## Taichung Power Plant Testing of Fast Transfer Relay (SEL-451) for Auxiliary Power System

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## 1. Introduction

Auxiliary systems play a crucial role in power plants, primarily supporting the operation of generating equipment and maintaining stable plant operations. These auxiliary systems include cooling, fuel, electrical, air, and water treatment systems. A stable power supply to these systems is essential for ensuring the efficient operation of the main generating equipment.

In recent years, newly constructed power plants have widely adopted fast transfer relays for auxiliary power system switching. This design not only allows manual power transfer during unit maintenance but, more importantly, enables immediate power supply from other auxiliary transformers when the auxiliary power system fails. Taichung Power Plant units #7 and #8 utilize SEL-451 fast transfer relays for their auxiliary power system switching. During testing at Unit #7 in May 2023, our team discovered that testing the fast transfer relay required circuit breaker feedback signals, but on-site power transfer could not be switched arbitrarily. Therefore, we developed a specialized testing fixture.

## Testing Methods and System Architecture (Figs. 1-4)

- (1) The test system consists of the following components:
  - A. Doble Protective Relay Tester: This device provides voltage output and simulation control room operation signals and receives circuit breaker feedback signals.
  - B. SEL-451 Relay: Device under test.
  - C. Fast Transfer Testing Fixture: Simulates circuit breaker status and operating conditions.



Source: Evbrt Ltd Figure 1 Doble Protective Relay Tester



Source: TPRI Figure 3 Fast Transfer Testing Fixture External View



Source: Allis Electric Ltd Figure 2 SEL-451 Relay



Source: TPRI Figure 4 Testing Fixture Internal Wiring Diagram

- (2) Testing Fixture Functions: Our fast transfer testing fixture, specifically designed for the SEL-451 relay, can simulate on-site circuit breaker status signals with the following features.
  - A. Simulate manual synchronization operations
  - B. Simulate automatic synchronization operations
  - C. Simulate fault trigger conditions
  - D. Real-time LED indication of circuit breaker status
  - E. Pre-wired terminals to prevent on-site wiring errors
- (3) Test Items:
  - A. Synchronization Parameters and Timing Test
    - (A) Test synchronization parameters from the standby to the main power source

- (B) Test synchronization parameters from the main to the standby power source
- (C) Record synchronization switching time and voltage, phase angle, frequency limits
- B. Sync-Check Function Test
  - (A) Verify the main to standby power source transfer functionality
  - (B) Monitor IED indicator light status changes
- C. Fast Transfer Function Test
  - (A) Verify the main to standby power source transfer functionality
  - (B) Measure switching time
  - (C) Monitor IED indicator light status changes
- D. Residual Voltage Transfer Test
  - (A) Test the pickup voltage for residual voltage transfer
  - (B) Measure switching time
  - (C) Monitor IED indicator light status changes
- E. Manual Transfer Function Verification
  - (A) Verify bidirectional transfer capability
  - (B) Measure switching time
- F. Decoupling Protection Function Test
  - (A) Simulate main and standby power source transfer failure scenarios
  - (B) Verify the protection function operation
  - (C) Monitor IED indicator light status changes

## 3. Conclusion

The SEL-451 fast transfer relay testing fixture, developed by our team, resolves technical difficulties in field testing and establishes standardized testing procedures. This testing fixture provides the following benefits:

- (1) Improves testing efficiency and reduces testing time
- (2) Reduces the risk of human operation errors
- (3) Establishes standardized testing procedures

This fixture can be implemented at other power plants using SEL-451 fast transfer relays in the future, providing more reliable protection for power system stability.