گروه کالوت
KALOT GROUP
Protect Today For Tomorrow
Since: 1972 تاسیس: ۱۳۵۱

Ground Improvement Materials

Three specialist solutions for better earthing system performance







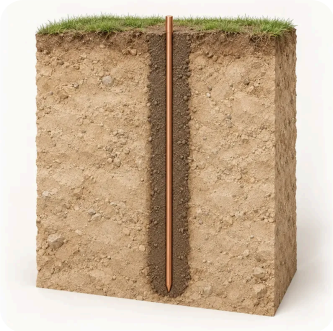
GIM Light® **GIM®** **ECO GIM®**

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KALOT Group

Manufacturer of earthing system equipment

Building on technical know-how and industrial experience, KALOT Group offers engineered solutions for lowering earth resistance and improving the performance of earthing systems. KALOT ground improvement materials are engineered compounds: by improving the electrical conductivity around the electrode, they lower the resistance of the earthing system and make it more stable in different soil conditions.



Applications

- **Power plants and critical infrastructure**
- **Industry and industrial complexes**
- **Commercial and residential buildings**
- **Solar power plants**
- **Transport and telecommunications projects**

Product family

Three products with different compositions and properties for different soil conditions and project requirements

GIM Light®

Optimised composition

Easy installation with good performance in typical conditions



GIM®

Carbon-based composition

High performance in special projects and corrosive environments



ECO GIM®

Clay-based composition

An economical option with good performance for most projects



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A safer future is possible with us

GIM®

Ground improvement material for highly corrosive environments

Carbon-based
(Carbon-Base)

Very low specific spreading resistance
8 Ω·m²

Stable performance in the harshest ground conditions



GIM® is a carbon-based (Carbon-Base) ground improvement material designed specifically for highly corrosive environments. Made from high-purity minerals and engineered additives, it lowers earth resistivity considerably and ensures stable, long-lasting performance of the earthing system in harsh environmental conditions.

With more than 20 years in the Iranian market, GIM® is designed and produced to international standards and is used in industrial, power plant, oil and gas and critical infrastructure projects.

Key features

Carbon-based
A stable composition suited to corrosive environments

High durability and stability
Reliable, long-term performance

High electrical conductivity
Improves earthing efficiency

Low solubility in acidic environments
Suited to harsh, corrosive conditions

High polarisation resistance
Above 8 ohm square metres

Environmentally friendly
Free from harmful compounds

Backed by accredited laboratory certificates
Confirmed quality and performance

Technical specifications

Resistivity	below 0.5 ohm metre
Polarisation resistance	above 8 ohm square metres
Application	Highly corrosive environments
Base material	Carbon (Carbon-Base)
Material density	900 kilograms per cubic metre

ENGINEERED EARTHING FOR A SAFER TOMORROW

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GIM Light®

Ground improvement material for normal environmental conditions

Carbon-based
(Carbon Base)

Resistivity
below 1 Ω·m

Stable performance in standard ground conditions

GIM Light® is a carbon-based ground improvement material developed specifically to improve earthing system performance in normal environmental conditions. Its optimised formulation lowers earth resistance considerably while keeping the earthing system stable over the long term as moisture and temperature change. Easy to install and compatible with standard soils, GIM Light is a strong choice for building, industrial and infrastructure projects.



ENGINEERED EARTHING FOR A SAFER TOMORROW

Key features

Suitable for normal environments
For building, industrial and infrastructure projects

Carbon-based
A stable composition suited to normal environments

Stable performance
Keeps the earthing system effective over the long term

Better electrical contact
Raises conductivity around the electrode and lowers earth resistance

Easy, compatible installation
Suits all types of electrodes and common installation methods

Low resistivity
Below 1 ohm metre for effective performance

Technical specifications

Base material	Carbon (Carbon Base)
Application	Normal environments
Resistivity	below 1 Ω·m
Polarisation resistance	above 7.5 Ω·m²
Packed weight	15 kilograms

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ECO GIM®

Ground improvement material for normal environmental conditions

Clay-based
(Clay Base)

Polarisation resistance
above 7.2 Ω·m²

The economical choice for general projects

ECO GIM® is a clay-based soil improvement material designed to improve the performance of earthing systems economically in normal soil conditions. By improving contact between the electrode and the soil, it helps lower earth resistance and deliver stable, reliable long-term performance.

