# GROUNDING TRANSFORMERS

aktif
GÜÇ ELEMANLARI

# Aktif Group

aktif
GROUP OF COMPANIES

aktif
MÜHENDİSLİK

aktif
KOMPANZASYON

aktif
ELEKTROTEKNİK

aktif
GÜÇ ELEMANLARI

## Where we are

# Grounding Transformers

# Grounding Transformers

How an electrical system should be grounded is an important decision for the electricity generation and distribution system. It is a general acceptance that the neutral point of the system must be grounded.

The purpose of system grounding is;

- To control the system's voltage with the respect to ground, within predictable limits,
- To provide for a ow of current that will allow detection of an unwanted (such as short-circuit) connection between system phases and ground and thus to disable the source of the voltage (such as transformer or generator) from the system.

There are several methods and criteria for system grounding. Each has its own purpose, advantages and disadvantages.

**Methods of Neutral Grounding System:**

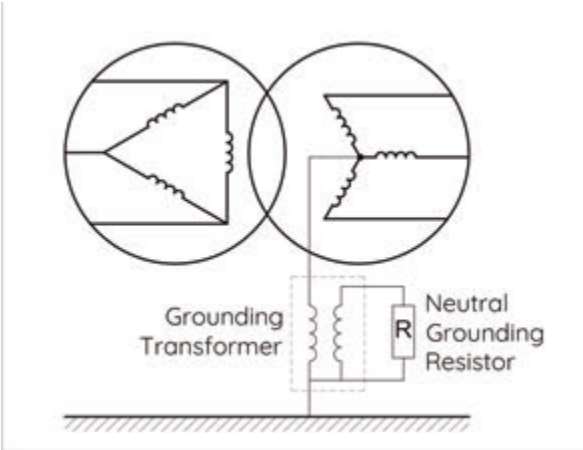
The basic methods for system neutral grounding are as follows;

1. Ungrounded system (No intentional grounding)
2. Neutral grounded system through a resistance
   2.1. Low-resistance grounding
   2.2. High-resistance grounding
3. Neutral grounded system through a reactance (coil)
4. Neutral grounded system through a Peterson Coil (Resonant Grounding)
5. Solidly grounded system
6. Grounding System Through a Transformer
   6.1. Neutral Grounded System Through a Single-Phase Transformer and a Resistor
   6.2. Obtain the System Neutral with Ziz-zag Transformer
   6.3. Obtain the System Neutral with Wye-delta transformer
   6.4. Obtain the System Neutral with Wye-Open Delta

# Grounding Transformers

## Neutral Grounded System Through a Single-Phase Transformer and a Resistor

A single-phase grounding transformer and neutralgrounding resistor are used together in this system. This system is particularly suitable for grounding of generators. Because this system behaves normally as a non-grounded system but limits the fault current when a phase to ground fault occur. The primary winding of the grounding transformer is connected to the neutral winding of the system and Neutral grounding resistor is connected to the secondary winding of grounding transformer.

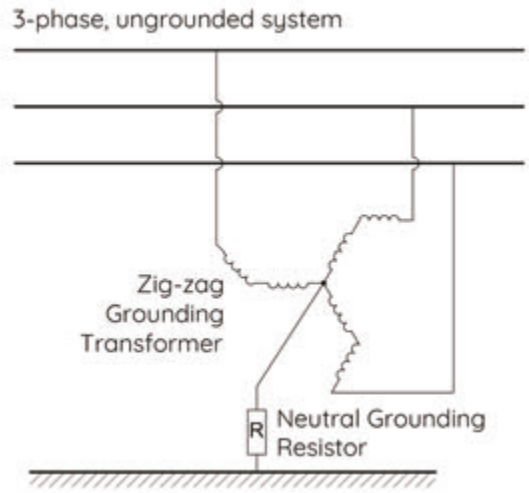



In this system, the fault current is usually limited a fault current less than 15 A on the primary side of the grounding transformer. The fault duration is usually 1 minute. The system therefore functions as a high-resistance neutral grounding.

The primary voltage value of the grounding transformer is up to the phase-neutral voltage of the system. The secondary voltage value is usually designed as 240 V, 120 V. In this way, the neutral grounding resistance is advantageous in terms of volume and therefore price, since it will be produced at low voltage, which is the secondary value of the earthing transformer, rather than the phase-neutral system voltage.

