

NEUTRAL EARTHING RESISTORS

The earthing system plays a very important role in an electrical network. For network operators and end users, avoiding damage to equipment, providing a safe operating environment for personnel and continuity of supply are major drivers behind implementing reliable fault mitigation schemes.

A widely utilised approach to managing fault currents is the installation of neutral earthing resistors (NERs). NERs, sometimes called Neutral Grounding Resistors, are used in an AC distribution networks to limit transient overvoltages that flow through the neutral point of a transformer or generator to a safe value during a fault event.

Generally connected between ground and neutral of transformers, NERs reduce the fault currents to a maximum pre-determined value that avoids a network shutdown and damage to equipment, yet allows sufficient flow of fault current to activate protection devices to locate and clear the fault. NERs must absorb and dissipate a huge amount of energy for the duration of the fault event without exceeding temperature limitations as defined in IEEE-32 standards.

Therefore the design and selection of an NER is highly important to ensure equipment and personnel safety as well as continuity of supply.

THE IMPORTANCE OF NEUTRAL GROUNDING

Fault current and transient over-voltage events can be costly in terms of network availability, equipment costs and compromised safety.

Interruption of electricity supply, considerable damage to equipment at the fault point, premature ageing of equipment at other points on the system and a heightened safety risk to personnel are all possible consequences of fault situations.

By installing NERs on the distribution system and controlling fault currents and transient over-voltages, the following benefits can be realised:

- Elimination or reduction of physical damage to equipment
- Extended life of connected distribution equipment such as transformers
- Reduced operation and maintenance expenses
- Simplification and fast isolation and clearing of the original fault
- Improvement in network security and reduction in unplanned shutdowns



METHODS OF NEUTRAL EARTHING

Depending on application and network, there are several methods of neutral earthing including:

HIGH OR LOW RESISTANCE GROUNDING

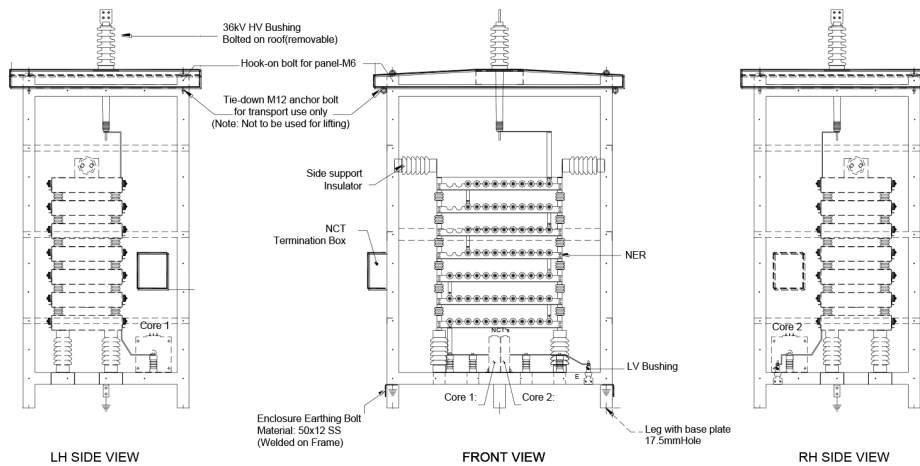
High resistance grounding is used in commercial systems that require continuous operation even after a fault occurs, such as continuous process industries. NERs typically reduce the current to a low value, 10 Amps or less, without tripping the circuit breakers. Protection schemes are activated during a fault event, allowing the system to quickly locate and clear a fault or shut down the system in an orderly manner. No damage will occur at this current level.

Low resistance grounding is used in large MV/HV electrical networks where there is a high level of capital equipment and network interruptions have a significant economic impact. These NERs are generally sized to permit only 200A to 2500A of fault current to flow. The allowed current level is enough to operate protective devices yet not enough to create major damage at the fault point.

SOLIDLY EARTHED GROUNDING

Solidly earthed grounding NERs are typically used in LV applications of 600V or less and connect the neutral point to earth. These systems reduce the problem of transient over-voltage but do not limit the fault current during a fault event.

SPECIFYING AN NER



When designing and sizing an NER, the engineer must consider these parameters:

Rated voltage: the line-to-neutral voltage.

Rated current: maximum current that will flow through resistor when it is cold.

Duty rating or time rating: length of time the NER must tolerate rated current.

Short time rating: normally 10 seconds or 60 seconds depending on design parameters of the protection system.

Continuous rating: normally 10% of full load current for healthy system neutral earthing resistor to be designed for continuous rating of 5% to 10 % of full load current (if required).

Insulation: specified based on line voltage.

