

## Low-resistance grounding module



- The grounding resistance of traditional metal grounding electrode changes greatly with climate (dampness degree of soil), and as time goes by, the grounding resistance increases constantly which shortens product service life.
- Low-resistance grounding module applies nonmetallic elements as its main material and is composed by electrolytic material and non-metallic mineral substance with good conductivity and stability which help increasing dispersion area of grounding body and decreasing contact resistance between grounding body and soil. The product has excellent moisture absorbing and retaining abilities. By releasing electrolyte into the soil, the conductivity of soil around is improved for getting low and stable grounding resistance.



## 01

Corrosion resistance, nonhazardous, long service life and convenient installation



Electrical field distribution of grounding body is uniform to reduce electrochemical corrosion

In accordance with environmental quality standards GB15618-1995, meet related environmental requirements

Pass through tests of Korea's Ministry of Environment

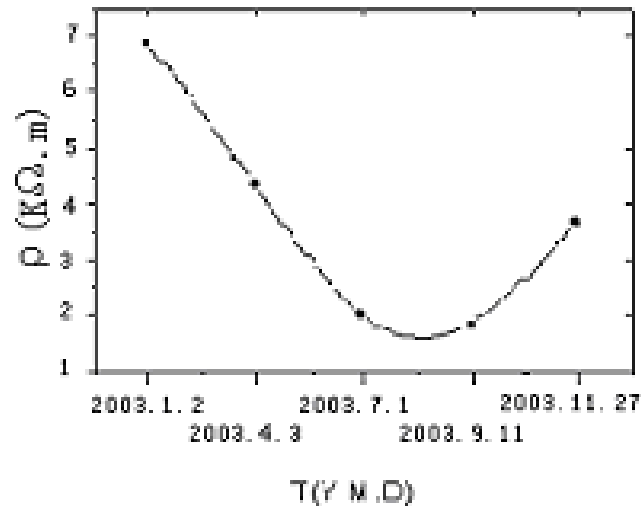
Nonmetal composite material has functions of protection and metal corrosion inhibition

Service life can reach up to more than 50 years

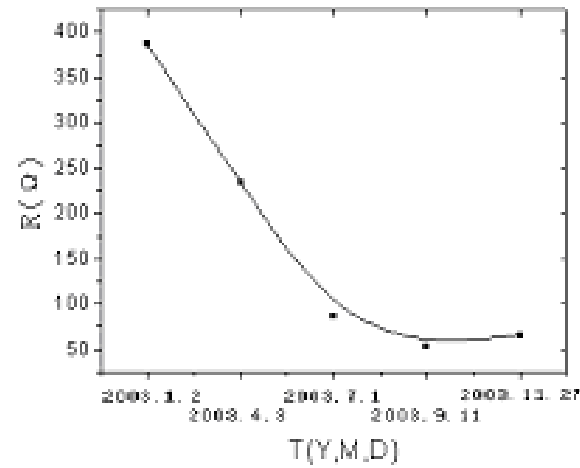
Can be used in regions with poor geological condition, such as desert area and perennial permafrost zone

## 02

Moisture absorbing and retaining abilities, low grounding resistance, 22% ~ 40% lower than tubular steel grounding rod with the same size



