

Magnetite ( $Fe_3O_4$ ) is a natural mineral with good conductivity and a high degree of oxidation that makes it resistant to corrosion even at high temperatures. Careful alloying with other minerals can produce anodes with excellent electrochemical properties and mechanical strength.

The magnetite anode is casted in hollow cylindrical forms to minimise weight and to facilitate cable-to-anode connections at the centre of the anode. This center cable-to-anode connection allows a uniform current distribution at the anode surface.

The surface of the anode in the hollow centre is lined with a layer of copper of optimum thickness and length to ensure a highly reliable current conduction between cable connector and anode.

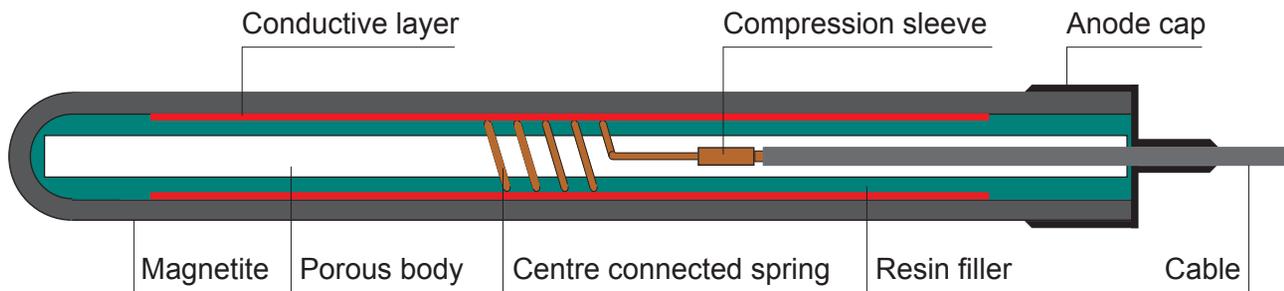
The hollow annular space is filled with a dielectric compound after the cable connection is made and the ends of the anode are sealed with anode caps to prevent ingress of foreign matter.

**Special features:**

- operates at high current densities with extremely low dissolution
- not susceptible to ripple in DC supply
- no limit on DC voltage output
- light weight and easy to install, removable for inspection and reinstallation
- centre cable-to-anode connection for uniform current distribution and consumption of anode surface

Specific gravity	4.7 - 4.8 kg / dm <sup>3</sup>
Brinell hardness	344 HB
Bending strength	5 kN / cm <sup>2</sup>
Density	4.71 g / cm <sup>3</sup>
Melting point	1500 °C
Consumption rate	0.02 kg/A year
Current density <sup>1)</sup>	0.7 A/dm <sup>2</sup>

1) depends on environment



**Highlights:**

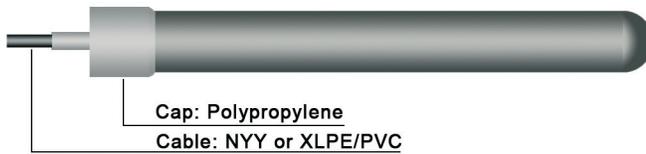
The magnetite anode performance has been tested for several years. Endusers, technical analysts and independent research laboratories have regularly confirmed its reliability as an anode.

**Quality and value additions:**

- independent series of examinations and selection of castings for the making of the anodes
- experienced-based selection of anode caps and lead materials according to enduser specifications and environmental conditions
- impregnable anode cap connections with corrosion resistant material and special welding process
- special electrical resistance and potential tests to confirm uniform current distribution without hot spots
- controlled sealing of anode hollow annular space with special dielectric compound
- a full range of accessories for easy installation, inspection and replacement according to enduser specified requirements and environmental conditions

**TYPE: MA-U**

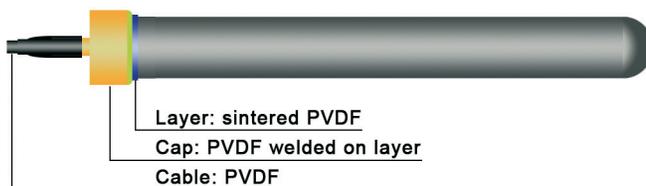
Surrounding electrolyte: neutral soil and water without chlorine and sulphate content  
 Applications: shallow groundbeds, deep groundbeds



Diameter	60 mm
Total length	720 mm
Effective length	670 mm
Total weight	6.0 kg
Minimum effective mass	4.7 kg
Surface area	13.4 dm <sup>2</sup>
Max. current load	3.0 A

**TYPE: MA-CS**

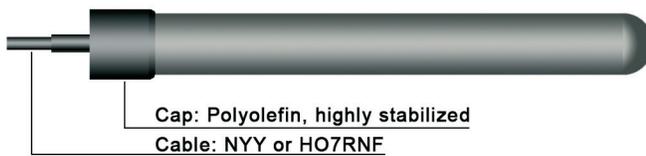
Surrounding electrolyte: chlorine and/or sulphate containing soil or stagnant water  
 Applications: shallow groundbeds, deep groundbeds



