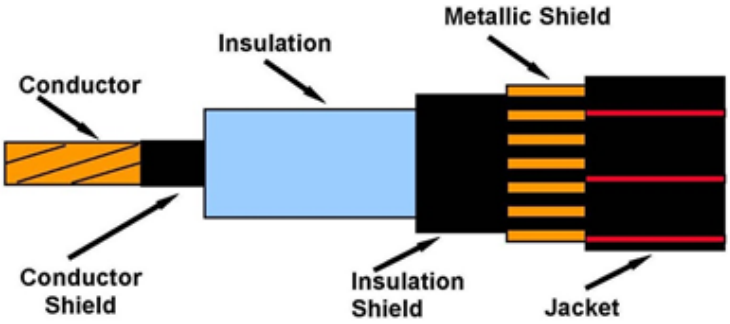
Underground cables are part of the electric transmission system designed for underground installation. Their main purpose is the transmission of electrical energy. Undergrounding refers to the replacement of overhead cables providing electrical power or telecommunications, with underground cables. This is typically performed for aesthetic purposes. In figure 1 below one can see how cables can improve the visual impact to people and surroundings.

Figure 1 (left) – Before and after laying underground cables.

One of the commonly used types of underground cables is an extruded dielectric cable which consists of the following components:

- Conductor – Typically aluminum or copper. It carries current and voltage.
- Strand Shield – It is applied over the conductor to form a smooth, concentric shape preventing insulation from flowing into the strands.
- Insulation – Typically rubber (EPR) or plastic (XLPE or TR XLPE.) It insulates the medium voltage conductor from ground.
- Insulation Shield – It controls the stress within the insulation and is part of the dead-front configuration.
- Metallic Shield – Typically copper or aluminum, but may also be lead. The shape can be concentric neutrals, copper tape, longitudinally corrugated copper tape, drain wires, flat strap, or lead sheath.
- Outer Jacket – It provides protection to the metallic shield that helps prevent moisture from attacking the shield or migrating into the insulation where it can cause trees and potential cable breakdown.[1].

Figure 2 (right) – Construction of an underground cable.



In Figure 2 one can see construction of underground cable.

Underground cables are known to have certain advantages in comparison with overhead lines. Among them:

- Less subject to damage from severe weather conditions.
- Greatly reduced emission, into the surrounding area, of electromagnetic fields.
- Underground cables pose no hazard to low flying aircraft or to wildlife.

Figure 3 (left): Damage of overhead lines and reliability of underground cables from severe weather conditions.

- Much less subject to conductor theft, illegal connections, sabotage, and damage from armed conflict.

In figure 3 one can see why underground cables are less subject to damage from severe weather conditions.

On the other hand, underground cables also have disadvantages:

- Undergrounding is more expensive, since the cost of burying cables at transmission voltages is several times greater than overhead power lines.
- Underground repairs can take days or weeks, and for this reason redundant lines are run.
- Underground cable locations are not always obvious, which can lead to unwary diggers damaging cables or being electrocuted.
- Underground cables are more subject to damage by ground movement.[2].

Figure 4 (right): Repair of underground cable.In figure 4 one can see repairs of underground cables.

To sum up, using undergrounding can increase the initial costs of electric power transmission and distribution but may decrease operational costs over the lifetime of the cables. Underground cables can transmit power across densely populated areas or areas where land is costly or environmentally or esthetically sensitive. Underground and underwater crossings may be a practical alternative for crossing rivers.

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