Changing curve of soil resistivity



Changing curve of grounding resistance

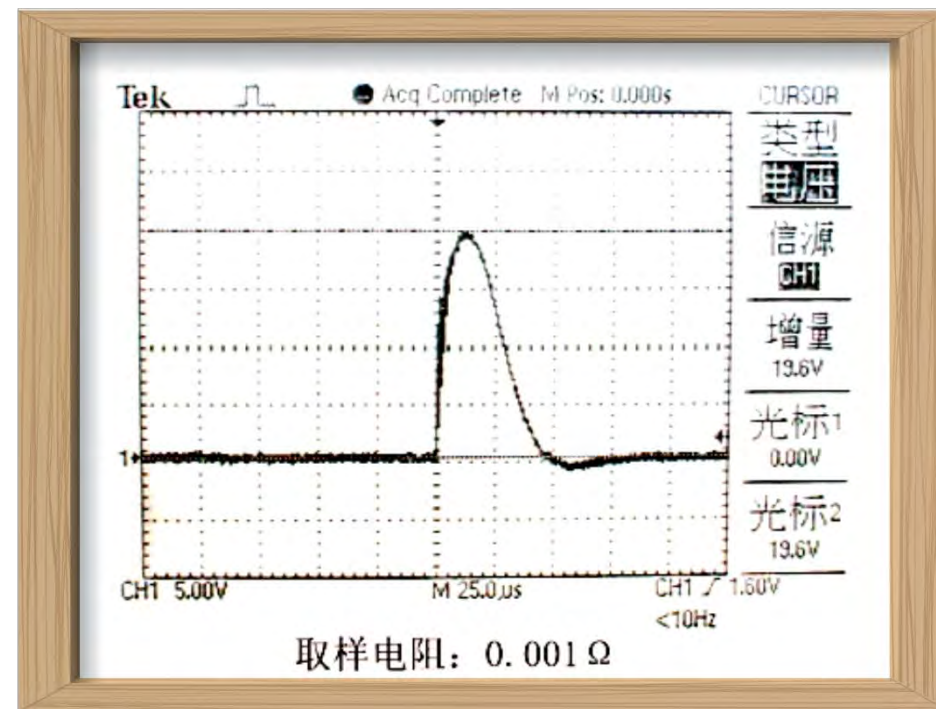
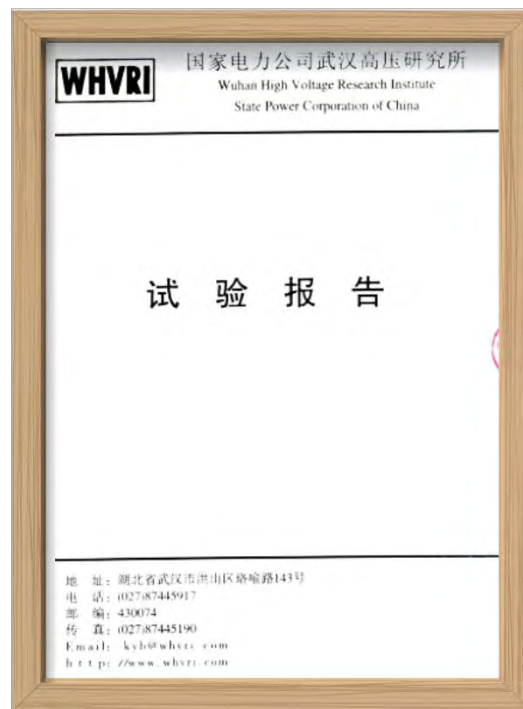


- ◆ Grounding comparison test and verification by Design and Research Institute of China Ministry of machinery industry
- ◆ Grounding test verification in high-altitude permafrost zone (Balang mountain 4000m)
- ◆ Grounding comparison test and verification by large-scale communication equipment manufacturer in China

## 03

Being struck by large lightning current, the product still keeps no resistance increase and has no signs of induration, brittleness and fracture.

- ◆ Pass through the test of Wuhan high-voltage research institute of China's state grid
- ◆ 8/20 $\mu$ s 20 kA impulse wave diagram



# Features of grounding module

## Comparison between grounding module and traditional metal grounding products

- ◆ With the same earth resistivity, the consumption rate of grounding module is lower;
- ◆ The higher the earth resistivity is , the more obvious the advantages of this product shows.

No.	Earth resistivity $\rho$ ( $\Omega\cdot\text{m}$ )	Grounding resistance for single grounding module in soil R ( $\Omega$ )	The number of grounding module meeting the required value	Grounding resistance of single copper bar R ( $\Omega$ )	The number of copper bar meeting the required value $n\approx$
1	100	11	2	37	5
2	200	22	3	74	9
3	300	33	4	111	13
4	400	44	6	148	18
5	800	88	14	296	44
6	1000	110	16	370	53
7	1500	165	24	555	80
8	2000	220	32	740	106

Notes:

1. For the purpose of comparison, target ground resistance is 10 $\Omega$ .
2. Choose ZGD-I-3 grounding module, the diameter D of copper grounding electrode is 0.022m and the length L is 2.5m.
3. There is electromagnetic shielding between vertical grounding materials, so the materials consumption is high and the required construction amount increases greatly.

