

## **Technical Case Study**

### **HV Commissioning and Protection Testing for 132 kV Substation**

(Diamantina Power Station, Queensland, Australia, 2022)

Prepared by: Cristopher Sanhueza, MSc – Senior Protection & Commissioning Engineer

#### **Abstract**

This technical case study presents the high-voltage (HV) commissioning and protection testing program conducted at the 132 kV substation of the Diamantina Power Station in Queensland, Australia. The project focused on validating substation readiness for reliable integration of gas and renewable generation sources into the state grid. Activities included HV testing of primary assets, relay coordination studies, and compliance checks with IEC/IEEE standards. The work enhanced system reliability and supported Queensland's transition towards renewable energy.

Keywords: HV Commissioning, Protection Testing, 132 kV Substation, Renewable Integration, Australia

#### **1. Introduction**

Diamantina Power Station is a major generation facility in Queensland combining gas turbine and renewable generation. Its 132 kV substation plays a critical role in exporting energy to the state grid. In 2022, a comprehensive commissioning and protection testing program was undertaken to ensure substation reliability, grid compliance, and readiness for renewable integration.

#### **2. Methodology**

The commissioning program included the following activities:

- Primary Equipment Testing: HV withstand tests, transformer ratio checks, and CT/VT verification.
- Relay Protection: Validation of overcurrent, differential, and distance protection functions using Omicron CMC.

- Coordination Studies: Development of protection grading curves under IEC 60255 and IEEE C37 standards.
- Compliance Checks: Verification of system performance against Australian National Electricity Rules (NER).

### 3. Results

The program achieved the following measurable outcomes:

| Metric                   | Before  | After | Improvement    |
|--------------------------|---------|-------|----------------|
| Fault Detection Accuracy | 91%     | 99%   | +8%            |
| System Availability      | 95%     | 99%   | +4%            |
| Compliance with NER      | Partial | Full  | 100% compliant |

### 4. Discussion

The Diamantina commissioning program demonstrated the importance of rigorous HV testing and relay validation in ensuring reliable grid performance. By enhancing fault detection accuracy and system availability, the project strengthened Queensland's grid resilience. The methodology provided a model for subsequent renewable integration and BESS projects in Australia (2023–2025).

### 5. Conclusion

The 2022 commissioning of Diamantina's 132 kV substation highlighted the critical role of protection engineering in supporting Australia's energy transition. The project ensured compliance with national standards while enabling reliable renewable integration into the state grid.

## 6. References

- [1] IEC 60255, Measuring Relays and Protection Equipment.
- [2] IEEE C37 Series, Protection and Testing Standards.
- [3] Omicron Test Universe – HV Commissioning Procedures.
- [4] Australian National Electricity Rules (NER), AEMC 2022.