ECO GIM is suited to general building, industrial and infrastructure projects that need an economical, practical and dependable way to improve the earthing system in non-corrosive or normal environments.



ENGINEERED EARTHING FOR A SAFER TOMORROW

Key features

- **The economical choice** — For general projects
- **Clay-based** — (Clay Base)
- **Suitable for normal environments** — Normal environmental conditions
- **Resistivity** — below 1 Ω·m
- **Simple installation** — Compatible with common earthing methods
- **Polarisation resistance** — above 7.2 Ω·m²

Technical specifications

Base	Clay (Clay Base)
Application	Normal environments
Resistivity	below 1 Ω·m
Polarisation resistance	above 7.2 Ω·m²
Material density	about 750 kilograms per cubic metre

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Comparing the three ground improvement materials

A guide to choosing the right product for your project conditions



ECO GIM



GIM Light



GIM

Property	ECO GIM	GIM Light	GIM
Base material	Clay (Clay Base)	Carbon (Carbon Base)	(Carbon Base)
Resistivity	below 1 Ω·m	below 1 Ω·m	below 0.5 Ω·m
Polarisation resistance	above 7.2 Ω·m²	above 7.5 Ω·m²	above 8 Ω·m²
Suitable environment	Normal / economical	Normal environments	Highly corrosive environments
Material density	about 750 kg/m³	about 900 kg/m³	about 900 kg/m³
Bag weight	15 kilograms	15 kilograms	15 kilograms
Bag material	Composite	Composite	Composite
Sulphur content	below 2%	below 2%	below 2%
Standard	IEC 62561-7	IEC 62561-7	IEC 62561-7

ECO GIM
An economical solution for typical projects in normal environmental conditions, while meeting the technical requirements.

GIM Light
A balanced option for general projects that need stable performance and easy installation.

GIM
For projects facing highly corrosive environments that need the greatest stability of performance.

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A safer future is possible with us

Test results and compliance with standards

A review of the test results for GIM®, GIM LIGHT® and ECO GIM® against IEC 62561-7 and IGS-I-EL-001

Quality assurance and stable performance

Compliant with international standards

Tested in accredited laboratories

Property	GIM®	GIM LIGHT®	ECO GIM®	IEC 62561-7	IGS-I-EL-001
Resistivity (Ω·m)	< 0.5	< 1	< 1	As per catalogue	As per catalogue
Polarisation resistance (PR) (Ω·m²)	> 8	~ 7.5	~ 7.2	> 8 (corrosive environment) > 4 (non-corrosive)	> 8 (corrosive environment) > 4 (non-corrosive)
Sulphur (%)	< 1.4	< 1.5	< 1.9	< 2	< 2
Iron (mg/lit)	0.21	0.17	0.18	< 0.3	< 0.3
Copper (mg/lit)	0.03	0.04	0.03	< 0.05	< 0.05
Zinc (mg/lit)	0.01	0.05	0.007	< 3	< 3
Nickel (mg/lit)	0.04	0.01	0.05	< 0.07	< 0.07
Cadmium (mg/lit)	0.002	0.002	0.001	< 0.003	< 0.003
Cobalt (mg/lit)	0.01	0.03	0.03	< 0.05	< 0.05
Lead (mg/lit)	0.008	0.01	0.01	< 0.01	< 0.01
Arsenic (mg/lit)	0.009	0.008	0.009	Not specified	< 0.01
Barium (mg/lit)	0.06	0.05	0.05	Not specified	< 0.1
Chromium (mg/lit)	0.03	0.02	0.02	Not specified	< 0.05
Mercury (mg/lit)	0.0007	0.001	0.001	Not specified	< 0.001

All three products, GIM®, GIM LIGHT® and ECO GIM®, have been assessed in compliance tests against IEC 62561-7 and IGS-I-EL-001. The samples were tested by accredited laboratories with sampling witnessed, and the results showed acceptable values and full compliance with the requirements of the relevant standards.

