Technical Case Study

Relay Protection Upgrade and HV Testing for Export Terminal

(Wiggins Island Coal Export Terminal – WICET, Queensland, Australia, 2023)

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Abstract

This technical case study presents the relay protection upgrade and high-voltage (HV) testing program conducted at the Wiggins Island Coal Export Terminal (WICET) in Queensland, Australia. The project aimed to modernize protection systems, enhance reliability of HV assets, and ensure compliance with Australian grid codes. Activities included relay replacements, coordination studies, and extensive secondary injection testing. The program ensured grid compliance and optimized reliability for one of Australia's largest export facilities.

Keywords: Relay Protection, HV Testing, Export Terminal, Grid Compliance, Australia

1. Introduction

Wiggins Island Coal Export Terminal (WICET) is one of Australia's largest coal export facilities, with significant power infrastructure to support loading and transport operations. In 2023, a protection system upgrade was required to address aging relay infrastructure, mitigate nuisance trips, and ensure compliance with Australian National Electricity Rules (NER). The project focused on modernizing relay schemes and validating protection performance through rigorous HV testing.

2. Methodology

The upgrade and testing program included the following phases:

- Relay Replacement: Deployment of modern digital relays (SEL, Siemens) replacing legacy electromechanical devices.

- Secondary Injection: Functional validation of overcurrent, earth fault, and breaker failure schemes using Omicron CMC.

- Coordination Studies: Protection grading analysis under IEEE C37 and IEC 60255 guidelines.

- HV Testing: Circuit breaker timing, contact resistance, and insulation resistance checks to verify operational reliability.

3. Results

The project achieved the following measurable outcomes:

Metric	Before	After	Improvement
Nuisance Trips (annual)	7	1	-86%
System Availability	94%	99%	+5%
Grid Compliance (NER)	Partial	Full	100% compliant

4. Discussion

The WICET protection upgrade highlighted the importance of transitioning from legacy relays to modern IEDs for large-scale industrial facilities. By combining relay replacement, Omicron-based testing, and HV equipment validation, the project achieved significant improvements in system availability and compliance. The methodologies applied here also informed future renewable integration projects in South Australia, particularly for large-scale BESS commissioning.

5. Conclusion

The 2023 relay protection and HV testing program at WICET demonstrated the value of modernization in ensuring grid reliability and compliance. The success of the project provided a framework for similar upgrades across Australia’s critical industrial and renewable energy infrastructure.

6. References

[1] IEEE C37 Series, Protection and Testing Standards.
[2] IEC 60255, Measuring Relays and Protection Equipment.
[3] Omicron Test Universe – Secondary Injection Testing Procedures.
[4] Australian National Electricity Rules (NER), AEMC 2023.