



Hellenic Gas Transmission System Operator S.A.
357-359 Messogion Av., GR 152 31 Halandri
Tel.: 213 088 4000
Fax: 210 674 9504
Email: desfa@desfa.gr

TECHNICAL SPECIFICATION

Doc No: DSF-SPC-CPR-003

Rev. 1

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HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

CATHODIC PROTECTION POLARIZATION PROBE, REFERENCE ELECTRODE AND ER COUPON

JUNE 2021

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1	Second Issue	30-06-2021	PP	KM	TPI
0	First Issue	05-04-2011	PQ DPT.		V.G.
REV	DESCRIPTION	DATE	PRPD	CHKD	APVD



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1. COPE AND OBJECTIVES

This Specification covers the minimum requirements for the supply of the Long-Life Reference Electrodes, which shall be installed at the Transformer Rectifiers at the Anode Beds for measurements of the Cathodic protection potential, the supply of the Polarization Probes and the supply of the Electrical Resistance (ER) Coupons, which shall be installed at suspicious for AC corrosion areas.

2. REFERENCES

2.1 Reference Documents

2.2 Reference Codes and Standards

- 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.
ER	Electrical Resistance
T/R	Transformer Rectifier.

4. POLARIZATION PROBE

The polarization probe shall be with a 10 cm² bare steel plate, a 100 Ohm shunt resistance and a built-in reference electrode.

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In the case of AC corrosion monitoring, electrical resistance ER probes shall be installed with a 10 cm² bare steel plate.

The polarization probe and/or ER probe shall be delivered with a calibration and quality assurance certificate, in accordance with Section 8.

The polarization probe and/or ER probe shall also be delivered with cable at least 10 m long, type J1VV-U (NYY-O) 4 x 2,5 mm² or of similar size.

The polarization probe and/or ER probe shall be checked by Supervision before installation.

The Contractor shall provide to Client Representative the Manufacturer's Installation Instructions for the supplied Polarization Probes in order Client Representative to supervise the proper installation of the relevant Probes.

5. STATIONARY REFERENCE ELECTRODE

Copper/copper sulphate (Cu/CuSO₄) electrodes, should be used in low chloride soils (<500ppm) while silver/silver chloride (Ag/AgCl) electrodes are recommended for high chloride content (>500ppm) environments.

Each reference electrode shall be connected with 10 m cable type J1VV-U (NYY-O) 2 x 2,5 mm² or of similar size.

The Long-Life reference electrodes shall have a minimum lifetime of 30 years. The design lifetime of the electrode shall be extended at least by the specific nature and design of the membrane separating electrode element's electrolyte and soil environment as well as the electrolyte path length defined as the distance between the electrode's element and the membrane.

The reference electrode shall be engineered specifically for its intended use.

Within the specified lifetime the electrode potential must not change more than 30 mV.

The reference electrode must be effectively non-polarizing.

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The reference electrode shall be located in a proprietary (appropriate special Manufacturer's) backfill mix to retain moisture and minimize migration of contaminants from the surrounding soil. The measuring cable corresponding to the reference electrode shall be connected in accordance with the relevant wiring diagrams. It shall be never directly connected to the pipeline or other metal structure.

The stability of the reference electrode must be in the order $\pm 5\text{mV}$. Its current drain must be $3\mu\text{A}$ for 1min. and $0.01\mu\text{A}$ continuous.

The electrode shall be delivered with installation instructions and shall be approved by the Owner's Representative.

6. ER COUPONS

The Coupons shall be Electrical Resistance (ER) rod type. The Coupon shall be designed as Electrical Resistance probe with a shielded reference element and an exposed coupon element simulating a coating defect. The material of the coupon element shall be of steel.

The Coupons shall be with a 10 cm^2 bare steel plate surface, rod type and thickness $1000\mu\text{m}$.

The standard manufacturer's lead cable with 10m length of J1VV-U $2 \times 2.5\text{ mm}^2$.

PVC housing having size according to manufacturer's std.

The Contractor shall provide to Client Representative the Manufacturer's Installation Instructions for the supplied ER Coupons in order Client Representative to supervise the proper installation of the relevant Coupons.

Measurements:

- AC Voltage.
- AC Current.
- Potential ON, Eon.
- Potential OFF, Eoff.
- DC Current.
- Corrosion.