A professional choice for general and industrial projects

Environmentally compatible and cost-effective in use

Reliable performance in varied environmental conditions

Advanced materials, safer infrastructure

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Why is polarisation resistance the most important parameter of a ground improvement material?

Lowering the initial resistance is not enough: the stability of the earthing system is what counts

Some materials can lower the final resistance of the earthing system at first, but lowering the initial resistance alone is not the main criterion for choosing a ground improvement material. If the material's polarisation resistance is low, corrosion is not well controlled over time and the long-term stability of the earthing system cannot be guaranteed. Polarisation resistance is therefore one of the most important technical criteria for assessing and choosing a ground improvement material.

Key parameter: polarisation resistance

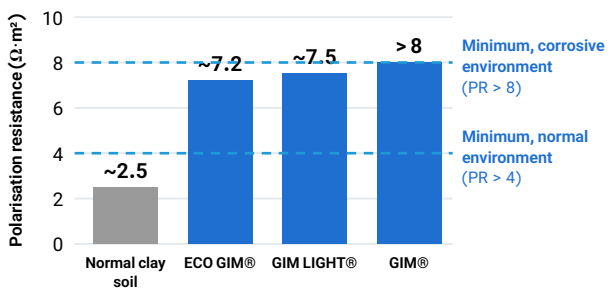
The main criterion for durability, corrosion control and stability of the earthing system

Standard minimums:

PR > 8 for corrosive environments

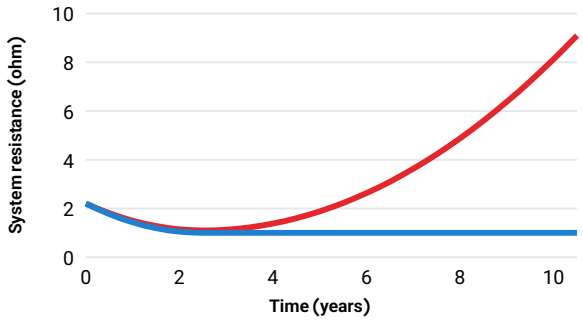
PR > 4 for normal environments

Guide to interpreting polarisation resistance



The higher the polarisation resistance, the more stable the earthing system is in corrosive conditions and the longer it lasts.

Stability of earthing system resistance over time



Material with adequate polarisation resistance

Material with low polarisation resistance

Materials with adequate polarisation resistance keep the earthing system resistance stable over time. Materials with low polarisation resistance, by contrast, let the resistance rise gradually through corrosion and instability.

In summary

A ground improvement material that only lowers the initial resistance of the earthing system is not necessarily the right choice for long-term stability. The main criteria are long-term performance, durability and a polarisation resistance suited to the environmental conditions.

Technical note on the standard

IEC 62561-7 does not set a specific, fixed resistivity value as a mandatory figure for all products, but polarisation resistance is an essential parameter in engineering calculations and in choosing the right material.

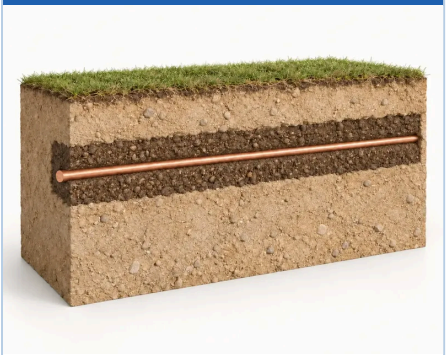
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Installation methods for ground improvement material

Correct installation of the ground improvement material, matched to the project conditions and the right method, improves the contact between the electrode and the surrounding soil, lowers the resistance of the earthing system and increases its stability and long-term performance.

