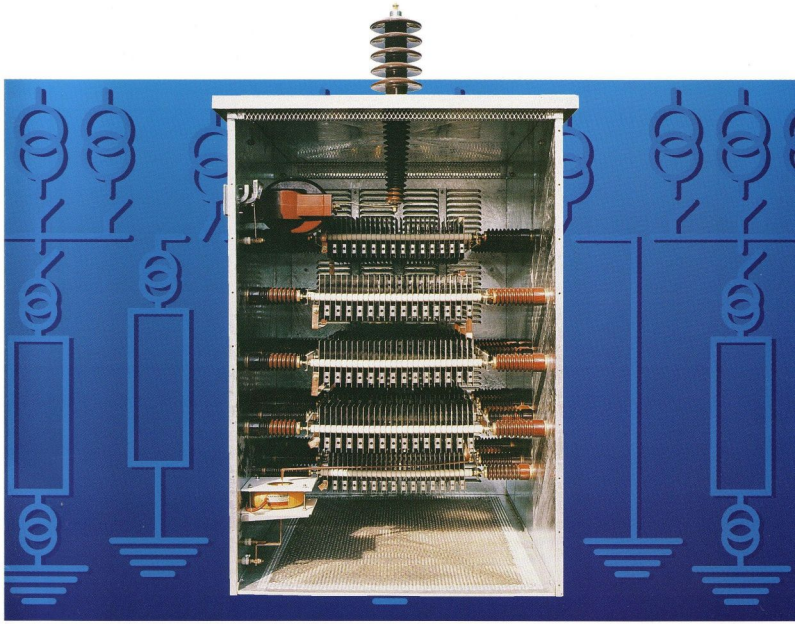
Power resistors

NEUTRAL EARTHING RESISTOR



METAL DEPLOYE RESISTOR

LET US KNOW YOUR RESISTORS PROBLEMS

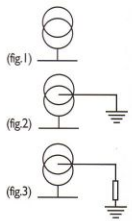
WE PROVIDE SOLUTIONS

SYSTEM EARTHING

The general purpose of earthing is to protect life and property in the event of 50/60 Hz faults (short circuit) and transient phenomena (lightning switching operations).
The question of how a system shall be earthed is governed by regulation.
The regulation that one point of every system shall be earthed is designed primarily to preserve the security of the system by ensuring that the potential on each conductor is restricted to such a value as is consistent with the level of insulation applied.

The choice of the earthing method is based on the following criteria :

- **Voltage level** : the insulation level of material must be in accordance with the induced voltage at the time of fault
- **Insulation co-ordination**
- **Limitation of fault current** : to reduce the electrodynamics stresses on material, to limit the induced voltage on telecommunications lines and over voltage on LV components.



There are 3 methods of neutral earthing :

- Insulated neutral system (fig.1)
- Direct earthing or solidely earthed (fig.2)
- Impedance earthing (fig.3)

The purpose of this method is to limit the current for greater safety.
There are 3 type of impedance earthing :

- Earthing through reactance
- Earthing through ARC - Suppression coil
- Earthing through resistor.

EARTHING THROUGH RESISTOR

This is the most common, economical and sufficient solution. It is used when the neutral of the supply transformer is available and its own impedance is not enough to limit the fault current.
There are different resistance material used to build a Neutral Earthing Resistor :

- cast iron resistance elements : fragile, no corrosion resistance
- liquid resistor : old technology, maintenance problems due to evaporation or freezing of electrolyse.
- Neutral Earthing Resistors made from stainless steal are the best technical and economical solution.


GRIDEX N

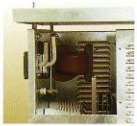

GRIDEX U


GRIDEX G

Founded in 1902, Métal Déployé S.A. has designed and developed several technologies based on expanded stainless steel metal grids to meet clients needs on neutral earthing resistors.

Métal Déployé neutral earthing resistors Gridex supplied all over the world are known for their solidity, reliability, performance and low maintenance requirement.

Range


Neutral Earthing Resistor with Current Transformer


Neutral Earthing Resistor with On Load Disconnector 12 kV

- Electrical criteria :
  - Rated fault current : from 5 to 5000 A
  - Rated voltage : from 0.38 to 500 kV
  - Rated time : from 1 sec to continuous time rating.
- Mechanical criteria
  - Direct connection or through top or side mounted bushing
  - Protection degree of housing : from IP 00 to IP 54 (recommended IP23)
  - Finishing : hot dip galvanised, painted or stainless steel housing.
- Options
  - current transformer HV or LV
  - ON or OFF load disconnecting switches
  - space heater
  - elevating stands.

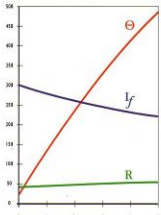

Neutral Earthing Resistor 1000 A, 12kV

Special construction :
To meet the client requirements, we have designed and supplied disconnecting and change over switch cabinets comprising disconnectors and current transformers for direct earthing through the Neutral Earthing Resistor.

CALCULATION OF NEUTRAL EARTHING RESISTOR

Three parameters are needed to specify the earthing resistor :
1) U : Rated voltage line to line voltage or system voltage (kV)
2) If : Rated fault current (A)
3) T s : Rated time (Sec) - Duration of the fault

Resistance value : $R = \frac{U}{I_f \sqrt{3}}$



When the flow of an electric current through a resistor is relatively short, dissipation is negligible and the heating temperature of that resistor depends on its capacity to store the electric energy (i.e. its heat value itself) in proportion to the mass and specific heat of the material used.

