

High-voltage busbar construction in the Democratic Republic of Congo

Article Overview

High-voltage busbar systems in the DRC are integral to HVDC and HVAC transmission projects, exemplified by the Inga-Kolwezi link and regional interconnectors, supporting reliable power delivery across long distances.

Key Projects and Infrastructure

The Inga-Kolwezi HVDC link is a 1,700 km, ± 500 kV high-voltage direct current transmission system connecting the Inga hydroelectric complex to the copper mining district of Katanga. It features converter stations at Inga and Kolwezi, each equipped with six single-phase converter transformers and AC harmonic filters. The busbar systems in these stations are designed to handle extremely high voltages and currents, with air-cooled thyristor valves arranged in series to achieve the required voltage ratings, ensuring reliable conversion between AC and DC power. The Kolwezi-Solwezi interconnector is a 148 km, 330 kV HVDC line linking the DRC and Zambia. This project demonstrates modern high-voltage busbar construction techniques for regional interconnections, enhancing grid stability in southern DRC.

Busbar Design Considerations

High-voltage busbars in the DRC are typically constructed using aluminium conductor steel-reinforced (ACSR) cables for overhead lines, supported by self-supporting lattice steel towers. A minimum separation of 40 meters is maintained between parallel lines to prevent electrical interference and ensure safety. Inside converter and switching stations, busbars are designed to:

- o Distribute high currents efficiently between transformers, reactors, and switchgear.
- o Support modular thyristor valve assemblies for HVDC conversion.
- o Allow maintenance and redundancy, enabling monopolar operation with ground return in case of line outages. Air-insulated and gas-insulated busbar systems are used depending on space constraints and environmental conditions. The DRC's tropical climate and logistical challenges require robust insulation, corrosion-resistant materials, and careful planning for long-term reliability.

Operational and Maintenance Aspects

High-voltage busbar systems in the DRC are maintained under preventive maintenance programs, including periodic inspections, cleaning, and testing of insulation and connections. Training of local personnel is emphasized to ensure operational reliability over decades, as seen in the long-term service agreements for the Inga-Kolwezi link.

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Challenges

Constructing high-voltage busbars in the DRC faces several challenges:

- o Remote and difficult terrain, complicating transport of heavy equipment.
- o Civil unrest and political instability, historically delaying projects.
- o High humidity and corrosion risk, requiring durable materials and protective coatings.
- o Long transmission distances, necessitating careful design of busbar spacing, insulation, and support structures .

Conclusion

High-voltage busbar construction in the DRC is a critical component of the country's electricity infrastructure, enabling efficient transmission of hydroelectric power and cross-border interconnections. Projects like the Inga-Kolwezi HVDC link and Kolwezi-Solwezi interconnector illustrate advanced busbar design, robust converter station integration, and long-term operational planning to ensure reliable power delivery in challenging environments .

It was primarily constructed by Morrison-Knudsen International, an American engineering company, with the converter equipment

The Democratic Republic of Congo (DRC) faces what is probably the most daunting infrastructure challenge on the African continent.

Inga-Kolwezi HDVC Link The Inga-Kolwezi link (formerly Inga-Shaba link) is a 1,700km long, 500kV high voltage

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