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Corrosion Rate will be remote monitored by MiniTrans remote monitoring System via GSM. In case the GSM net is not available at the installation place of the Corrosion Rate element (ER Coupon), the signal shall be transmitted via single mode fibre optic. Thus ER Coupon shall be provided either with Wireless GSM Modem device either with IP Gateway device, depending whether there is available GSM net or not.

The Transducer device shall be installed inside the measuring post.

The ER Coupon shall be power supplied by local installed batteries. The batteries shall be sized in order the ER Coupon to operate for at least two years, without the batteries to be recharged. Batteries are under ER Coupon Vendor scope of supply.

7. INSTRUCTION FOR SUPERVISION OF POLARIZATION PROBE

This instruction defines the extent of test and inspection to be performed for the Cathodic Protection Systems Polarization Probes.

7.1 Scope of Work

7.1.1 General

The Inspector shall check each polarization probe according to the following test procedure, and calibrate the built-in calomel electrode with a standard laboratory reference electrode.

The Inspector shall label each polarization probe with the respective change in which it is to be placed.

The Inspector shall check the steel plate surface area for accordance with Section 5.

If one of the acceptance criteria given in the following cannot be fulfilled the polarization probe shall be rejected.

Upon possible redress of faults, the Inspector shall repeat the check and calibration procedure.



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In case of ER probes the Inspector shall check each polarization probe according to the Manufacturer's testing procedures.

7.1.2 Cable Testing

Cable connection testing to the reference electrode:

The blue and brown cable conductors shall be connected with the terminals on an ohmmeter.

- The resistance recorded shall be less than 1 ohm.

Cable connection testing to the steel plate:

Both the black conductors shall be connected to the terminals.

- The resistance recorded shall be less than 1 ohm.

Testing of the connection with the steel plate:

One of the black conductors which are connected to the terminals on the measuring instrument shall be disconnected. The free terminal shall now be connected directly with the polarization probe's steel surface.

- The resistance recorded shall be less than 1 ohm.

7.1.3 Insulating Testing


Testing of insulation between diaphragm and steel plate:

- The brown cable conductor shall be connected with the negative (-) terminal on a DC-voltmeter; one of the black cable conductors shall be connected with the positive (+) terminal.
- A voltage not more negative than -5 mV is allowed, corresponding to more than 100 Mohm for the insulating circle between diaphragm and steel surface. The insulating circle shall be in an absolutely dry and clean state.

7.1.4 Counter Test

The diaphragm and the steel surface shall be simultaneously contacted with a moisturized finger.

- A voltage of about -100 to -800 mV shall be found.

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7.1.5 Built-In Reference Electrode Testing

Built-in reference electrode testing shall be executed according to Manufacturer's testing instructions.

7.2 Results

The measured results shall be recorded on the form "Check and Calibration of Polarization Probes". A copy of this form is shown on Figure 1 and an instruction for the filling-in is given in the subsequent clause.

7.3 Instruction for Compiling of Check and Calibration of Polarization Probes Report

Reference is made to the numbering on Figure 1.

Re. (1):

The polarization probe shall be labeled and identified by the chainage in which it shall be placed.

Re. (2):

The specified test results, in para 8.1.2, 8.1.3, and 8.1.4, shall be stated.

Voltages shall be entered with polarity.

Re. (3):

If test results meet requirements, in para 8.1.2, 8.1.3, and 8.1.4, a "Yes" shall be entered.

Correspondingly "No" shall be entered if test results do not meet the above requirements.

Re. (4):

Receiver of document shall be marked with an "X" in the relevant square.

Receivers not preprinted shall be added on the form.



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CHECK AND CALIBRATION OF POLARIZATION PROBES

Main Project

Contract

Contract No.

Contractor

Report No.

CHAINAGE						
DATE						
CABLE TEST	TO CALOMEL ELECTRODE (Ω)					
	TO STEEL PLATE					
CABLE CONNECTION WITH STEEL PLATE (Ω)						
INSULATION TEST	INSULATING CIRCLE (mV)					
	COUNTER TEST (mV)					
REFERENCE ELECTRODE TEST (mV)						
DIAPHRAGM TEST (mV)						
DEVIATION						
REFERENCE ELECTRODE CALIBRATION (mV)						
APPROVAL YES/NO						

Remarks :



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INSPECTOR :

SUPERVISOR :

DATE :

DATE :

Distribution: Contractor Supervisor Superintd

File No.

Figure 1