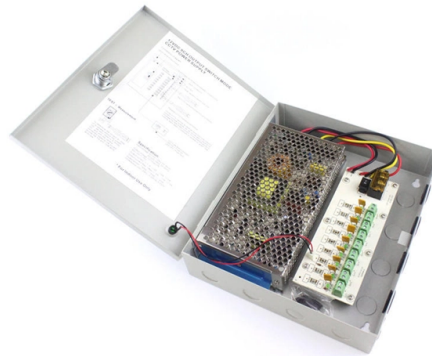


## Arc suppression coil and grounding transformer relay protection settings



### Overview

Microsoft Word This paper proposes a strategy for the protection of transformer banks and ASC in a compensated-grounded distribution substation Transformer.

### Key Takeaways

Relay protection for arc suppression coils (Petersen coils) and grounding transformers requires careful tuning to detect residual ground faults while coordinating with transformer differential protection. Arc Suppression Coil (ASC) Protection

An arc suppression coil, also known as a Petersen coil, is used in resonant-grounded or compensated networks to neutralize the capacitive component of single line-to-ground (SLG) faults, reducing fault current and minimizing fire risk . Key considerations for relay protection include:

- **Residual Current Monitoring:** Since the ASC reduces ground fault current, conventional differential protection may not detect SLG faults. A residual current compensation (RCC) module or zero-sequence overcurrent relay is often used to monitor the continuity of the grounding path and detect faults .
- **Tuning:** The ASC must be tuned to the network's capacitance to ground to achieve resonant compensation. Incorrect tuning can result in higher fault currents or failure to detect faults.



- Alarm and Trip Settings: Relays should provide alarm for minor deviations and trip for sustained faults. Typical settings involve:
  - Definite-time elements for trip: e.g., 126% pickup with 5-second delay.
  - Alarm elements: e.g., 108% pickup with 4-second delay.
  - Inverse-time elements may also be used for coordination with upstream protection .

### Grounding Transformer Protection

Grounding transformers provide a neutral point for Yg/Yg or delta-wye systems. Protection settings should consider:

- Differential Protection (87T): Main protection for transformer windings. Must coordinate with ASC relays to avoid nuisance tripping due to low-magnitude ground faults.
- Overcurrent Protection (50/51): High-side and low-side overcurrent relays should be set to:
  - Detect high-magnitude faults on the transformer or feeder.
  - Include a short delay (e.g., 8 cycles) to allow differential elements to operate first .
- Voltage-Based Protection: Some applications use V/Hz or overfluxing curves to prevent transformer damage during overvoltage or overflux conditions.

### Coordination Strategy

- Sequence: Ensure 87T differential protection has priority for internal faults. ASC or residual current relays handle external SLG faults.
- Time Delays: Use short delays (5–8 seconds) for ASC trip elements to avoid unnecessary interruptions while allowing differential relays to clear internal faults first.
- Periodic Testing: Verify ASC tuning and relay settings regularly to maintain proper compensation and fault detection.

### Practical Notes

- In compensated-grounded systems, ground fault currents are very low, so standard overcurrent relays may not operate reliably .
- Monitoring continuity of the grounding path is critical to ensure the ASC is functional.
- Relay settings should be coordinated with system MVA, transformer impedance, and network capacitance to avoid misoperation. By combining residual current monitoring, differential protection, and carefully tuned time/current settings, utilities can ensure safe operation of both arc suppression coils and grounding transformers while minimizing fire risk and service interruptions .

## Article Content

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4.5.1 Protection, alarm and arc suppression coil control relays shall be chosen in accordance with the schedules at the end of this

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