



# Neutral Earthing Aggregates

THE **PROVEN** POWER.





# Introduction

Power utilities are increasingly confronted with various divergent requirements. On the one hand, continuity of supply and a high degree of personnel safety must be ensured. On the other hand, the capital costs as well as operating and maintenance costs of the apparatus, substations and networks must be minimised. To meet these requirements, the method of high impedance earthing, where necessary through a Neutral Earthing Aggregate (NEA), has proved an optimum solution in electric power systems.

As a consequence, more and more utilities are implementing this type of neutral earthing technique in their distribution networks. The high reliability of our products, and our field-proven designs, have positioned Trench Austria as a leading supplier wherever electric energy is transmitted and distributed. Tailor-made solutions, including composite Neutral Earthing Aggregates, complete with associated control and protection devices, make up our well-proven product range for earthing of power systems.



Fig. 1 20 kV / 433 A Neutral Earthing Aggregate

# Application Areas for NEAs

Environmental concerns and issues of reliability and operational safety of power systems, increasingly result in network designs using underground cables. Consequently the earthfault currents in the distribution networks may increase, which in some cases may overload the neutral connection of the power transformer, to which the correspondent arc suppression coil (ASC) is connected. In these cases, as well as in the absence of a power transformer with a readily available neutral/star-point (e.g. where there is a delta connected supply transformer winding), the connec-

tion of the ASC is accomplished via a Neutral Coupler (Earthing transformer) which creates an artificial neutral/star-point connection.

NEAs are devices, housing a Neutral Coupler with an appropriate zig-zag winding which provides a low zero-sequence impedance and high positive- and negative-sequence impedances and an Arc Suppression Coil of various designs in a common oil-filled tank. If required, a low voltage shunt resistor for earthfault detection can also be integrated.

## Neutral Earthing Aggregates are noted for the following advantages:

- **Space-saving construction**  
Considerably reduced installation area compared to other solutions.  
Applicable for compact substations.
- **Lower installation costs**  
Saving of one transformer cubicle or transformer bay, including an oil catchment pit.
- **Simplified layout and interconnection**  
The external connection between Neutral Coupler and ASC can be dispensed with.
- **Avoids duplicate monitoring and protection devices**  
Reduction of signals and control/signal cabling.

# Technical Data

Technical Data	
Power range	<ul style="list-style-type: none"> <li>• 100 kVAr – 12500 kVAr</li> </ul>
Voltage range	<ul style="list-style-type: none"> <li>• up to 52/√3 kV</li> </ul>
Rated frequency	<ul style="list-style-type: none"> <li>• 50 Hz (16 2/3 Hz and 60 Hz on request)</li> </ul>
Duty	<ul style="list-style-type: none"> <li>• 2 hours short time</li> <li>• continuous</li> </ul>
Neutral Coupler	<ul style="list-style-type: none"> <li>• main winding (ZN)</li> <li>• secondary winding (yn or zn on request)</li> <li>• equalizing winding (on request)</li> <li>• primary voltage regulation (on request)</li> </ul>
ASC	<ul style="list-style-type: none"> <li>• plunger core coil design (fixed or step design on request)</li> <li>• current regulating range – depending on core type – from 1 : 2.5 to 1 : 10</li> <li>• motor drive (alternatively hand drive or tap changer)</li> </ul>
Cooling method	<ul style="list-style-type: none"> <li>• ONAN (self cooling)</li> </ul>
Installation	<ul style="list-style-type: none"> <li>• indoor or outdoor</li> </ul>

