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## TECHNICAL SPECIFICATION

**Doc No: DSF-SPC-ELE-017**

**Rev. 1**

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### HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

# PERMANENT ELECTRICAL EARTHING

**JUNE 2021**

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## REVISION HISTORICAL SHEET

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## 1 INTRODUCTION

## 2 SCOPE AND OBJECTIVES

This Specification covers the minimum requirements for the design, supply and installation for the permanent electrical earthing's system along the transmission line in connection with measuring posts and permanent electrical earthing system stations (vent stack, pits, fencing, steel structures etc.).

## 3 REFERENCES

### 3.1 Reference Documents

### 3.2 Reference Codes and Standards

2014/34/EU	Equipment Explosive Atmospheres Directive
2014/35/EU	Low Voltage Directive
2014/30/EU	Electromagnetic Compatibility Directive
MINISTERIAL DECISION	
50/12081/642/2006 F A –	
GG B / 1222/5.9.2006	Security Home Electrical Installations (E.I.E.). Introduction of a Differential Current Installation of Construction and Fundamental Grounding
ELOT EN 1594 E3	Gas Supply Systems. Pipelines for Maximum Operating Pressure over 16 bar. Functional Requirements
ELOT EN 14161+A1	Petroleum and Natural Gas Industries. Pipeline Transportation Systems
BS EN 62561-1:2017	Lightning protection system components (LPSC). Requirements for connection components
BS EN 62561-2:2012	Lightning Protection System Components (LPSC). Requirements for conductors and earth electrodes



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BS EN 62561-3:2017	Lightning protection system components (LPSC). Requirements for isolating spark gaps (ISG)
BS EN 62561-4:2017	Lightning protection system components (LPSC). Requirements for conductor fasteners
BS EN 62561-5:2017	Lightning protection system components (LPSC). Requirements for earth electrode inspection housings and earth electrode seals
BS EN IEC 62561-6:2018	Lightning protection system components (LPSC). Requirements for lightning strike counters (LSC)
BS EN IEC 62561-7:2018	Lightning protection system components (LPSC). Requirements for earthing enhancing compounds
ELOT EN IEC 60079-0 E5	Electrical Apparatus for Explosive Gas Atmospheres - Part 0: General Requirements
ELOT EN 60079-7 E3	Electrical Apparatus for Explosive Gas Atmospheres - Part 7: Increased safety e
ELOT EN 60079-10-1 E2	Electrical Apparatus for Explosive Gas Atmospheres – Part 10: Classification of Hazardous Areas
ELOT EN 60099-4 E3	Surge Arresters - Metal Oxide Surge Arresters without Gaps for A.C. Systems
ELOT EN IEC 60099-5 E3	Surge Arresters - Selection & Application Recommendations
ELOT EN 62305-1 E2	Protection against Lightning, Part 1: General Principles
ELOT EN 62305-2 E2	Protection against Lightning, Part 2: Risk Management
ELOT EN 62305-3 E3	Protection against Lightning, Physical Damage to Structures and Life Hazard
ELOT EN 62305-4 E4	Protection against Lightning, Part 4: Electrical and Electronic Systems within Structures
ELOT EN ISO 9001 E4	Quality Management Systems
ELOT EN ISO/IEC 17025 E3	General Requirements for the Competence of Testing and Calibration Laboratories
ELOT HD 384	Requirements for Electrical Installations



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ELOT HD 60364	Electrical Installations of Buildings
EN 61000	Electromagnetic compatibility (EMC)
EN 61643-11	Low Voltage Surge Protective Devices – Part 11: SPDs Connected to Low Voltage Power Distribution Systems – Performance Requirements and Testing Methods
EN 61643-21	Low Voltage Surge Protective Devices – Part 22: SPDs Connected to Telecommunication and Signaling Networks – Performance Requirements and Testing Methods
IEC 60664	Insulation Coordination for Equipment within Low-Voltage Systems
IEC 61643-12	Low Voltage Surge Protective Devices – Part 12: SPDs Connected to Low Voltage Power Distribution Systems – Selection and Application Principles
IEC 61643-22	Low Voltage Surge Protective Devices – Part 22: SPDs Connected to Telecommunication and Signaling Networks – Selection and Application Principles
IEC 62548	Design Requirements for Photovoltaic (PV) Arrays
IEC 62561-1	Lightning Protection Components (LPC), Part 1: Requirements for Connection Components
IEC 62561-2	Lightning Protection Components (LPC), Part 2: Requirements for Conductors and Earth Electrodes
IEC 62561-3	Lightning Protection Components (LPC), Part 3: Requirements for Isolating Spark Gaps
IEC 62561-4	Lightning Protection Components (LPC), Part 4: Requirements for Conductor Fasteners
IEC 62561-5	Lightning Protection Components (LPC), Part 5: Requirements for Earth Electrode Inspection Housings and Earth Electrode Seals
IEC 62561-6	Lightning Protection Components (LPC), Part 6: Requirements for Lightning Strike Counters