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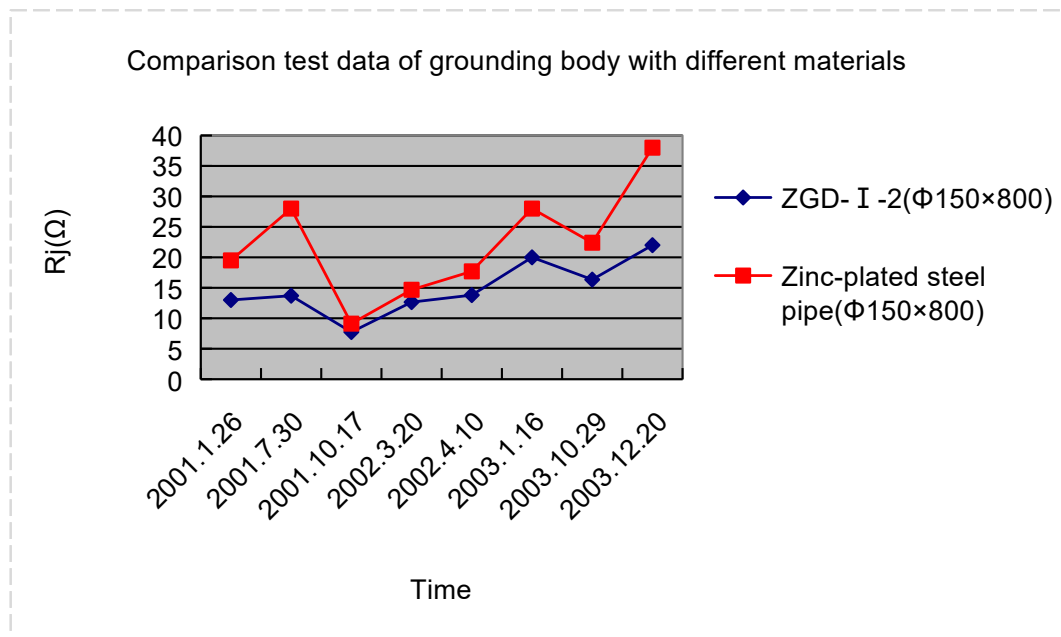


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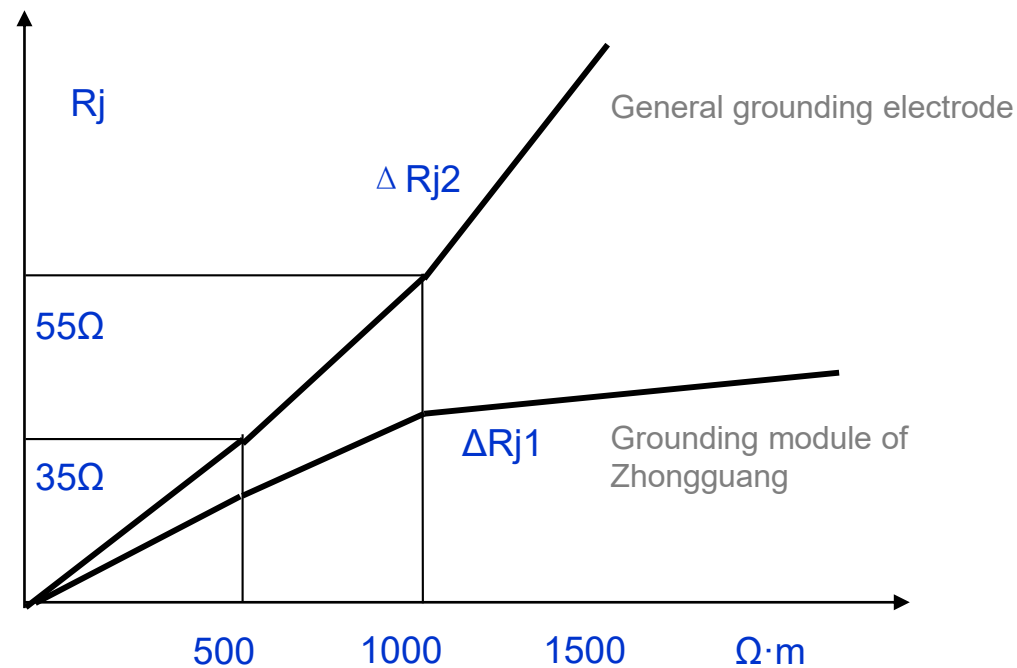
# Features of grounding module

## Comparison between grounding module and traditional metal grounding products

- ◆ The resistance of grounding module is influenced less by season and keeps stable for a long time. ( compared with Zinc-plated steel pipe)



- ◆ Grounding module has lower grounding resistance, the higher the soil resistivity is, the more obvious the advantage it shows.