## Obtain the System Neutral with Ziz-zag Transformer

In the case of delta-connected systems with no neutral point or if the neutral point cannot be reached in some way, an earthing transformer is used to create an articial neutral point and system can be grounded via this neutral point. Most grounding transformers are designed to be exposed to fault current below 1 min (usually 10 s), so they are much smaller in size than an ordinary three-phase continuously rated transformer with the same rating and cheap. One of these grounding transformers is zig-zag transformers.



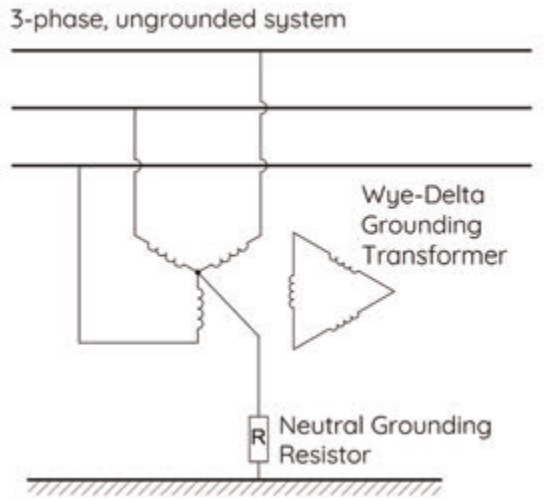

In Zig-zag transformers, the phases are made with 6 windings and 2 windings per phase are connected to reverse phase to provide high impedance to the phase currents. The transformer impedance to zero-sequence voltages, however, is low so that it allows high ground-fault currents to ow. The transformer divides the ground-fault current into three equal components; these currents are in phase with each other and ow in the three windings of the grounding transformer. Zig-zag transformers have not got a seconder winding and a neutral point is obtained because the windings are connected according to the Wye conguration. This neutral point can be grounded through a resistor.

# Grounding Transformers

## Obtain the System Neutral with Wye-Delta Transformer

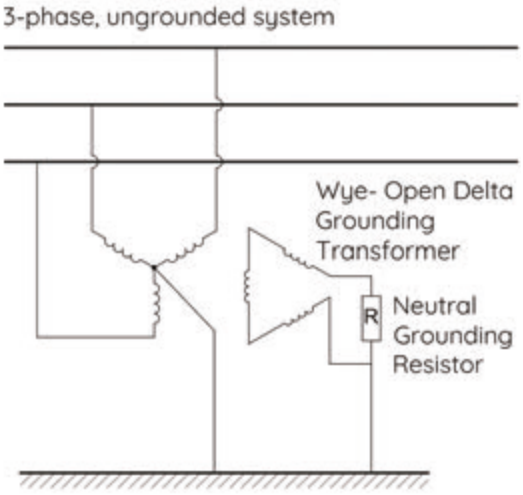
A wye-delta connected three-phase transformer or transformer bank can also be utilized for system grounding. The primary phase windings are connected to the phases of the system and the neutral point is connected directly or via a resistance to the ground. The delta connection must be closed to provide a path for the zero-sequence current, and the delta voltage rating is selected for any standard value. When a phase neutral fault occurs, the fault current is limited to the sum of the transformer leakage reactance and neutral resistance as the transformer has zero sequence in the primary Wye windings and the secondary delta is a closed series circuit.

- The voltage rating of the wye winding shall not be less than the normal line-to-line system voltage.
- Wye-delta grounding transformer should be connected between the secondary terminals of the system's power transformer and the main circuit breaker as close as possible to the power transformer.
- If there is more than one power transformer in the system, a separate grounding transformer must be connected for each. However, it should be ensured that there is only one earthing transformer in the same section of the system.




## Obtain the System Neutral with Wye-Open Delta Transformer

In this application, the neutral side of the primary of the Wye open delta earthing transformer is directly connected to the ground. A limiting resistor is connected to the open ends of the open delta connected secondary windings. When a phase earth fault occurs in the system, this resistance limits the current in closed secondary delta windings. In this way, the fault current in the primary windings of the earthing transformer is also limited.




## Grounding Transformer Production Plant

Neutral grounding transformers of Aktif are manufactured in Izmir. Transformer manufacturing plant has 3500 square meters closed area with total of 5500 square meters. Transformer manufacturing plant is equipped with latest, high tech machineries to sustain high efficiency and to assure high quality standards.