Earthing trench method (horizontal)



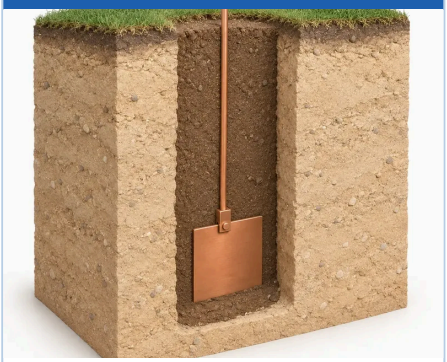
The material is placed continuously around the buried conductor to create effective contact with the surrounding soil and increase the stability of the earthing system.

Earth rod method



The material is compacted around the earth rod to lower the earthing system resistance and improve its long-term performance.

Earth pit method (plate / pipe / 5 rings)



The material is used around the plate, pipe or earth pit rings to improve electrical conductivity around the electrode and increase system stability.

How to mix the ground improvement material

Mix the material with water in the recommended ratios to obtain a uniform mortar and ensure correct installation.

GIM® / GIM Light® (GIM and GIM Light)

Portland cement 2 kilograms	+	**Water** 8 litres	=	**Ready mortar** GIM / GIM Light

GIM and GIM Light are mixed with 2 kg of Portland cement and 8 litres of water per bag.

ECO GIM®

Suitable clay soil 15 kilograms	+	**Water** 8 litres	=	**Ready mortar** ECO GIM

ECO GIM is mixed with 15 kg of suitable clay soil and 8 litres of water per bag.

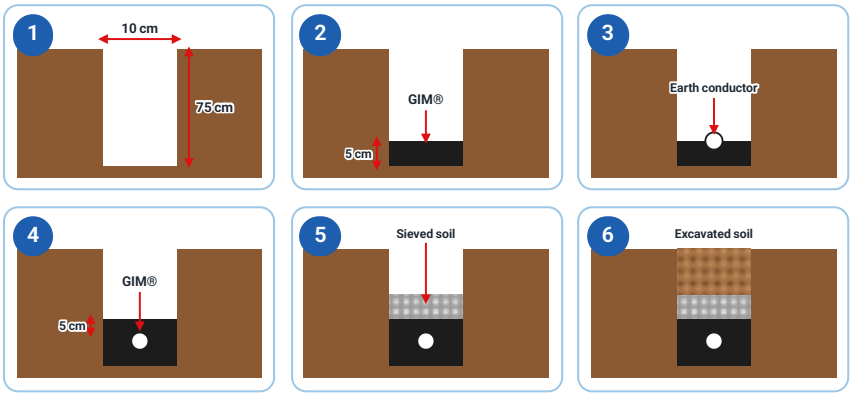
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Earthing trench method (horizontal)

Steps for installing ground improvement material in horizontal trenches

In this method, the ground improvement material is placed as a mortar on the trench floor and over the earth conductor, so that effective contact with the surrounding soil increases and the earthing system keeps performing stably.



Installation steps

1. Dig a trench at least 10 cm wide and 75 cm deep. Where needed, keep the floor and walls free of slope.
2. Fill the trench floor with GIM® mix to a thickness of at least 5 cm (according to Tables 1 and 2).
3. Lay the earth conductor (bare copper conductor) on the layer of material.
4. Cover the conductor again with GIM® mix at least 5 cm thick so that it is fully covered.
5. Fill at least 15 cm above the material with sieved soil and compact it well.
6. Fill the rest of the trench completely with the excavated soil.

Table 1: trench length filled by one bag of GIM® / GIM Light
(density 900 kilograms per cubic metre)

Trench width (cm)	*GIM® / GIM Light* height (cm)				
	5	10	15	20	25
10	333	167	111	83	67
15	222	111	74	56	44
20	167	83	56	42	33
25	133	67	44	33	27
30	111	56	37	28	22
35	95	48	32	24	19
40	83	42	28	21	17

Table 2: trench length filled by one bag of ECO GIM®
(density 750 kilograms per cubic metre)

