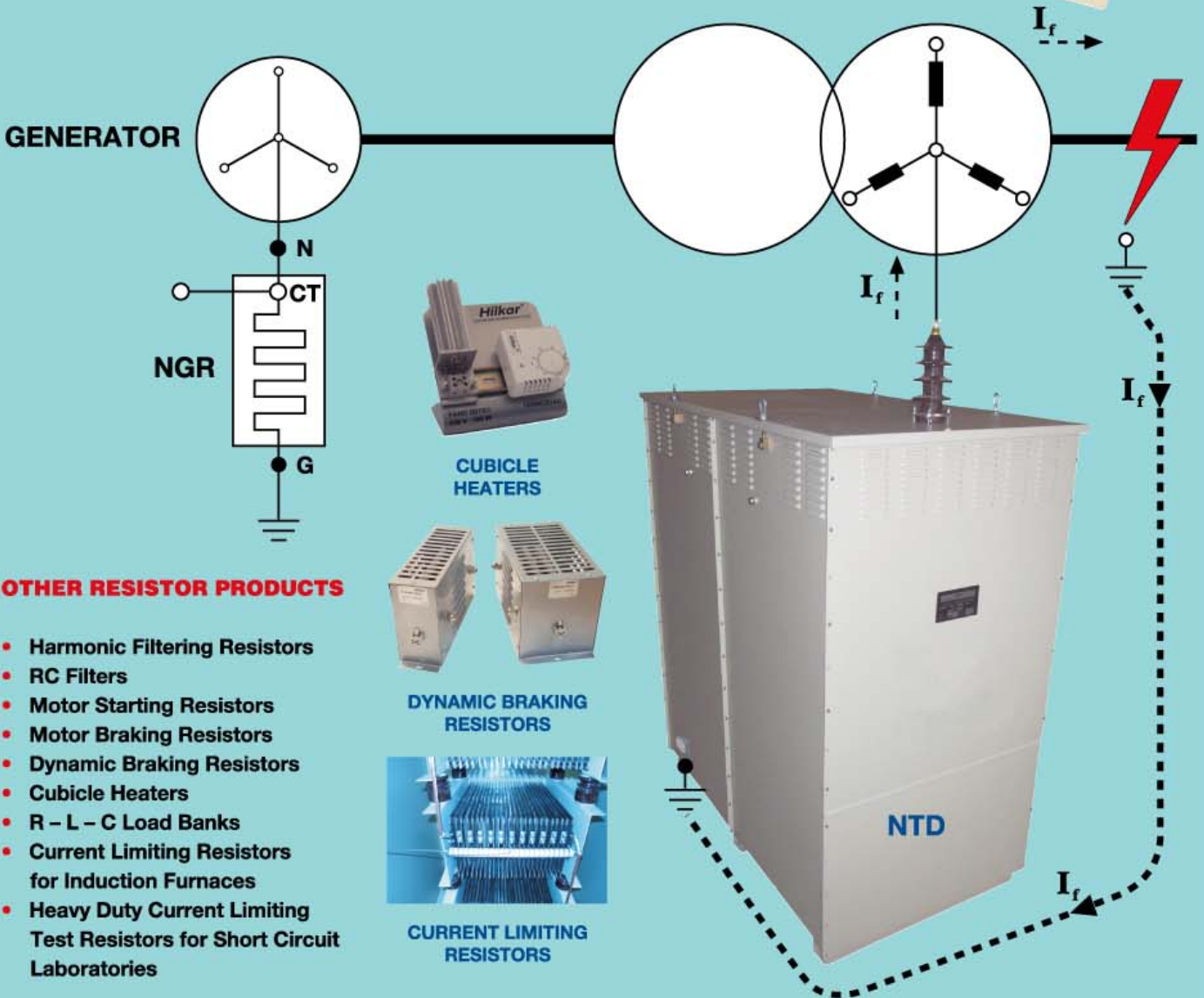




NEUTRAL GROUNDING RESISTORS



OTHER RESISTOR PRODUCTS

- Harmonic Filtering Resistors
- RC Filters
- Motor Starting Resistors
- Motor Braking Resistors
- Dynamic Braking Resistors
- Cubicle Heaters
- R - L - C Load Banks
- Current Limiting Resistors for Induction Furnaces
- Heavy Duty Current Limiting Test Resistors for Short Circuit Laboratories