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IEC 62561-7	Lightning Protection Components (LPC), Part 7: Requirements for Earthing Enhancing Compounds
ELOT EN 60071-1	Insulation Coordination – Definitions, Principles & Rules
ELOT EN 60071-2	Insulation Coordination – Application Guide
EN 60664-1	Insulation Coordination for equipment within Low Voltage Systems
IEC 61643-11	Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power distribution systems - Requirements and tests

## 4 ACRONYMS

AC	Alternating Current
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ATEX	ATmosphères EXplosibles (Explosive Atmospheres)
ATS	Automatic Transfer System
BMS	Building Management System
BVS	Block Valve Station
BCC	Back-up Control Centre at Nea Messimvria
CCTV	Closed Circuit Television System
CPR	Construction Products Regulation
CP	Cathodic Protection
CPU	Central Processor Unit
CS	Compressor Station
DB	Distribution Board
DC	Direct current
DCS	Distributed Control System
DEG	Detailed Engineering
DIN	Deutsches Institut für Normung (German Institute of Standardization)
DVA	Digital Voice Announcer



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DVD	Digital Video Disc
EDG	Emergency Diesel Generator
ELOT	Hellenic Organization for Standardization
ELV	Extra Low Voltage (nominal voltage not exceeding 50 V AC or 120 V DC (ripple-free) between conductors or to earth, as defined by the Standard EN 61558)
EN	European Norms
EPC	Engineering, Procurement and Construction
EU	European Union
ESD	Emergency Shut Down
F&G	Fire and Gas
FACP	Fire Alarm Central Control Panel
FARP	Fire Alarm Repeater Control Panel
FAT	Factory Acceptance Test
FEG	Field Engineering
FC	Floe Computer
FOC	Fibre Optic Cable
GCC	Gas Control Centre at Patima
HEDNO	Hellenic Electricity Distribution Network Operator
HDPE	High Density Polyethylene
HMI	Human Machine Interface
HVAC	Heating Ventilation Air Conditioning
I/O	Input / Output
IEC	International Electrotechnical Commission
ISO	International Organization for Standarization
ITU	International Telecommunication Union
LAN	Local Area Network
LCS	Local Control System
LED	Light Emitting Diode
LFEP	Local Fire Detection & Fire Extinguishing Panel
LV	Low Voltage





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LSP	Load Share Panel
MSC/MCS/SMC	Main Station Controller
MV	Medium Voltage
MPS	Master Project Schedule
MPR	Monthly Progress Report
NFPA	National Fire Protection Association
NNGTS	National Natural Gas Transmission System
NTSC	National Television System Committee
O&M	Operation and Maintenance
PID	Piping and Instrumentation Diagram
PA/GA	Public Address / General Alarm
PCS	Process Control System
PED	Pressure Equipment Directive
PEP	Project Execution Plan
PFD	Process Flow Diagram
PLC	Programmable Logic Controller
PMS	Power Management System
POC	Project Organization Chart
PAL	Phase Alternate Line
PPC	Public Power Corporation
PTZ	Pan, Tilt, Zoom
PVC	Poly Vinyl Chloride
QA	Quality Assurance
RCC	Remote Communications and Controls
RFI	Radio Frequency Interference
RTD	Resistance Temperature Detectors
RTU	Remote terminal Unit
S/S	Scraper Station
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition (including Telemetry)
SCS	Station Control System



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SFP	Small Form-factor Pluggable
SPD	Surge Protection Device
SPL	Sound Pressure Level
UDP	User Datagram Protocol
UPS	Uninterruptible Power Supply
UV	Ultraviolet
VGA	Video Graphics Array
VMS	Video Management Software

## 5 EARTHING ALONG TRANSMISSION LINE DUE TO PROXIMITY EFFECTS

Contractor shall install the earthing system along the transmission line and supply all necessary bulk materials.


