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TECHNICAL SPECIFICATION

Doc No: DSF-SPC-CPR-001

Rev. 1

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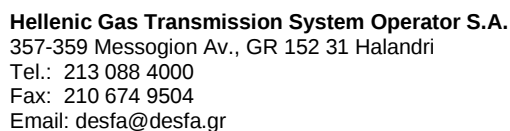
HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

CATHODIC PROTECTION ANODE MATERIAL

JUNE 2021

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1. SCOPE AND OBJECTIVES

This Specification covers the minimum requirements for the design, fabrication and supply of standard design magnetite impressed current anodes for installation in horizontal or vertical ground beds. This specification also covers anode material for sacrificial anodes.

2. REFERENCES

2.1 Reference Documents

2.2 Reference Codes and Standards

MIL-A-18001:	Anodes, sacrificial zinc alloy.
ELOT EN 10204:	Metallic products - Types of inspection documents.
ELOT EN 12438:	Magnesium and magnesium alloys - Magnesium alloys for cast anodes.
EN 12954:	General principles of cathodic protection of buried or immersed onshore metallic structures.
ISO 15589-1:	Petroleum, petrochemical and natural gas industries — Cathodic protection of pipeline systems — Part 1: On-land pipelines.

3. ACRONYMS

CP	Cathodic Protection.
EN	European Norms.
ELOT	Hellenic Organization for Standardization.

4. ANODE MATERIAL FOR "INSTALLATION WITH IMPRESSED CURRENT"

The Anodes to be used for the Impressed Current Cathodic Protection System shall be Magnetite Anodes or FeSi Anodes. All anodes shall be of the same cast when more than one anode is ordered. Minimum design life of the anodes shall be 30 years for the operating current.



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4.1 Anode Material

The anodes shall be in accordance with the following specifications:

Magnetite anodes:

Material : Magnetite Cast Anodes.
Overall length : Minimum 800 mm.
Effective length : Minimum 720 mm.
Diameter : Minimum 60 mm.
Gross weight : Minimum 6,0 kgs.
Magnetite weight : Minimum 4,7 kgs.
Consumption : Max. 20 g/A/yr.
Cables fitted : 5 meters of 1X10 mm² XLPE/PVC insulated copper cable.
Internal resistance : <0,05 Ohm.

High Silicon Iron (FeSi) Anodes:

Material : Silicon Iron Anodes.
Effective length : Minimum 1200 mm.
Diameter : Minimum 50 mm.
Gross weight : Minimum 18,6 kgs.
FeSi weight : Minimum 16 kgs.
Consumption : Max. 500 g/A/yr.
Cables fitted : 5 meters of 1X10 mm² XLPE/PVC insulated copper cable.
Internal resistance : <0,05 Ohm.

Silicon Iron Anodes shall have a Chromium content of 5% in accordance with ELOT EN 12438.

The surface of the anode material shall be free from sand and slag. The size of any non-metallic particles included in or adhering to the surface of the anode material shall not exceed 5 mm.



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4.2 Anode Feeder Cable Connection

Each anode shall be equipped with feeder cable connection. A flat piece of iron shall be cast in the anode head to permit low-resistance connection of the feeder cable by brazing. The voltage drop across the brazing joint shall not exceed 3 mV when tested at 10 A. To prevent damage to the anode head, each anode feeder cable connection shall be protected by a sturdy plastic pipe or heat shrinkable sleeve and sealed with epoxy resin. Where it emerges from the epoxy resin sleeve, each anode feeder cable shall be protected by a neoprene sheath to prevent bending.

4.3 Backfilling

Coke breeze (size 5) shall be used as backfill, in a quantity corresponding to min. 0,9m³ per anode for horizontal continuous coke beds.

Coke breeze backfill material shall be calcite petroleum coke meeting the following requirements:

a. Chemical Analysis

H₂O : 0,04%

Volatiles : 0,13%

Ash : 0,42%

Si : 0,034%

Fe : 1,51%

C fixed : 99,45%

b. Physical Data, Screen Analysis

Smaller than 0,1 mm : 14%

0,1 - 0,2 mm : 32%

0,2 - 0,4 mm : 37%

0,4 - 0,6 mm : 16%

Larger than 0,6 mm : 1%

bulk density approx. : 800 kg/m³

specific gravity : 1,98

resistivity : ≤10 ohm.cm



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4.4 Delivery

Anodes shall be delivered in polystyrene packaging in a secure case.

5. ANODE MATERIAL FOR "INSTALLATION WITH SACRIFICIAL ANODES"

When more than one sacrificial anode is used it shall be ensured that all anodes including backfill are of identical nature and made from one cast.

5.1 Anode Material

Magnesium or Zink Anodes according to the following specifications shall be used:

Magnesium Anodes:

Material : Magnesium Alloy Anodes.
Alloy : AZ63.
Purity of Alloy : In accordance with MIL-A-21412A.
Capacity : Min. per anode 400 mA for one year.
Weight : Min. 4 kg. Mg.
Cables fitted : 10 meters of 1X10 mm² XLPE/PVC insulated copper cable.
Packing : Each anode shall be supplied in a cotton bag containing a backfill.
Backfill composition : 75% Powdered Gypsum.
20% Granular Bentonite.
5% Sodium Suphate.

Shipping : Anodes shall be transported in an airtight PVC sack in a solid transport box.

Total packaged weight : Min. 9 kg.

Zink Anodes:

Material : Zink Ribbon Anodes.
Purity of Alloy : In accordance with MIL-18-001-H.



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Weight : Min. 0,8 kg. zink/meter.
Cables fitted : 5 meters of 1X10 mm² XLPE/PVC insulated copper cable.
Shipping : Anodes shall be transported in a solid transport box.

All anodes shall be of the same cast when more than one anode is installed.

5.2 Delivery

The individual anodes shall be packed in a strong PVC sack, in a secure case.

6. ALTERNATIVE ANODES

If other type of anodes than the above mentioned are used they shall be specified in detail and they shall be approved by the Owner Representative before placed in the project.

The minimum life time of the anodes shall be 30 years by operating current.

7. MATERIAL TESTS

The Manufacturer / Vendor shall perform material tests of the anodes in accordance with EL0T EN 10204, type 2.2.

Type test certificates of the anodes such as:

- chemical analysis.
- measurement of material loss rate etc.

shall be available with the anodes.

The Manufacturer / Vendor shall provide factory tests certificates, such as, measurement of brazing joint resistance, etc.