HARMONIC FILTERING RESISTORS



R - L - C LOAD BANKS



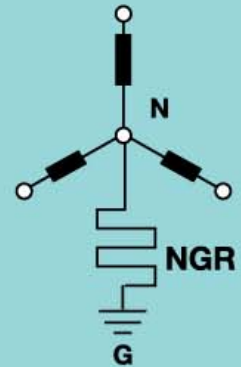
MOTOR STARTING AND BRAKING RESISTORS



RC FILTERS

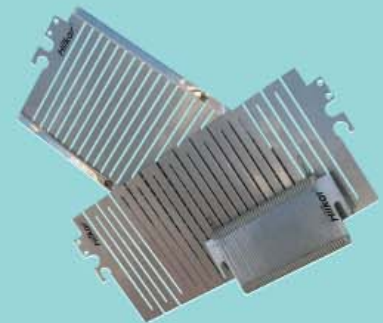
COMMON REASONS for USING NEUTRAL GROUNDING RESISTORS

- Reducing single phase fault currents which occur in M.V. electrical networks to prevent damages on transformers and generators,
- Reducing temporary over voltages occurred by braking instantaneous fault current,
- Providing long-life for switchgear,
- Reducing step voltages to a harmless level for personnel.



FEATURES

- Stainless-steel resistor elements.
- Current transformer included.
- Bolted resistor element connections instead of welded connections in order to be able to assemble spare parts on site immediately.
- Typically, RAL 7032 (and others) polyester (70 micrometer thickness) electrostatic powder paint for enclosure element to provide maximum resistance against corrosion.
- Typically, 2 mm hot dip galvanized steel enclosure.
- High thermal capacity to absorb high currents.
- High altitude ratings.
- Custom made lifting eyes provide secure lifting.
- Rugged shock-resistant construction.



GRIDS

TECHNICAL SPECIFICATIONS

OPERATION VOLTAGE	Up to 72 kV line to line systems
RATED CURRENT (A)	Up to 5000
AMBIENT TEMPERATURE (°C)	< 55
RESISTANCE ALLOY	Stainless – steel
PROTECTION DEGREE	IP 23 (outdoor) and others
STANDARDS	IEEE 32, EN 60137, EN 60529, EN ISO 1461 , EN 60298 , EN 60273, EN 60071, EN 60060

Neutral Grounding Resistors are used for resistance grounding of industrial power system. They are generally connected between ground and neutral of transformers, generators and grounding transformers. Neutral Grounding Resistors are used in order to limit maximum fault current to a value which will not damage the equipment in the power system, yet allow sufficient flow of fault current to operate protective relays to clear the fault. Although it is possible to limit fault currents with high resistance Neutral Grounding Resistors, earth short circuit currents can be extremely reduced. As a result of this fact, protection devices may not sense the fault. Therefore, it is the most common application to limit single phase fault currents with low resistance Neutral Grounding Resistors to approximately rated current of transformer and / or generator.

EXAMPLE: A 10000 kVA 13,8 kV generator's rated current is 419 A. Therefore, 400 A or 500 A Neutral Grounding Resistor is generally considered as suitable for that application.

Hilkar resistors are designed to absorb a large amount of energy without exceeding temperature limitations defined in IEEE 32. Hilkar Neutral Grounding Resistors can be used for indoor and outdoor and the neutral point is connected with a porcelain bushing or with a (minimum cross-section = 70 mm² copper or 95 mm² aluminum) high voltage (XLPE) cable from the bottom. The most common protection degree preferred for Neutral Grounding Resistors is IP 23 as it allows the resistor elements to cool easier and they can be used both at sea shores and deserts because the resistor elements are completely stainless steel and does not get affected by extreme conditions. Neutral Grounding Resistors are sent with MAINTENANCE AND INSTALLATION GUIDELINES. In MAINTENANCE AND INSTALLATION GUIDELINES, recommended relay settings for each Neutral Grounding Resistor are stated. Hilkar provides complete technical assistance in order to meet your specifications or site conditions.

ENCLOSURE FEATURES

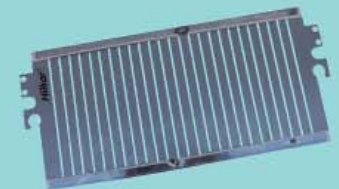
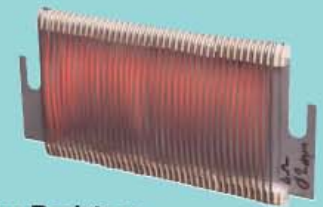
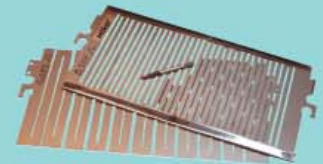
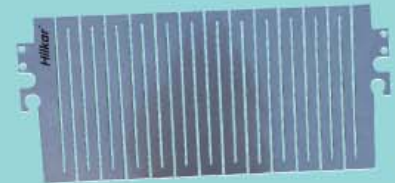
- 2 mm hot dip galvanized steel enclosure.
- Epoxy-based RAL 7032 (or RAL 70XX) polyester electrostatic powder paint provides maximum protection.
- Solid top cover sloped to prevent water accumulation.
- Custom made lifting eye bolts for secure lifting.
- Front cover for easy access to connection and inspection.
- Corrosion resistant nameplate.