The earthing along the transmission line in connection with measuring posts shall be horizontal, continuous hot dip galvanized steel stay wire, connected as shown in standard drawings.

### 5.1 Earthing Electrode Material

The horizontal earthing shall be established with electrodes in accordance with the following material specification:

- Continuous hot dip galvanized steel stay wire.
- External diameter minimum 12 mm.
- 70 µm layer of zinc corresponding to 500 g/m<sup>2</sup>.

The electrode material shall be approved by the Owner's Representative prior to installation. Further material details are shown in relevant Material Requisition.

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## 5.2 Construction of Horizontal Earthing

Contractor shall construct horizontal earthing running parallel to pipeline, with leakage resistances to remote earth as indicated on the relevant drawings with the following tolerance on the resistance value:

+ 10%, -20%.

All parts of the horizontal earthing shall be minimum 0.2m from secondary metallic constructions (pipeline).

Location of the earthing shall be approved by the Owner's Representative.

The earthing shall be established by laying horizontally and parallel to pipe line with the necessary length of wire into the ground.

Cable connection to earthing electrode shall be performed by "C" type compression connector, and the join shall be placed inside cast resin type splicing kit (type 3M 92-A1 or similar), in accordance with standard drawings.

All necessary precautions shall be taken in order to avoid electrolytic corrosion between different types of metal.

The construction shall be carried out by personnel skilled and experienced in the establishing of electrical earthing.


Important Note:

The values of soil resistivity and length of earth wire are approximately.

The exact values of soil resistivity at the individual earthing electrode points shall be measured by Contractor in accordance with IEC 61936 and prEN 50522.

The actual length of earth wire and the earthing leakage resistance to remote earth is Contractor's responsibility.

The maximum earth wire length shall be 110m in the case of a one-side connection to the pipe line and 220m in the case of a centre-connection to the pipeline. In case that a longer (than 220m) earth wire is necessary due to increased value of soil resistivity, an appropriate backfilling material (clay) shall be used to decrease the soil resistivity, in order the required earth wire length to be up to 220m.

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## 6 PERMANENT ELECTRICAL EARTHING AT PIPELINE STATIONS

Contractor shall install horizontal earthing system at vent stack (where insulating coupling exists only), and vertical earthing system at pits, fences and other steel structures as shown in standard drawings.

### 6.1 Horizontal Earthing at Vent Stacks

Contractor shall install horizontal earthing system at vent stacks only where insulating coupling exists, in accordance with Standard Drawings.

- Electrode, as per para 2.1 above, length 5m.
- NYY-J cable.
- Various bulk materials as shown on Std Drawing No. STD-4-73-01 para 2.4.

All materials shall be approved by the Supervision and/or Owner's Representative prior to installation.

The location of the earthing shall be approved by the Owner's Representative.

Cable connection to earthing electrode shall be performed by "C" type compression connector and the join shall be placed inside cast resin type splicing kit (type 3M 92-A1 or similar).

All necessary precautions shall be taken in order to avoid electrolytic corrosion between different types of metal.

### 6.2 Vertical Earthing

Contractor shall install vertical earthing system at pits, fences and other structures.

The vertical earthing shall be established with electrode and NYY cable with the following material specifications:

- Steel core copper glad ground rod 2 x 1.5 m, diameter 3/4".
- NYY-j cable.
- Various bulk materials as shown in standard drawings.

The materials shall be approved by the Owner's Representative prior to installation. Cable connection to earthing electrode shall be performed by suitable connector.

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All necessary precautions shall be taken in order to avoid electrolytic corrosion between different types of metal.

## 7 CONTRACTOR'S DOCUMENTATION

During the installation of the earthing Contractor shall record the earthing leakage resistance to remote earth with suitable intervals.

Contractor shall prepare as-built drawings showing locations of earthing, pipeline, measuring post with chainage, and cable connections.

The leakage resistance record and the as-built drawing shall be presented to the Owner's Representative for approval.