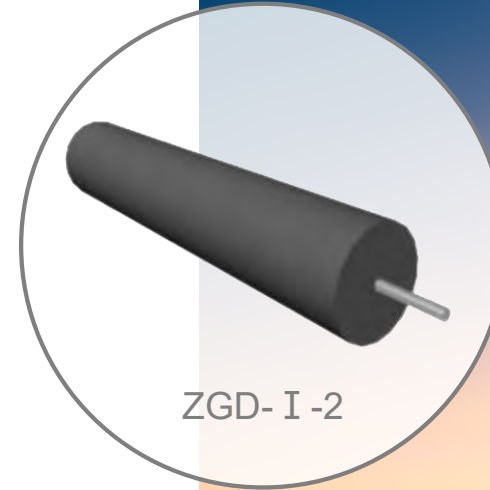


## Calculation of power frequency grounding resistance

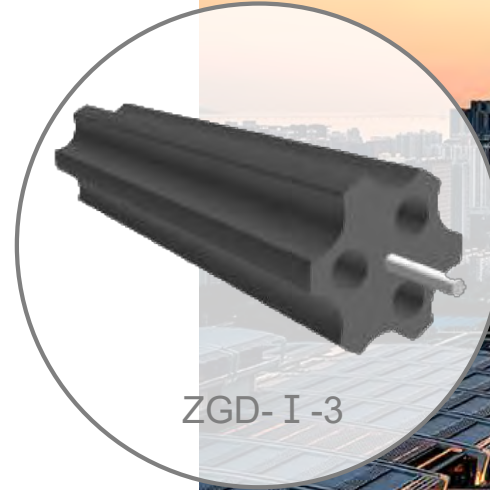
- ZGD- I is suitable for burying vertically
- Grounding resistance for single module

$$R_j = \left[ \frac{\rho}{2\pi L} \ln \frac{4L(L+2h)}{d(L+4h)} \right] \times M_0$$

- $M_0$ — adjustment coefficient of module
- ZGD- I -2: 0.35
- ZGD- I -3: 0.30
- simple estimation formula for power frequency grounding resistance:
- ZGD- I -2:  $R_j \approx 0.18\rho$
- ZGD- I -3:  $R_j \approx 0.11\rho$



ZGD- I -2



ZGD- I -3





## Calculation of power frequency grounding resistance

- ZGD-II-1 is suitable for burying horizontally
- Grounding resistance for single module:

$$R_j = 0.22 \times \frac{\rho}{\sqrt{a \times b}} \times M_0$$

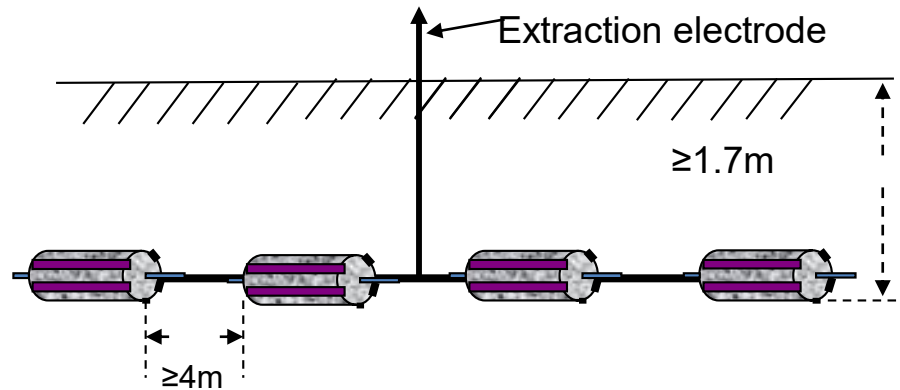
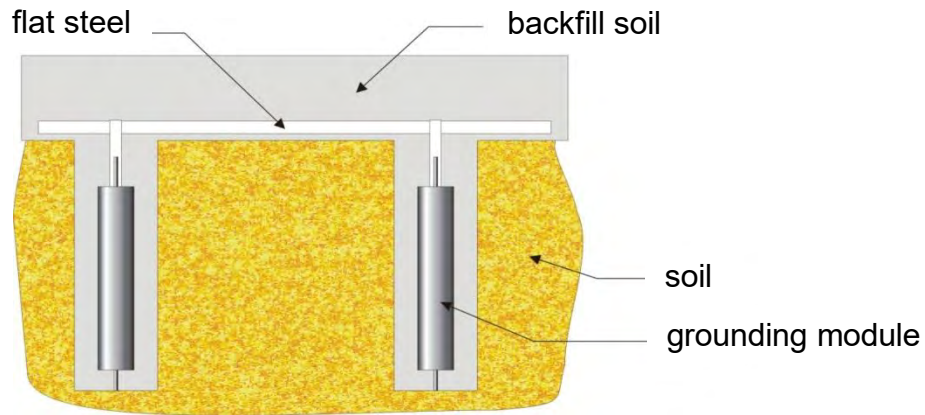
- a, b —  $\Pi$ : length and width (m)
- $M_0$  — adjustment coefficient of module
- ZGD-II-1: 0.33
- simple estimation formula for power frequency grounding resistance:
- ZGD-II-1:  $R_j \approx 0.16\rho$