The rise in the resistor's temperature will be provided by the relation :

$$\Delta\Theta = \int \frac{RI^2 dt}{mC}$$

C : specific heat of the material (joule/kg/°K) ;
I : effective current in amperes (A) ;
R : mean value of the resistance (Ω) for an intermediate temperature between cold an hot.
ΔΘ corresponds to the temperature rise of the resistor

$\Delta\Theta = \Theta_2 - \Theta_1$ (°K) ;
Θ_2 = Temperature of resistor after rated time (°K)
Θ_1 = ambient temperature (°K)

When large-scale masses and energies are involved, the real resistance value of the resistor is taken into account, because it varies with the temperature which itself depends on the current flow time.
With that method of calculation we can determine the exact dimensions of the resistor to be built.
For resistors heating adiabatically, masses as high as possible are therefore required.

CALCULATION OF HOT RESISTANCE VALUE
(Resistance value after rated time)
The resistance of resistor element changes to extent with temperature after rated time. The change may be calculated from the temperature coefficient of resistivity .

$R_2 = R_1 (1 + \alpha \Delta\Theta)$
R_2 = Hot resistance value (Ω)
R_1 = Resistance value at ambient temperature (Ω)
α = Temperature coefficient of resistance material

As per IEEE-32 for neutral earthing resistor made from stainless steel resistance material, the allowable temperature rise for 10,30 or 60 sec time rating is 760°K., 610°K for extended time rating and 385°K for continous rating.

QUALITY IS OUR BUSINESS

DESIGNING, HANDLING, MANUFACTURING TOOLS and FACILITIES

To meet the various requirements and clients needs in resistors, the graduate engineers and engineers team of Métal Déployé has developed different software :
- mechanical and electrical calculation
- vibration and seismic simulation
- drawings made by CAD

MANUFACTURING AND TESTING FACILITIES

Manufacturing : the factory is located in Montbard close to DIJON and is equipped with CNC and automatic machines.

Testing : all routine and type tests (except lightning and switching impulse tests) are performed in the electrical laboratory equipped with all necessary instruments; power transformers and software.

QUALITY AND STANDARD

Routine tests performed on each Neutral Earthing Resistor:
Measurement of resistance
High Voltage Power Frequency
Insulation Measurement
Aspect Verification
Dimensional control

All resistors are designed in accordance with international standards IEC and if required the resistor can be designed in respect of other standards as BS, DIN, UTE, NFC, IEC, IEEE, ANSI, NEMA.
An internal quality system based on a quality manual has been developped and certified ISO 9001 *by* AFAQ in 1994.

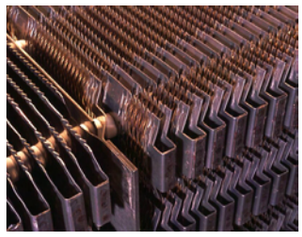
METAL DEPLOYE
RESISTOR

RESISTOR FOR
NEUTRAL EARTHING

To protect the transmission and energy distribution networks from any destruction or disruption caused by too much current, a resistor is inserted between the neutral and the earth.


Neutral Earthing resistor, Saudi Arabia.


Neutral Earthing resistor, Romania.


Expanded metal, our technology.

RESISTOR FOR
HARMONICS FILTER

The proliferation of complex electronic equipment generates increased disturbance on the network called "harmonics". To ensure voltage stability and to reduce defects in the current, it is necessary to install HVDC or SVC type HV filters.


East Link, HVDC connection between Estonia and Finland.


3 Gorges Dam, site of Longquan, China.


Ottawa, Canada.

LOAD BANK

The load bank tests and ensures the smooth operation of electric power production systems (generators, inverters, accumulator battery discharges, dynamos). The use of load banks is also common on test platforms and electricity laboratories.


Load bank of 600 kilowatts with control cabinet.


Mobile load bank of 1875 kVA on road trailer.

- Load bank that can be adapted for and integrated into the generator
- Resistant and reactive
- Battery discharge

OUR RANGE O

METAL DEPLOYE RESISTOR

RESISTOR FOR
RAILWAY TRACTION

The traction resistor is for railway locomotive brakes (Trains, High-speed trains, trams, monorails).

EMU, Poland.

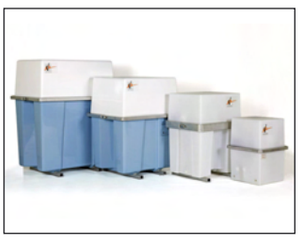
Monorail for Disney World, Orlando, USA.

- Brake rheostat
- Auxiliary circuit resistor

RESISTOR FOR
MOTOR CONTROL

The motor control resistors are used to limit the intensity of starting, braking, controlling the starting torque and varying the speed of industrial motors. They are the motors of gantry cranes, port cranes, crushers, pumps, etc.

Electrolytic starters (Vectrohm) for starting motors in a progressive and linear way, keeping the rated torque throughout the startup.



Vectrohm electrolytic starters.

Rotor starter resistor.

- Braking resistor for speed control
- Stator and rotor starter
- Slider control
- Direct current resistor

RESISTOR FOR
INDUSTRIAL HEATING

These resistors allow the use of electrical energy in applications related to heating for the chemical, pharmaceutical or food industries.

Air heating resistors for drying wood.

Air heating resistors for dehydrating alfalfa.

- Heating elements for the chemical, pharmaceutical and food industries
- Hot air generator
- Floor heating

F RESISTORS