Temperature rise: the maximum short time temperature rise for the resistive element is 760°C, according to IEEE32.

Element type: metallic resistors are usually specified over liquid as they do not suffer from evaporation, freezing etc and require no ancillary supply.

IP rating: ingress protection is typically specified at IP23 but higher ratings are available for harsh environments, although this can significantly affect the cooling of the unit.

Enclosure: usually available in stainless steel, mild steel or aluminium depending on specification or application.

Ancillary items: vacuum contactors, current transformers, protection relays and monitoring equipment are all optional extras.



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PRODUCT OVERVIEW

Ampcontrol's neutral earthing resistors (NERs) protect vital equipment such as switchgear, generators and transformers from damage in the event of faults in AC distribution systems.

The NERs limit the current that flows through the neutral point of a transformer or generator to a safe value which is sufficient enough to operate protective relays, yet prevent unwanted fault damage. An over-current flowing in this neutral path is usually the result of a phase to phase, phase to neutral or phase to earth fault.

The unit's fast response time allows protection relays and current transformers to operate and quickly identify, isolate and clear the fault. Subsequent faults are also avoided. Damage to equipment is therefore minimised and the risk of hazardous arc flash is reduced or eliminated.

For continuous process industries or sites where loads are connected directly to the distribution system, NERs eliminate the need to trip from the first fault and can avoid unscheduled shutdowns and interruption to service.

Available as a standard or customised unit, Ampcontrol neutral earthing resistors can be supplied as individual units, packaged with a transformer or integrated into a substation.

NERs are available with roof mounted or side mounted HV bushings. Lower voltage units may have the connection point underneath.

FEATURES

- Fast response fault protection
- Improved safety for personnel through reduced electrical shock and arc flash hazards
- Damage to electrical system and connected equipment minimised
- Locate and clear faults quickly
- Reduced unscheduled shutdowns due to electrical faults and equipment damage
- High protection schemes
- High quality, high reliability resistors
- Seismic structural options available such as enclosure reinforcement

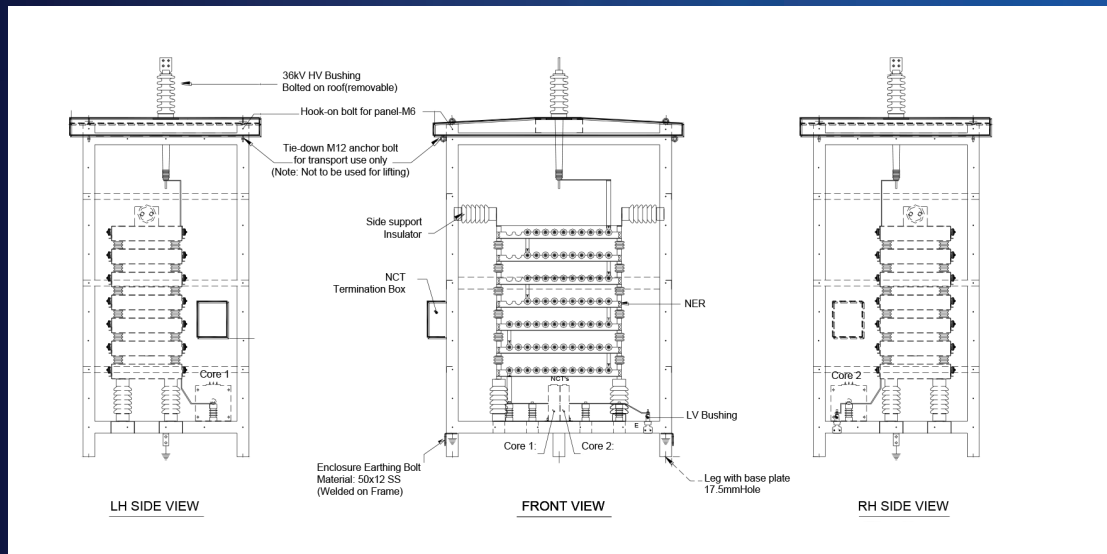
NER PRODUCT DETAILS

SPECIFICATIONS

| | |
|------------------------------|--|
| Current ratings | Up to 2500A |
| Voltage ratings | Up to 33kV |
| Resistance | Predetermined to customer requirements |
| Time rating | 5 seconds, 10 seconds or continuous (other times available) |
| Protection available | Back up earth leakage, neutral earthing resistor monitors, current transformers |
| Permissible temperature rise | As per IEC, typically 760°C |
| Enclosure options | Stainless steel or powder coated mild steel, open frame, vented, louvered, indoor or outdoor enclosures rated from IP23 to IP66 depending on application, stainless eyebolts for hoisting and transportation, removable panels |



STANDARD DRAWING





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