ArmCoil

Delivering Power Solutions through Transformers & Substations

CASE STUDY

Custom Mini Substations for Debswana - Jwaneng Mine

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PROJECT OVERVIEW

The project involved the design, manufacture and testing of an ANAF (Dry Type) Medium Voltage skid-Substations for the Jwaneng Mine a critical component of the mines early works extension. The end user, a leading entity in Botswana's mining sector, required customized, durable Dry Type Medium Voltage Skid Substations (MVS) to meet the harsh conditions of the mine. The project focused on ensuring the substations' resilience, safety, and operational reliability in the surface mining industry.

Key features of the substations included remote switching for improved operational control, Cast Resin Transformers (CRT) designed to endure extreme conditions, and a dual LV configuration for flexible power distribution. The use of advanced CRTs enhanced operational efficiency, while infrared temperature sensors and arc fault monitoring systems ensured real-time safety. A fire suppression system was integrated to mitigate fire hazards, and a custom monitoring system with DTR relays was added for optimal performance and control.

DESIGN & MANUFACTURING PROCESS

ArmCoil's approach to the design, manufacturing and testing involved creating a fully tailored solution for the client, which has never been done before. The substations featured dry-type Cast resin transformers with forced cooling, ensuring their ability to withstand extreme operating conditions.

The design included dual LV compartments—less common than dual HV configurations—providing greater versatility. The substations were locally manufactured in South Africa and mounted on a skid base for easy mobility and deployment across the mine site.

To meet the client's specific requirements, every aspect of the mini substations was customized.

The manufacturing process utilized cutting-edge materials and technologies, such as NERM and Adit relays, infrared and arc fault sensors, and a robust fire suppression system. Additionally, a remote pendant for switching ensured ease of operation for both high and low-voltage sections. The design incorporated precise steelwork, with components laser cut and bent for optimal accuracy.

The substations were engineered to support both 6.6kV and 11kV voltage classes, adding to their versatility. Testing was thorough, with ingress water protection test ensuring that the units could withstand harsh environmental conditions typically encountered in mining environments.

CHALLENGES & SOLUTIONS

The project faced several challenges despite meticulous planning. These included extended payment terms, delays in design approval, and logistical issues. The initial 60-day payment terms led to delays in material procurement and manufacturing, requiring renegotiation with the client for more flexible terms. Design revisions caused further delays, which were managed by improving collaboration with the client to expedite approvals. A significant issue occurred during testing when a high-voltage winding connection failure resulted in a transformer malfunction. This was resolved within three weeks by replacing the damaged transformer winding, which was a "never done before" operation and was successfully completed. Paint curing problems also caused delays, but after consulting with suppliers and providing additional training, the issue was addressed and resolved.

Modifications During Production

Throughout production, several modifications were made based on client feedback. The design was originally based on a welded structure but was changed to a bolt-type structure to enhance durability and flexibility. Additionally, the motorized circuit breaker for the low-voltage section was modified to allow pendant control, improving usability.

LESSONS LEARNED & FUTURE OPPORTUNITIES

The project provided valuable insights, particularly in managing extended payment terms more effectively, improving communication with clients, and considering product standardization for future projects. The experience gained from this project will help ensure smoother execution in future endeavors, as the team now has a clearer understanding of the product expectations and client needs. There is also an opportunity to expand the product range by applying the lessons learned to refine both design and operational processes moving forward.

SCOPE OF WORK

The project scope included the production and delivery of several mini substations, featuring both 6.6kV and 11kV configurations, along with various additional components, including the 1000kVA Dual Voltage Miniature Substation. Key deliverables included:

- Schnider RM6 Ring Main Unit, with 2 x motorized Isolator and 1 x C/Breaker
- CRT transformer 1MVA 6.6/1.0-.55kV Dyn11yn11 or 1MVA 11/1.0-.55kV Dyn11yn11 with copper windings
- 3 x Auxiliary Transformers: different sizes.
- NER and NERM panels for each LV neutral
- Cast Resin Transformers with Cu windings.
- Schneider RMU on HV compartment
- LV Compartments equipped with ABB components, including motorized MCCBs, ammeters, and earth leakage relays.
- Fire Suppression System,
- Skid Base, and other key electrical components.
- DTR relay x 1

CONCLUSION:

This project successfully demonstrated ArmCoil's ability to design and manufacture highly customized medium voltage substations that met the specific requirements of an international mining leader. With advanced technology, rigorous testing, and a client-focused approach, the project was delivered on time and exceeded expectations, showcasing ArmCoil's commitment to quality, innovation, and excellence.

THANK YOU!

Let us guide you towards your own success story. Reach out to us today and embark on a path towards exceptional results.

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