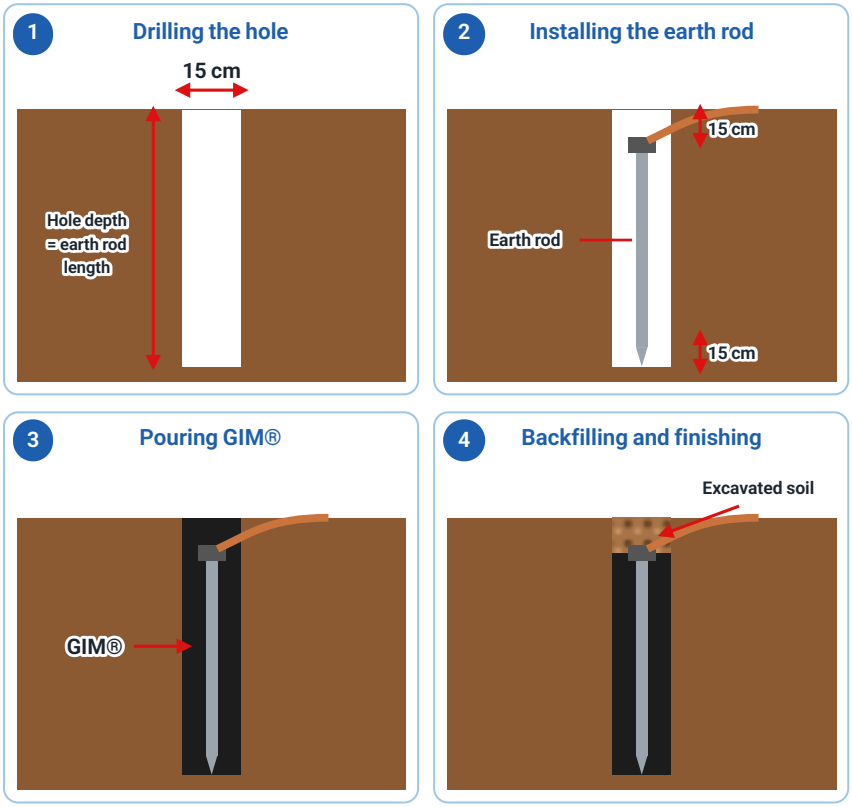
Trench width (cm)	*ECO GIM®* height (cm)				
	5	10	15	20	25
10	400	200	133	100	80
15	267	133	89	67	53
20	200	100	67	50	40
25	160	80	53	40	32
30	133	67	44	27	30
35	114	57	38	29	23
40	100	50	33	25	20

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Earth rod method

Steps for installing ground improvement material with the earth rod method

In this method, the earth rod is installed vertically in a hole in the ground and the space around it is filled with GIM® mix, giving better electrical contact with the soil and ensuring the long-term stability of the earthing system.



Installation steps

1 Drilling the hole
Drill a hole at least 15 cm in diameter and as deep as the length of the earth rod.

2 Installing the earth rod
Place the earth rod in the hole. Where possible, put about 15 cm of a bentonite soil mix at the bottom of the hole; the top of the earth rod should sit about 15 cm below ground level. At this stage the earth conductor (tape or bare copper conductor) is connected to the earth rod by exothermic welding or a clamp.

3 Using GIM® mix
Pour GIM® evenly around the earth rod and compact it, so that the whole hole is filled with ground improvement material.

4 Backfilling and finishing
Fill the rest of the hole with the excavated soil. If needed, you can use dedicated methods to keep access for later inspection.

Table 2-1: earth rod method, GIM and ECO GIM
Number of *GIM®* bags needed (density 900 kilograms per cubic metre)

Hole diameter (cm)	Hole depth (m)						
	1.2	1.5	2	2.5	3	4.5	6
10	1	1	1	1	1	2	2
15	1	1	2	2	3	4	6
20	2	2	3	4	5	7	10
25	3	4	5	6	8	12	16
30	4	6	7	9	11	17	22
35	6	8	10	13	15	23	31
40	8	10	13	17	20	30	40

Table 2-2: earth rod method (ECO GIM)
Number of *ECO GIM®* bags needed (density 750 kilograms per cubic metre)