OPTIONS

- Elevated support stands are provided for ground clearance and safety.
- Custom made AISI 304 stainless steel enclosures are available.
- Different paint types are available.
- Specially designed units for hazardous and extreme locations.
- Voltage transformers are mounted inside the resistor enclosure.
- Protection Relays are available.
- Porcelain entrance bushings can be mounted on top or on the side of Neutral Grounding Resistors.
- Motorized or manual single pole disconnecter switches, voltage transformers, surge arresters and heaters in the Neutral Grounding Resistors.

ROUTINE TESTS

- Measurement of insulation resistance between enclosure and resistor.
- Withstand test of dielectric strength at network frequency for one minute.
- Measurement of total DC resistance.
- Insulation test of resistor blocks.
- Galvanize thickness test.
- Paint thickness test.



**NEUTRAL EARTHING RESISTOR
WITH DISCONNECTOR PANEL**

TYPE TESTS (on demand)

- Temperature rise test
- Protection degree test
- Impulse voltage test (1,2 / 50 μ s)
- Measurement of AC resistance
- Seismic test

SELECTION DETAILS

- System Voltage
- Line to Neutral Voltage
- Desired Current Rating
- Desired Resistance Level
- Maximum Time ON (seconds)
- Bushing Entry or Cable Entry
- Current Transformer Ratio (if applicable)
- Disconnecter Switch (if applicable)
- Special Options (if applicable)



DIFFERENT NGR APPLICATIONS

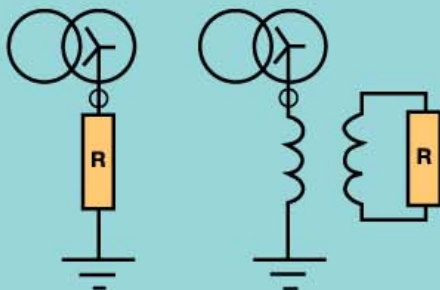
DIMENSIONS OF SAMPLE NEUTRAL GROUNDING RESISTORS

Un (kV)	In (A)	Seconds	Weight (kg)	W x L x H (cm)
36 / $\sqrt{3}$	1000	5	950	111 x 190 x (210 + 40*)
7.2 / $\sqrt{3}$	300	60	470	111 x 95 x 160
17.5 / $\sqrt{3}$	400	10	440	111 x 95 x 160
4.1 / $\sqrt{3}$	400	10	150	111 x 95 x 70
12 / $\sqrt{3}$	1000	5	400	111 x 95 x 160
11 / $\sqrt{3}$	700	10	380	111 x 95 x 210
6.9 / $\sqrt{3}$	400	10	280	111 x 95 x 160



3D DESIGN OF NEUTRAL GROUNDING RESISTORS

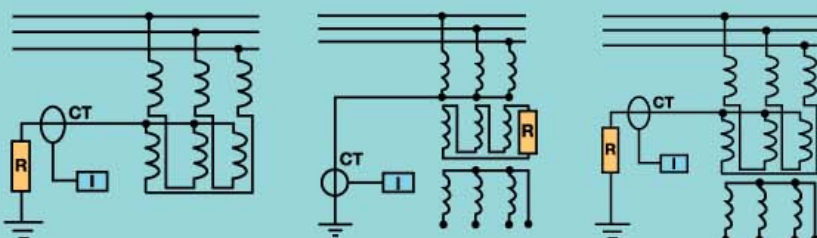
(* Height of bushing)



Examples of grounding the neutral point through the resistance

OTHER PRODUCTS

- **Iron Core Reactors**
 - Harmonic Filter Reactors
 - Line/Load Reactors
 - Low Voltage Shunt Reactors
 - Motor Starting Reactors
- **Air Core Reactors**
 - Harmonic Filter Reactors
 - Shunt Reactors
 - Neutral Grounding Reactors
 - Current Limiting Reactors
 - Test Laboratory Reactors
 - Arc Furnace Reactors
 - Motor Starting Reactors
 - Smoothing Reactors
- **Testing Instruments**
 - Turn-key Short Circuit Test Laboratories
 - High Current Injection Test Systems
 - Resistive-Inductive-Capacitive Load Banks



Examples of providing artificial neutral point if it is impossible to reach the neutral point of the source or the connection is delta.