



Customer Highlight



TRANSFORMER ENERGIZATION AND POWER QUALITY

Mining operation ensures power quality with point-on-wave controlled closing

POINT-ON-WAVE SWITCHING TECHNOLOGY times the opening and closing of each phase of a breaker with microsecond precision to reduce breaker restrikes and transformer inrush current—extending breaker life, improving power quality, and keeping sensitive loads online.

Challenge

Southern Peru Copper Corporation, one of the largest copper producers in Peru, operates a transmission network that connects several substations. At one of the company's substations, several 138 kV lines converge, and two 120 MVA, 138/34.5 kV power transformers operate in parallel.

Because the company's rock crushing mills must work around the clock throughout the year, the transformers are rarely de-energized. When they're re-energized after maintenance, the most important objective is to keep the mills in service.

The company's existing control device for point-on-wave closing was malfunctioning, causing high currents and voltage drops each time one of the paralleled transformers was energized and resulting in the loss of sensitive loads, including the rock-crushing mills.

Solution

Because it was impractical to isolate voltage disturbances by islanding the transformers during energization, Southern Peru Copper Corporation needed a new controlled switching solution. The company decided to evaluate an SEL-352 Breaker Failure Relay, which provides point-on-wave switching technology, as a replacement.

SEL engineers used the 1 MHz and 10 KHz three-phase voltage and current recording capabilities of an SEL-T400L Line Protection Relay to measure the closing and opening times of the circuit breaker and determine the exact moment at which the breaker poles closed.

Then, having determined the optimal moment for closing, they set the new controller to perform the point-on-wave closing operation at the correct time.

Results

Testing performed during commissioning showed that the point-on-wave closing control provided by the SEL-352 Breaker Failure Relay reduced inrush current from 2.5 pu to less than 1 pu upon transformer energization. Voltage drops were minimal, well within the ride-through parameters of the rock crushing mills' undervoltage protection.

The improved power quality has kept the mining company's rock crushing mills online, preserving operations availability and preventing production and revenue losses.

About SEL

SEL is a 100 percent employee-owned company that specializes in creating digital products and systems that protect, control, and automate power systems around the world. This technology mitigates blackouts and improves power system reliability and safety at a reduced cost. Headquartered in Pullman, Washington, SEL has manufactured products in the United States since 1984 and serves customers worldwide.

Cybersecurity philosophy

We build layers of defense and maintain the integrity of each layer's purpose—in other words, we apply the right technology at the right layer. We believe simpler products are easier to defend and that the safety of the power system and availability of the protection and control devices come first.

Reliability

SEL products are designed and manufactured for the world's most challenging environments, exceeding all industry standards for temperature, shock, and electric stress.

Our products have a mean time between returns for repair (MTBR) of more than 250 years, based on observed field performance. This means that if you have 250 SEL products installed in your systems, you can expect to have less than one unscheduled removal from service per year for any reason, whether it's a defect or an external factor such as overvoltage, overcurrent, wildlife damage, or environmental exposure.

Warranty

SEL backs our products and commitments with a ten-year warranty, no-charge diagnostic and repair services, local support, and a variety of test procedures and certifications.

Support

SEL support teams are stationed in regional offices around the globe and staffed with application engineers who are experts in our products and in power system applications. We offer free, 24/7 emergency technical support for the life of your SEL products, even if they're outside of our ten-year warranty.

Contact us

To learn more about partnering with SEL Engineering Services, contact esinfo@selinc.com or visit selinc.com/engineering-services.

Read the technical paper:

Point-on-Wave Closing Method to Reduce Transformer Inrush Current Used at Southern Peru Copper Corporation, Rolando Jesus (Southern Peru Copper Corporation) and Hernan Flores and Eduardo S. Palma (Schweitzer Engineering Laboratories, Inc.), October 2023.