Aktif manufactures high quality, world class neutral grounding transformers.

## Production Stages

### Magnetic Core

A transformer is an electrical device that transfers energy between two or more circuits through electromagnetic induction. A varying current in the transformer's primary winding creates a varying magnetic eld in the core and this varying magnetic eld induces a varying voltage in the secondary winding. For best energy transfer each transformer core is produced with interleaved laminations of cold rolled, grain oriented, low loss electrical sheet steel conforming. Our core designs are ensuring minimum noise and loss levels with uniform ux distribution throughout the magnetic circuit.

### Low Voltage and High Voltage Windings

According to customer requirements Low Voltage and High Voltage windings are designed with Copper are Aluminum conductors. LV windings are made of paper insulated conductors or foils. HV windings are made of enameled wires or paper insulated conductors. All components of insulation are made from electrical grade insulating board; processed to ensure electrical and mechanical stability throughout the temperatures found in operational service. High technology winding machines and manufacturing with quali ed technicians ensure that each winding is able to withstand the excessive axial forces, which may result from external sources.

### Tank and Top Cover

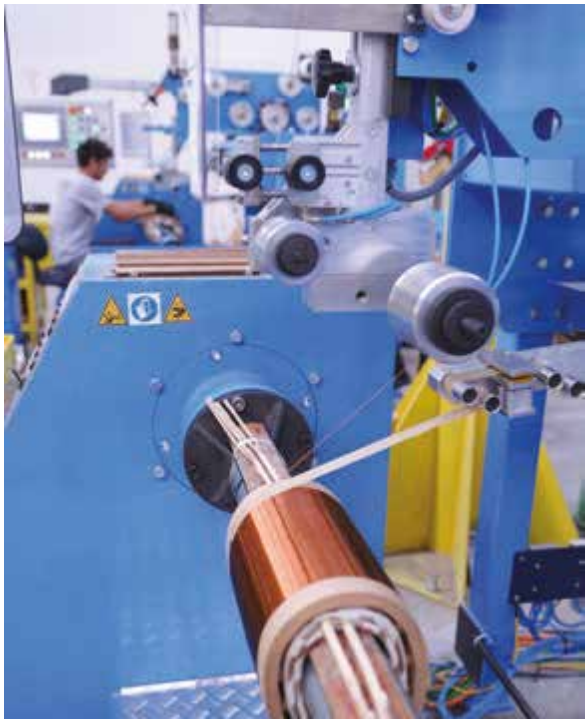
Transformer tanks are manufactured using mild steel, which is electrically welded. Cooling is eected corrugated walls or radiators, electrically welded and independently pressure tested. Metal is pre-treated by sand blasting, then immediately covered with a high performance industrial paint nish, suitable for highly corrosive environments. This nish is designed to give maximum world-wide, long term protection in coastal, industrial, and general environments with suitable heat and oil resistance.

### Drying Process and Final Assembly

Completed core-coils are dried in thermostatically controlled vacuum ovens, tted into the transformer tank and lled with oil under a vacuum. This is followed by oil pressure adjustments. After the tanking process is complete the transformer is prepared for test.

### Test

Aktif applies all routine tests, type and special tests as per IEC EN 60076-1 standard. Tests according to ANSI/NEMA/CSA standards can also be carried in ATLAS Trafo laboratory. Intermediate tests in all production stages are carried to assure high quality production as well.



GROUP OF COMPANIES



**Headquarters**

Bayraktar Blv. Şehit sk. No: 5 Aktif Plaza
34775 Ümraniye İstanbul / Turkey
Tel : +90 (216) 314 93 20
Fax : +90 (216) 314 93 60
www.aktif.net - info@aktif.net

**Switchgear Factory**

Akşemsettin Mh. Çatalca sk. No:113
06930 Sincan Ankara / Turkey
Tel : +90 (312) 269 46 02
Fax : +90 (312) 269 45 01
www.aktif.net - info@aktif.net

**Resistor Factory**

Pirahmetler Mh. D-100 Yanyol cd.
No:78/A Erenler 54200 - Sakarya / Turkey
Tel : +90 (264) 276 64 50
Fax : +90 (264) 276 64 52
www.aktif.net - info@aktif.net