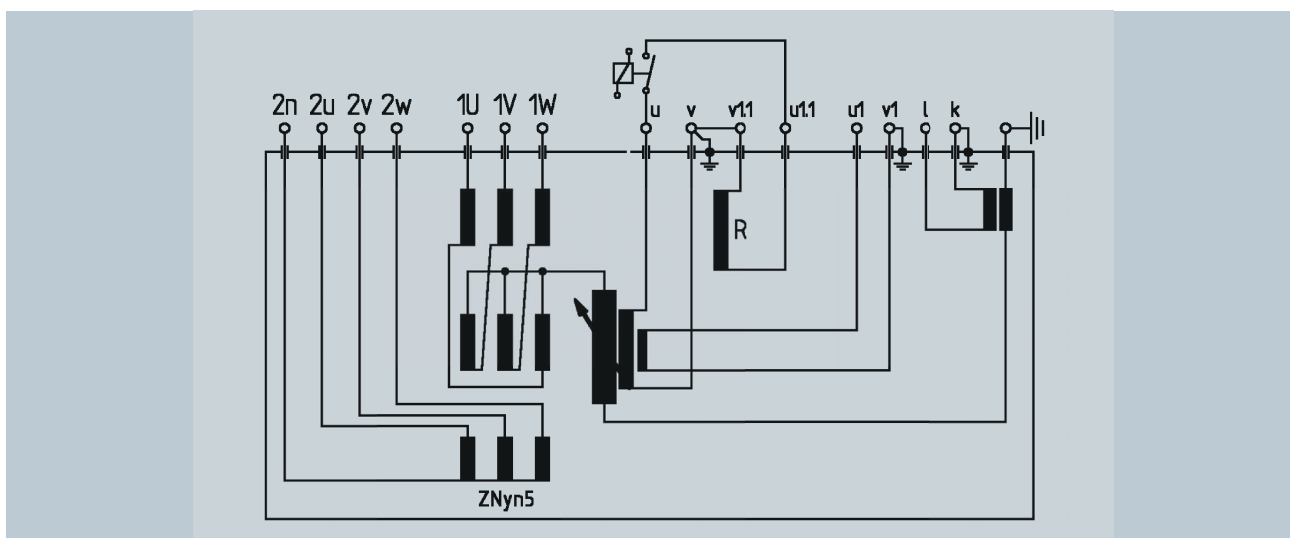


Fig. 2 Electrical diagram of a Neutral Earthing Aggregate (Earthing transformer, ASC and shunt resistor)