Hole diameter (cm)	Hole depth (m)						
	1.2	1.5	2	2.5	3	4.5	6
10	1	1	1	1	1	2	2
15	1	1	2	2	3	4	5
20	2	2	3	4	5	6	9
25	3	4	5	5	7	10	14
30	4	5	6	8	10	15	19
35	5	7	9	11	13	20	26
40	7	9	11	15	17	25	34

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Earth pit method

(Plate / pipe / 5 rings)

This method uses a plate, pipe or rings to build earth pits. Installing it correctly and in line with the instructions, with a suitable backfill (GIM® or ECO GIM®), gives the earthing system stable performance and better long-term results through effective contact with the surrounding soil.

1. **Dig the earth pit to suitable dimensions.**
   Dig to the depth shown on the installation drawing. The pit walls must be stable and safe.
   Choosing the plate earthing system.
2. Connect the earth wire or cable to the conductor plate (by exothermic welding or a suitable mechanical connection).
3. **Pouring the first layer of GIM® at the bottom of the pit.**
   Pour at least 10 cm of GIM® mix on the pit floor and level its surface.
4. **Placing the earth plate.**
   Stand the conductor plate vertically in the centre of the pit.
5. **Filling around and over the plate with GIM®.**
   Fill with GIM® mix to above the edge of the plate. Then install the inspection cover (manhole).

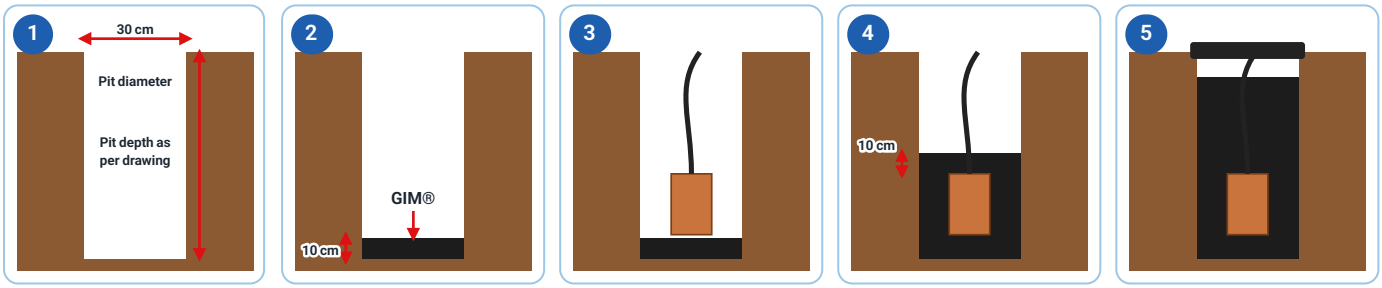


Table 4: plate method
Number of GIM® and GIM Light bags needed

Pit diameter (cm)	GIM® height (cm)						
	20	30	70	80	90	100	120
60	3	4	10	12	13	15	18
70	4	6	14	16	18	20	24
80	5	8	19	21	24	27	32
90	7	10	24	27	30	34	40
100	8	12	29	33	37	42	50
110	10	15	35	40	45	50	60
120	12	18	42	48	54	60	72

Table 4: plate method
Number of ECO GIM® bags needed (approximate)

Pit diameter (cm)	ECO GIM® height (cm)						
	20	30	70	80	90	100	120
60	3	4	9	10	11	13	15
70	4	5	12	14	15	17	20
80	5	7	16	18	20	23	27
90	6	9	20	23	25	29	34
100	7	10	25	28	31	35	42
110	9	13	30	34	38	42	50
120	10	15	35	40	45	50	60

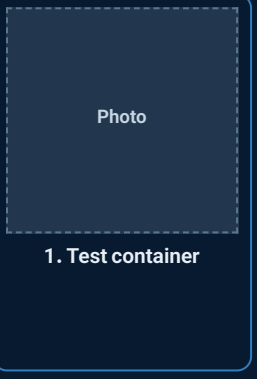
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Why are unsuitable ground improvement materials a problem?

