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## TECHNICAL SPECIFICATION

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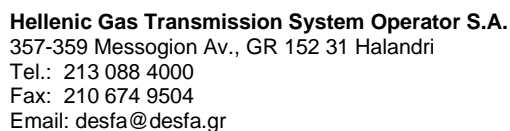
### HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

# ELECTRICAL ENGINEERING DOCUMENTS

**JUNE 2021**

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## 1 INTRODUCTION

## 2 SCOPE AND OBJECTIVES

This Specification outlines data and information to be included in the engineering documentation produced by Contractors and Vendors/Manufacturers.

Extent of data, information and documentation to be prepared, will be mutually agreed among the parties for each specific project.

## 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	Floer 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 Standardization
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 GENERAL

All information shall be expressed or shown using terms, definitions, letter symbols and graphical symbols as standardized by ELOT EN 60027 and IEC 60050.

A summary of terms and symbols is given in this specification.

## 6 CLASSIFICATION OF HAZARDOUS LOCATIONS


It shall be represented by drawings showing on the plot plan the plan view and, where required, the elevation of the extension of hazardous areas for each class and division (zone) of hazardous locations.

The same drawings shall show one of the following information:

- a. The individual sources of hazard giving the different area classifications and the zone contour.
- b. The envelope of the area where the sources of hazard giving the same area classification is supposed to be located.

Special care shall be taken in indicating the opening (building doors and windows or openings in general). If special provisions are taken to permit a certain classification by means of walls, barriers, ventilation, exhaust ducts etc., they shall also be shown on the drawings.

## 7 ONE LINE DIAGRAMS FOR D.C. AND AC. POWER CIRCUITS

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The diagrams shall include the following information: Major equipment ratings indicated below:

- a. Generators: voltage: power output - power factor - sub transient and transient impedance in per unit - frequency - efficiency.
- b. Power Transformers: power - ratio - voltages - vector group - hour number – taps impedance in per unit - neutral connection (isolated or earthed).
- c. Circuit Breakers: Rated current-interrupting current and half wave current-making capacity (peak value).
- d. Busses: Rated current-half wave current-short time thermal current (1s) - phase rotation-reference hour number L1, L2, L3 phases. Neutral - earth.
- e. Arresters: Rated voltage.
- f. Neutral Earthing Devices: Current limit and time.
- g. Cables: Rated current, cross section area type, and number of conductors.

Quantity, ratios and connections of current and potential transformers, vector group and phase rotation and hour number, where necessary.

Relays code number and quantity of elements.

Dotted lines to associate the major protective relays to the primary circuit devices, which they operate, using arrows at the devices concerned. (This last information may be shown on separate drawings).

Symmetrical (half cycle and interrupting) short circuit levels on which design is based.

Identification and rated power of individual loads connected to each switchgear, motor control center, turnaround power center, local sub-panel etc.

Expected power demand on each bus (maximum and normal operating).

Main breakers shall be specified if draw-out type or fixed type, type of interrupting method (air, oil, vacuum etc.).

## 8 ONE LINE DIAGRAM FOR INSTRUMENT POWER SUPPLIES

It shall be based on the instrumentation load computation and related busses voltage and maximum loads (active and apparent power in the A.C. circuits).

The one-line diagram shall include the following information:

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- Major equipment rating indicated below:
- Battery Charger: voltage-power output.
- Batteries: voltage-capacity.
- Inverters: voltage-power output, power factor.
- D.C. Stabilizer: voltage-power output, percent stabilization.
- A.C. Stabilizer: voltage-power output, percent stabilizing power factor.
- Relays and Devices: code, number-quantity.
- On Load Switches: rated current-symmetrical short circuit current, making current (peak value).
- Meters: Volt meters-ammeters, watt meters, varmeters, frequency meters (quantity-scale).
- Fuses: Rated current-quantity.
- Dotted lines shall be used to associate protective relays with related operated equipment.
- Symmetrical short circuit voltage on which design is based shall be shown on each bus.
- Quantity of conductors on each bus or line.


## 9 EQUIPMENT SPECIFICATIONS AND MATERIAL REQUISITIONS

Manufacturer/Vendor shall prepare for each type of equipment the relevant material requisition, with all information regarding item identification, required changes-reference documents and, standards ratings and technical characteristics. Manufacturer/Vendor's documents reference, supply system, site conditions, terminals and connection cables characteristics, special requirements.

The Material Requisition and Manufacturer / Vendor's documents (drawing, calculations, certificates etc.) must be approved by the Owner before placing Purchase Order for the equipment.

Specifications attached to Material Requisition shall give design criteria for the above-mentioned equipment according to the Job Specification issued for the Contract.

## 10 SCHEMATIC DIAGRAMS

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Schematic diagrams and the related connection and interconnecting diagrams shall be supplied to serve construction purposes, trouble shooting and maintenance requirements.

Manufacturer/Vendor's drawings shall be used to the maximum practicable extent.

## 11 CONNECTION AND INTERCONNECTING DIAGRAMS

Interconnecting diagrams shall show the devices identification, terminal strip reference, terminal numbers and designation that appear on the schematic diagrams.

Similar procedures must be followed by Manufacturer/Vendors for what concerns internal connection inside the equipment and panels.

Internal wiring shall be numbered and ferrule only when specifically required by Owner.

## 12 LOAD DATA LIST AND LOAD COMPUTATION

Tabulation shall be prepared containing at least the following information:

- Item reference.
- Service.
- Nameplate rating (kW or KVA).
- Design load.
- Normal operating load active.
- Normal operating load reactive or apparent (only if essential for design purposes).
- Maximum demand load.
- Usage factor.