# Principle Construction

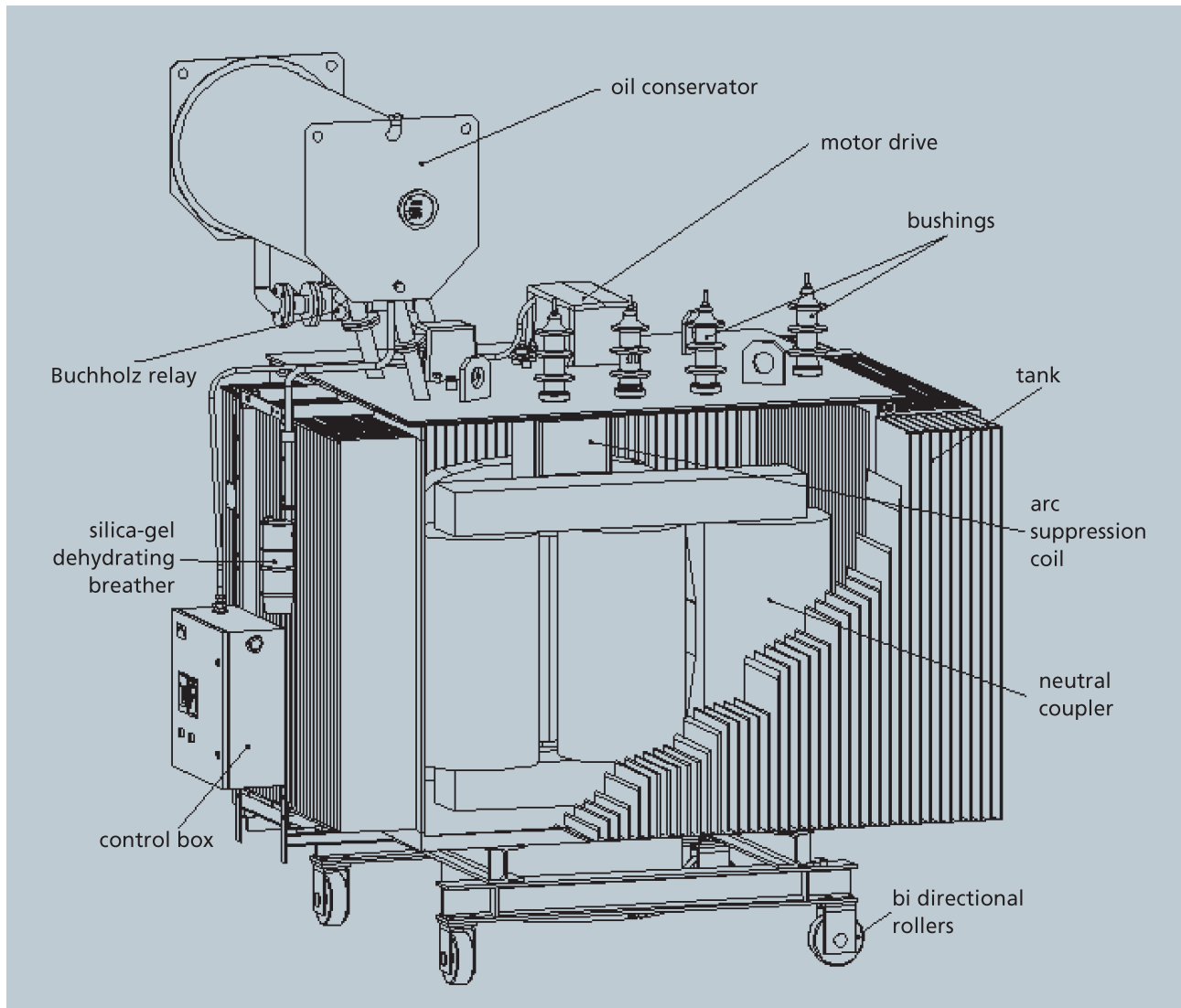


Fig. 3 Sectional drawing of a Neutral Earthing Aggregate

# Standard Design and Outfit

- Oil-filled corrugated steel tank with detachable conservator
- Mobile base with bi-directional rollers
- Neutral Coupler: optional with secondary winding
- ASC: iron-cored reactor coil with continuously variable on-load air gap adjustment by means of a plunger core
- Suitable for automatic earthfault compensation via the Trench Austria earthfault compensation controller EFC50/EFC50i
- The connection between Neutral Coupler and ASC is done internally
- Motor drive unit: Trench Austria model DMA2, 230/400 V, 50 Hz, mounted on top of the tank, with hand-crank for emergency service
- Porcelain bushings as per DIN, or optional dead-front construction by means of plug-in cable termination system
- Protective cap over low voltage bushings
- Voltage measuring winding 100 or 110 V / 3A
- Auxiliary power winding (500 V, 5 % of coil power, 30 s short time duty) for connection of diverse secondary devices
- Magnetic oil gauge
- Silica-gel dehydrating breather
- Drive monitoring devices on request
- Oil-filling: non-PCB mineral oil with naphthenic base, accord. to IEC 60296 : 2003
- Surface treatment according to DIN EN ISO 12944-5, system no. A1.11, with final grey finish, RAL 7033

## Routine Tests

- Measurement of winding resistance
- Measurement of current over the whole adjustment range
- Measurement of no-load losses and current
- Measurement of voltage ratio between main and secondary winding
- Operating tests of the core air gap mechanism of the ASC
- Seperate-source power frequency over-voltage test
- Induced over-voltage test

## Type Tests / Special Tests

- On request or as per agreement

## Special Designs

- **Sliding Core ASC**  
Simplified design for a power range of 100 – 1250 kvar, current regulation range 1:5, with hand drive or motor drive
- **Step Core ASC**  
Iron-cored reactor coil with taps, adjustable by means of an off-load tap changer, current regulating range 1:2.5
- **Fixed Core ASC**  
Iron-cored reactor coil with multiple sub-divided air gaps, for compensation of fixed (non-varying) network sections, without adjustment device
- **Dry Type Design**  
Design with epoxy resin impregnated windings for indoor installation

# Accessories

## Earthfault Compensation Controller EFC50

When changes in the network topology occur, the ASC must be immediately adjusted to the actual network parameters. This task is achieved by the Trench

Austria earthfault compensation controller EFC50, through adjustment of the inductive reactance of the ASC in resonance with the actual system earth capacitance.

For a detailed description, refer to our brochure Earth-fault Compensation Controller EFC50/EFC50i.



Fig. 4 Earthfault Compensation Controller EFC50

## Shunt Resistor

In order to eliminate earth-faults rapidly, the faulty feeder has to be detected quickly and selectively. One approach for detection of low-magnitude resistive earthfaults is by means of directional power relays. When this approach is used, it is sometimes necessary to increase the residual earth-fault current via a low voltage shunt resistor connected to the power auxiliary winding of the ASC.

## Electronic Resistor Control EZA3

The electronic resistor control EZA3 is used for controlling a low voltage shunt resistor, which is connected to the power auxiliary winding of the ASC. It, in addition protects the resistor and the power auxiliary winding of the ASC from thermal overload.



The Trench Group is your partner of choice for electrical power transmission and distribution solutions today and for the development of your new technology solutions of tomorrow.

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