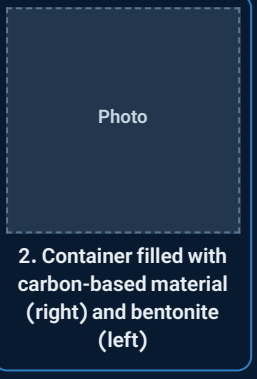
Clay-based materials such as bentonite can lower earthing system resistance at first because they absorb a lot of moisture, but that initial drop alone does not show stable performance. As the moisture is lost, these materials shrink, crack and leave air gaps around the electrode, so the resistance of the earthing system rises.

In systems exposed to heavy currents such as lightning, the rise in temperature can intensify the drying and even the baking of the soil around the electrode. In such conditions, even re-watering cannot always bring back the original performance, and maintenance or reinstallation costs rise.

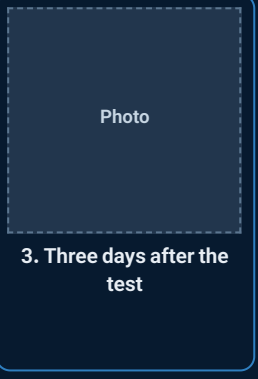
Changes observed over one month



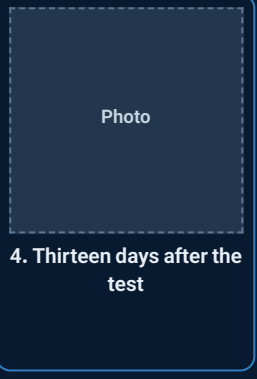
1. Test container



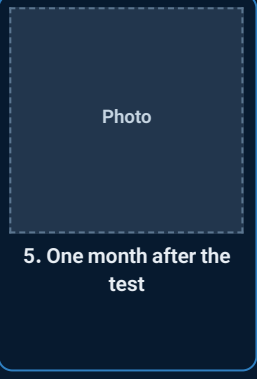
2. Container filled with carbon-based material (right) and bentonite (left)



3. Three days after the test



4. Thirteen days after the test



5. One month after the test

These pictures show how clay/bentonite-based material behaves compared with carbon-based ground improvement material. Cracking and loss of continuity in the unsuitable sample increase over time.

Under the new approach of the National Iranian Gas Company, clay-based materials such as bentonite are acceptable only where the sole aim is to lower earth resistance and the system is not exposed to lightning discharge current; for example some mechanical earthing systems, electrical panels and similar uses that are not connected and bonded to the lightning earthing system.

Choosing the right ground improvement material is not only about lowering the initial resistance; it is about keeping the earthing system stable, durable and reliable over time.

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GIM® certificates, tests and reference letters

Technical and laboratory documentation for GIM® ground improvement material

As a ground improvement material, GIM® has been assessed for its electrical and chemical properties and standard requirements in accredited university laboratories and centres in Iran and abroad. The test results show that it meets the criteria of IEC 62561-7 and IGS-I-EL-001 and delivers reliable performance in resistivity, polarisation resistance, pH, sulphur content and environmental considerations. Reference letters from foreign companies and operators also confirm the successful use of GIM® in construction and export projects.

Certificates and technical test results



IEC 62561-7 compliance
Razi Laboratory



pH and solubility test
Amirkabir University of Technology

Test report

IGS-I-EL-001 compliance
Tarbiat Modares University

Test report

Resistivity test
Tarbiat Modares University

Test report

Polarisation resistance test
Tarbiat Modares University

Test report

Resistivity test
Niroo Research Institute

Test report

Conductivity and resistivity test
Amirkabir University of Technology



IEC 62561-7 compliance
Tarbiat Modares University

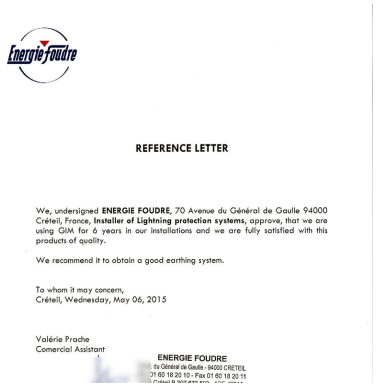
Test report

Sulphur test
Tarbiat Modares University

Test report

PAH test
Tarbiat Modares University

International reference letters



REFERENCE LETTER

We, undersigned **ENERGIE FOUDRE**, 70 Avenue du Général de Gaulle 94000 Créteil, France, **Installer of Lightning protection systems,** approve, that we are using GIM for 6 years in our installations and we are fully satisfied with this products of quality.