$$R_{nj} = \frac{R_j}{n\eta}$$

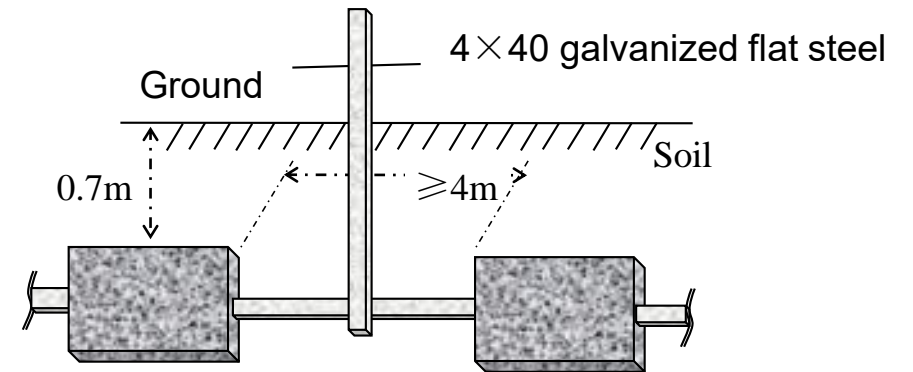
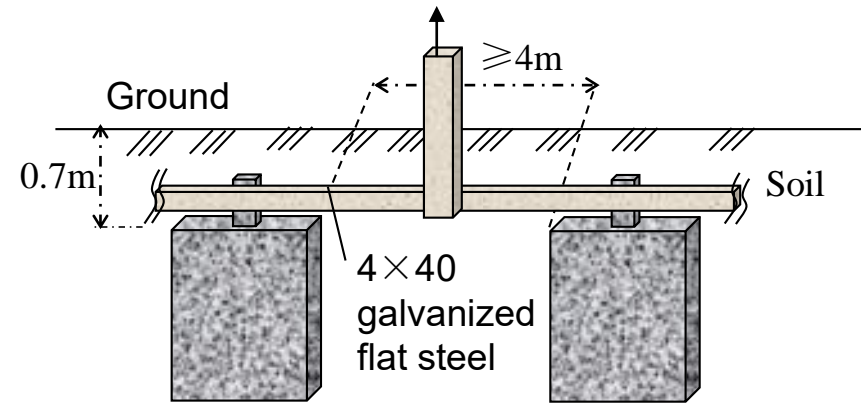
- Parallel grounding resistance utilization factor of module  $\eta$  is 0.55~0.85



## Burying method for grounding module



Buried of ZGD- I module



Buried of ZGD-II-1module

# Typical application projects of grounding module

Low-resistance grounding module is widely used in large and key projects in various industries and in many countries.

## For examples:

Korean presidential office; large oil field, west-east national gas transmission project, Qinghai-Tibet railway, overhead contact system of national electric railway, highway, civil airport, satellite launching base, large/medium transformer station and mobile communication base station.



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# High-efficient resistance reducing agent



## Features

- Resistivity in room temperature  $< 2\Omega \cdot \text{cm}$ .
- No toxicity, no harm and doesn't pollute air, water source and soil, meeting environmental requirements.
- Does not dissolve, decompose, or leach out with time.
- Non-corrosive.



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