Flooding & MV Outages

Why it’s (usually) the joint — not the cable

Introduction

Flooding, rising groundwater levels and extreme weather events are increasingly challenging the reliability of underground medium-voltage (MV) networks. What were once considered exceptional conditions are now becoming part of normal operating reality for many utilities. Despite this shift, the root causes of MV outages under flooded conditions are often misunderstood.

Field experience and post-event investigations consistently show that MV cables themselves usually withstand prolonged water exposure. Failures tend to occur elsewhere in the system. This document explains why cable joints represent the dominant weak point during flooding events and why joint reliability is central to building flood-resilient MV networks.

Flooding as a structural operating condition

Climate-driven changes have altered the boundary conditions for underground infrastructure. Longer periods of soil saturation, higher groundwater tables and repeated wet–dry cycles introduce continuous environmental stress on MV networks.

In many regions, flooding is no longer an incidental risk but a structural operating condition that must be addressed through design, material selection and asset strategy.

Under these conditions, network reliability is defined not by average performance, but by how components behave when exposed to sustained moisture and hydrostatic pressure.

What survives flooding — and what does not

Modern MV cable insulation systems, such as XLPE, are designed to tolerate long-term exposure to moisture. Numerous flooding events have shown that cables often remain electrically intact even after extended submersion.

By contrast, failures are disproportionately concentrated at joints, terminations and accessory systems. These failures may occur during the flooding event itself or appear months later as delayed outages initiated by moisture ingress.

This distinction is critical. When flooding leads to outages, the cable is rarely the limiting factor. The joint is.

Why cable joints are inherently more vulnerable

Unlike a continuous cable, a joint combines multiple materials, geometries and interfaces within a confined space. It introduces transitions between insulation systems, conductive elements, mechanical supports and external sealing layers.
Under wet conditions, water does not need to penetrate bulk material to cause damage. It exploits interfaces, micro-voids and imperfections in sealing.
Once water enters a joint, several degradation mechanisms may be triggered:

- reduction of insulation resistance
- increase of dielectric losses
- initiation of partial discharge
- accelerated thermo-electrical ageing

These processes often develop gradually and remain undetected until failure occurs, making joint reliability a hidden but decisive factor in MV network performance.

Lessons from international flooding events

Investigations following major flooding events across different regions show a consistent pattern. In large-scale flooding incidents, underground MV cables largely survived, while failures were concentrated at joints and terminations. Urban flood-risk assessments identified interfaces and accessory systems as primary water ingress points. In regions exposed to repeated flooding, ageing-related cracking and insufficient joint sealing were identified as leading causes of outages. Across geographies and network types, the engineering conclusion is the same: robust, void-free and well-sealed joints are essential to prevent both immediate and delayed failures under water exposure.

Implications for asset strategy

Treating flooding as a cable problem leads to incomplete risk mitigation and misplaced investments. Improving flood resilience requires shifting attention from the cable itself to the joint as a system-critical component.
For asset managers and technical decision-makers, this means:

- including joint design and sealing concepts in flood-risk assessments
- prioritising joint technologies validated for long-term water exposure
- recognising that joint performance often defines outage risk, repair cost and recovery time

Flood-resilient MV networks are built at the connection, not in the conductor.

Conclusion

Flooding rarely causes MV outages because cables fail. Instead, failures originate at joints, where interfaces, sealing quality and ageing effects converge. As flooding becomes a structural operating condition, joint reliability must be treated as a primary design and asset-management consideration rather than a secondary detail.

Continue exploring

If flooding is a real operating condition in your network, understanding joint behaviour is only the starting point. On the main page, you can explore deeper technical insights into joint failure mechanisms, flood-resilient design principles and practical selection criteria for MV joints used in water-logged environments.