Diameter	60 mm
Total length	760 mm
Effective length	710 mm
Total weight	6.0 kg
Minimum effective mass	4.7 kg
Surface area	13.4 dm <sup>2</sup>
Max. current load	6.0 A

**TYPE: MA-SEA**

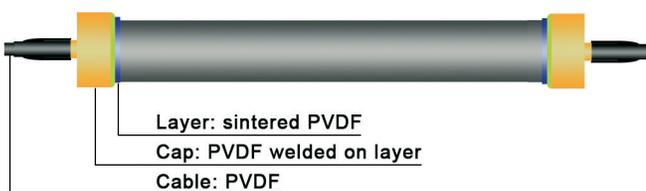
Surrounding electrolyte: flowing seawater or brackish water  
 Applications: platforms, jetties, harbours



Diameter	60 mm
Total length	760 mm
Effective length	710 mm
Total weight	6.0 kg
Minimum effective mass	4.7 kg
Surface area	13.4 dm <sup>2</sup>
Max. current load	16.0 A

**TYPE: MA-CHAIN-1**

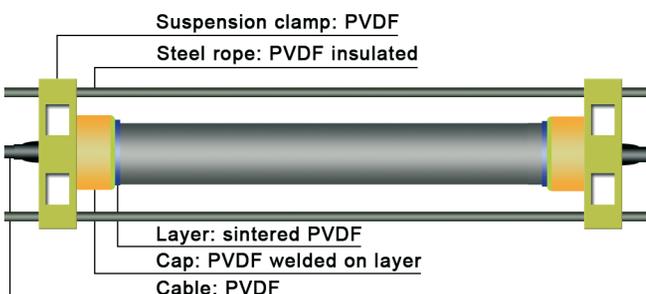
Surrounding electrolyte: chlorine containing soil or stagnant water  
 Applications: deep groundbeds open hole, deep groundbeds closed hole, water tanks



Diameter	60 mm
Total length	740 mm
Effective length	600 mm
Total weight	6.2 kg
Minimum effective mass	4.7 kg
Surface area	11.3 dm <sup>2</sup>
Max. current load (groundbeds)	6.0 A
Max. current load (tanks)	16.0 A

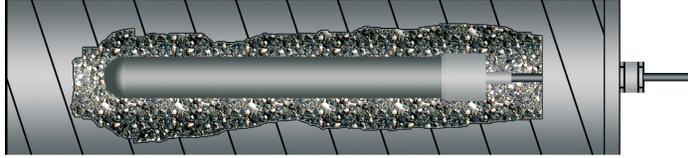
**TYPE: MA-CHAIN-2**

Surrounding electrolyte: chlorine containing soil or stagnant water  
 Applications: deep groundbeds open hole, deep groundbeds closed hole, water tanks



Diameter	60 mm
Total length	740 mm
Effective length	600 mm
Total weight	6.2 kg
Minimum effective mass	4.7 kg
Surface area	11.3 dm <sup>2</sup>
Max. current load (groundbeds)	6.0 A
Max. current load (tanks)	16.0 A

**CANISTER FOR TYPE: MA-U + TYPE: MA-CS**



**COKE BACKFILL**

Minimum carbon content	90	%
Maximum moisture content	5	%
Maximum resistivity	1	$\Omega\text{m}$
Density	700-950	$\text{kg/m}^3$
Maximum particle size (dia.)	20	mm

Standard canister	Diameter	Length	Total weight
CAN 10	160 mm	1000 mm	22 kg
CAN 15	300 mm	1500 mm	85 kg
CAN 20	300 mm	2000 mm	110 kg
CAN 21	160 mm	2100 mm	46 kg