For each bus the following information shall be listed (in a separate tabulation):

- Average 24 h load (active)
- Average 24 h load (apparent)
- Maximum 1 h load kW (active)
- Maximum 1 h load KVA (apparent)
- Average 24 h power factor.

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### 13 SHORT CIRCUIT CALCULATION

Manufacturer/Vendor shall prepare computations sheets and impedance diagrams, before starting any action related to Material Requisition releasing for electrical machinery and main equipment.

### 14 VOLTAGE PROFILE CALCULATION

Manufacturer/Vendor shall prepare the load flow study with the calculation of voltage drops on each bus and user or group of users.

### 15 CABLE SCHEDULE

A cable schedule shall be prepared for each cable with at least the following information:

- Item reference (identification).
- User data including starting time of motors (if higher than 5s), short circuit clearing time, voltage drop (normal and starting), rated voltage.
- Cable length.
- Type of cable.
- Cross sectional area.
- Maximum conductor temperature (normal and short circuit).

The item reference shall include in synthetic alphanumeric notation the following information:

- User identification and type of power user, such as lighting, control, communication, voltage level or category (ELV, LV, MV, HV).

### 16 TABULAR FORMS FOR RELAY DATA

For each bus or group of busses (substation or panel) a table shall be prepared showing for all relays the following information:



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- Panel of bus item number.
- Relay symbol.
- Service.
- CT or PT ratio.
- Setting range of time.
- Setting range of current or voltage.
- Diagram of time versus current (or versus other quantity).

## **17 RELAY CO-ORDINATION STUDY**

It shall be prepared the impedance diagram for each section of the electrical plant to which the relays are related showing the protective devices and the relays. The profile of any relay shall be plotted on a logarithmic scale diagram in order to show, for the various ranges of short circuit current, the selectivity and steps of time regarding that particular part of circuit.

## **18 UNDERGROUND CABLE LAYOUTS**

The underground drawing to be used shall be the most up to date which is available (UG drawings shall be in general common with other UG utilities like water, sewers, civil etc.)

The following information shall be shown:

- Direct buried cables.
- Underground cables lay in conduit or ducts banks (e.g. road crossing).
- Underground cables changing in direction (up or down).
- Underground cable leaving the ground.

For cables in conduit, it shall be shown conduit size, and user cable, identification:

- Typical sections for underground cables crossing roads in duct banks.
- Typical sections for concrete holes dimensions and ducts distances etc.

Typical details for cables leaving the ground and connection to final electrical equipment.



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## 19 ABOVEGROUND CABLE LAYOUT

For aboveground cables (AG) the drawings (plot plans and elevation drawings) shall show the following information:

- Cable trays type, location and dimensions.
- Cables in conduit or conduits banks, giving conduit type and size in inches.
- Details according to contractor's standards.

For the cables it shall be still valid the data required in para 15:

- Earth and protection conductors, earthing bus bars related to AC cable installation.

## 20 LIGHTING LAYOUTS AND WIRING DIAGRAMS


Layout plans shall include the following information:

- Lighting intensity assigned to each area.
- Type of lighting source e.g. incandescent, fluorescent, mercury vapor etc.
- Special purpose lighting fixtures.
- Lighting receptacles.
- Lighting panels.
- Quantity, location and type of lighting fixtures.
- Type of installation.
- Any information about feeding cables and protections.
- Reference cable of circuits to be associated to the panel outlets.
- Local switches inside buildings.

## 21 SUBSTATION LAYOUTS

Substation layouts shall include main electrical equipment, interconnecting means with special care for bus ducts, duct bank, trenches and building auxiliary equipment like exhaust fans, louvers, grounding pits, service entrances and battery limits.

Expansion direction foreseen for substation bulging and position assigned to future equipment shall be shown.

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## 22 COMMUNICATION LAYOUTS AND WIRING DIAGRAMS

Layout plant shall include the following information: type of communication equipment:

- Quantity, location and type of the communication sets.
- Type of installation.
- Any information about interconnection cables.
- Main frames distribution and terminal boxes.

## 23 FIRE ALARM LAYOUTS AND WIRING DIAGRAMS

Layout plant shall include the following information:


- Type of fire alarm push button stations, detectors, etc.
- Quantity, location and type of the push button station and/or detectors.
- Type of installation.
- Any information about interconnection cable(s).
- Main distribution box, distribution and terminal boxes.

## 24 EARTHING DRAWINGS AND CALCULATION OF EARTHING SYSTEM

Manufacturer/Vendor shall elaborate all computation of ground fault current and related clearing time.

The earthing system drawings shall give the following information:

- Type of earthing connection including section, material, bare or insulated conductors, and bars.
- Earthing pits.
- Identification of earthed equipment using different symbols for L.V. motors, M.V. motors, power panels, lighting panels, welding receptacles etc.

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Earth fault protective relays and relay co-ordination shall be shown on general relay system co-ordination documents described in this specification

## 25 LIST OF BULK MATERIAL (LIST OF MATERIAL REQUISITIONS)

Only if special requirements are needed for safety reasons as for installation in hazardous areas or for environmental protection purposes the material requisition of bulk material shall be considered as an engineering contractor responsibility.

## 26 OPERATING MANUAL

The preparation of an Operating Manual is not required where the electrical system is simple and no particular difficulties on operation are envisaged being available by Manufacturers / Vendors proper documentation.

Such document is mandatory in all cases in which the extent of the network, interconnection of various systems, in plant generation, connection with the Public Utility consist a "complex system".

The Operating Manual shall include of least the following:

- Description of the normal operation of the system.
- Description of the operation of the system in the various considered contingencies.
- Simplified block diagrams of sequences of automatic and/or manual operation.

## 27 MEASURING UNITS

Measuring units and letter symbols as per ELOT EN 60027.

International system of units SI.



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