Grid Solutions

AIR CORE NEUTRAL GROUNDING REACTORS

The optimum solution for ground-fault arc suppression

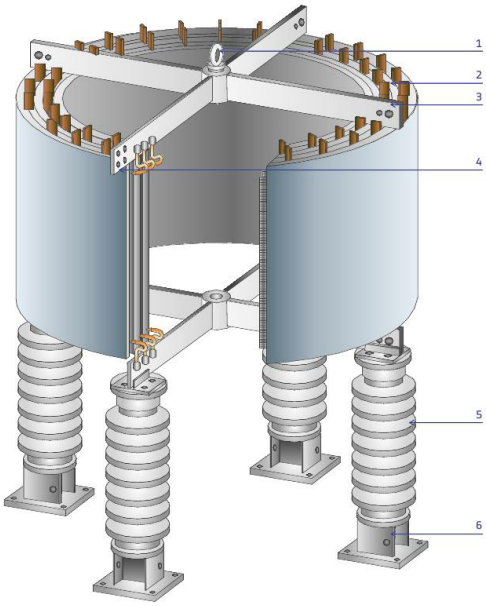
The case for neutral grounding reactors

A transmission system's transient stability and operational availability can be improved by single-phase auto-reclosing of the lines during internal ground faults. When the faulted phase is opened, a secondary arc current within the line is maintained by the capacitive coupling between the faulted and unfaulted phases. In most cases, this current self-extinguishes after opening the faulted phase; however, the time to extinguish may not be short enough to enable line auto-reclosing.

Neutral grounding reactors can be installed in the neutral of the line shunt reactors to speed up extinguishing of the secondary arc current and control transient recovery voltages caused by switching of the line.

Transient studies using appropriate arc models should be used to determine the parameters of the neutral reactors. However, a number of empirical formulas have been applied to provide a rough estimation of the reactor's ratings [see references].

This approach has demonstrated its feasibility in worldwide applications. Indeed, using an air core reactor is an eminently cost-effective solution providing excellent performance for high-voltage transmission systems.



Air Core Reactor Construction

1. *Lifting lug*
2. *Spacers (cooling ducts)*
3. *Crossarms (spider)*
4. *Terminal*
5. *Insulator*
6. *Extension brackets (pedestals)*

Customer Benefits

- Cost-effective solution
- Simple transport and erection
- No leakage
- Minimum maintenance requirements and environmentally friendly

GE VERNOVA

Our Solution

Air core reactors (ACRs) provide a linear response of impedance versus current, which is essential to numerous applications. The dry-type construction is environmentally friendly, requires little maintenance, and is easy to install.

Grid Solutions' air core reactor windings consist of numerous insulated aluminum conductors connected in parallel.

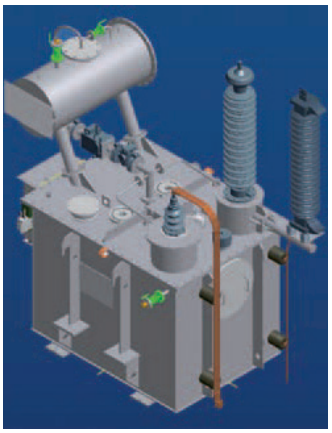
These conductors are mechanically immobilized and encapsulated in epoxy impregnated fiberglass filaments to form cylinders. Depending on the reactor ratings, one or more of these cylinders are connected in parallel between aluminum spiders. The individual cylinders are separated by fiberglass spacers to form cooling ducts.

Air core vs. oil-filled

Air core Reactor

- *72.5 kV*
- *2,000 Ω*
- *541 kg*
- *Dimensions (L x W x H) = 1.3 × 1.3 × 3.6 m*

Oil-filled reactor



- *72.5 kV*
- *2,000 Ω*
- *7,700 kg*
- *Dimensions (L x W x H) = 3.2 × 2.0 × 3.2 m*

The advantages of an air core solution

The benefits of the Grid Solution's air core reactor solutions can be summarized as follows:

- Simple and low-cost solution
- Simple transport and erection
- No leakage
- Minimum maintenance requirements and environmentally friendly
- Low noise level
- Customized space-saving solutions for installations in compact areas

References

[1] Kimbark, E.W., "Suppression of Ground-Fault Arcs on Single-Pole Switched EHV Lines by Shunt Reactors". IEEE Trans. on Power Apparatus and Systems, vol. 83, pp. 285-290, 1964.

[2] Nayak, R.N., Sehgal, Y.K., Sen, S. and Gupta, M., "Optimization of neutral grounding reactor parameters-an analysis for a double circuit EHV line". IEEE Power India Conference, New Delhi, India, 2006.

[3] Ramold M., Idarraga G. and Jäger J., "Transient shunt reactor dimensioning for bulk power transmission systems during normal and faulty network conditions". International Conference on Power System Technology, Chongqing, China, 2006.

[4] Tavares M.C. and Portela C.M., "Transmission system parameters optimisation – Sensitivity analysis of secondary arc current and recovery voltage". IEEE Trans. on Power Delivery, vol. 19, pp. 1464-1470, 2004.

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