**Type: MA-CHAIN-1**

**Maximum carrying load of fixing device up to 1.10 kN**

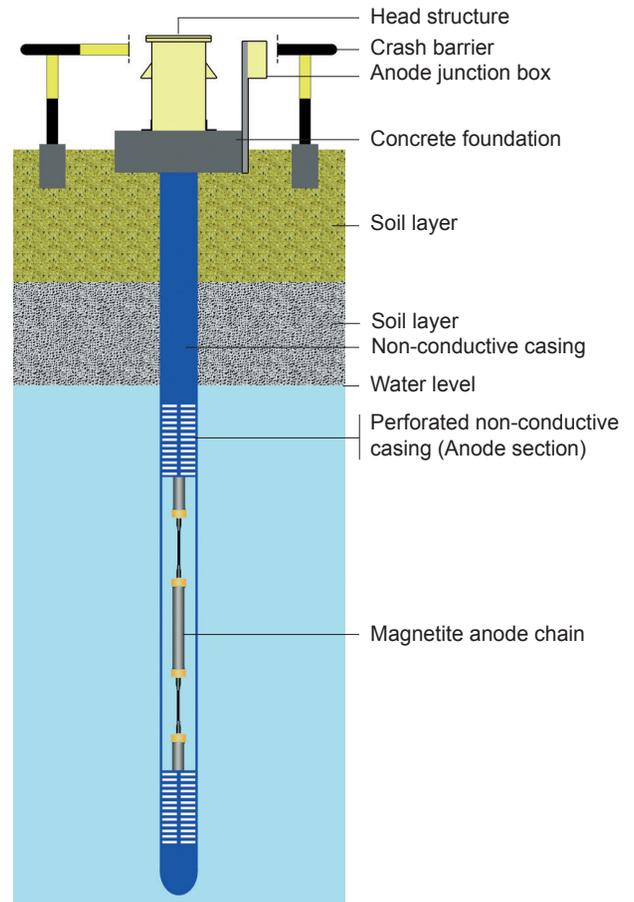
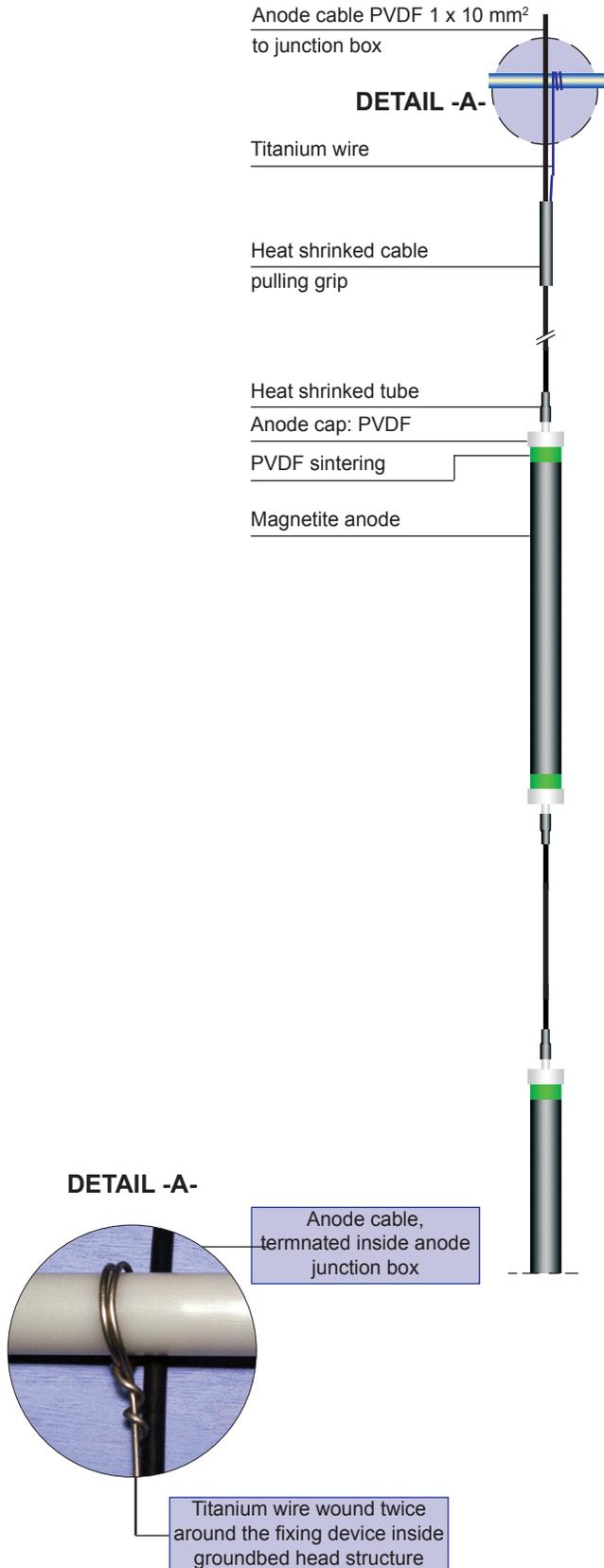
Special type magnetite anode chains that can be used for either open or closed hole deep well anode groundbeds.

As open hole anode groundbed they, can be used in conjunction with non-conductive slotted casing without backfill but they can also be used in close hole groundbeds with coke backfill material in case of unstable or non-existing static water level.

All parts of anodes, anode chains and suspension devices are made of material resistant against low pH values, high chloride content of water and high concentrations of chlorine gas.

Each anode is centre connected to the cable using a copper compression clamp and a bronze connection spring. The internal space is filled with a two component mixture of polyurethane and polyester.

Each anode chain has one individual lead cable connection and is suspended by one heat shrunk cable pulling grip, fixed to a titanium wire, ready for fixing on suspension device inside groundbed head structure.



**Type: MA-CHAIN-2**

**For carrying load of fixing device > 1.10 kN**

Special type magnetite anode chains that can be used for either open or closed hole deep well anode groundbeds.

As open hole anode groundbed, they can be used in conjunction with non-conductive slotted casing without backfill but they can also be used in close hole groundbeds with coke backfill material in case of unstable or non-existing static water level.

All parts of anodes, anode chains and suspension devices are made of material resistant against low pH values, high chloride content of water and high concentrations of chlorine gas.

Each anode is centre connected to the cable using a copper compression clamp and a bronze connection spring. The internal space is filled with a two component mixture of polyurethane and polyester.

Each anode chain has one individual lead cable connection ready for fixing on suspension device inside groundbed head structure.