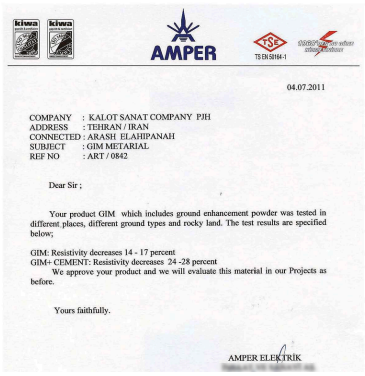
We recommend it to obtain a good earthing system.

To whom it may concern,
Créteil, Wednesday, May 06, 2015

Valérie Prache
Comercial Assistant

ENERGIE FOUDRE

Reference letter from Energie Foudre (France)



AMPER

04.07.2011

COMPANY : KALOT SANAT COMPANY PJH
ADDRESS : TEHRAN / IRAN
CONNECTED : ARASH ELAHIPANAH
SUBJECT : GIM METARIAL
REF NO : ART / 0842

Dear Sir ;

Your product GIM which includes ground enhancement powder was tested in different places, different ground types and rocky land. The test results are specified below;

GIM: Resistivity decreases 14 - 17 percent
GIM+ CEMENT: Resistivity decreases 24 -28 percent
We approve your product and we will evaluate this material in our Projects as before.

Yours faithfully.

AMPER ELEKTRİK

Reference letter from Amper (Turkey)

GIM®
An export product

Technical summary

- ✓ **Compliance with IEC 62561-7 and IGS-I-EL-001**
- ✓ **Assessment of resistivity and polarisation resistance**
- ✓ **pH, sulphur and PAH tests**
- ✓ **Laboratory documentation from accredited centres**
- ✓ **A track record of use and international reference letters**

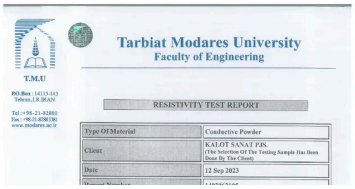
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GIM Light® and ECO GIM® test certificates

Laboratory confirmation of the products under IEC 62561-7

GIM Light®

Product test certificates


Tarbiat Modares University
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T.M.U
RESISTIVITY TEST REPORT
Type Of Material | Conductive Powder
Client | KALOT SANAT PJS.
Date | 12 Sep 2023

Resistivity certificate

Test report

Polarisation resistance certificate

Test report

Sulphur content certificate

Test report

Leaching test certificate

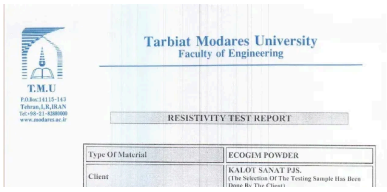
Summary of test results

- **Resistivity:** 0.77 Ω·m
- **Polarisation resistance:** 7.61 Ω·m²
- **Sulphur:** 1.5 %
- **Leaching:** Compliant with the standard

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Tarbiat Modares University, Faculty of Engineering

ECO GIM®

Product test certificates


Tarbiat Modares University
Faculty of Engineering
T.M.U
RESISTIVITY TEST REPORT
Type Of Material | ECOGIM POWDER
Client | KALOT SANAT PJS.

Resistivity certificate

Test report

Polarisation resistance certificate

Test report

Sulphur content certificate

Test report

Leaching test certificate

Summary of test results

- **Resistivity:** 0.85 Ω·m
- **Polarisation resistance:** 7.41 Ω·m²
- **Sulphur:** 1.9 %
- **Leaching:** Compliant with the standard

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