طرح نگهداشت و افزایش تولید 27 مخزن

SPECIFICATION FOR EARTHING & LIGHTNING SYSTEM

نگهداشت و افزایش تولید میدان نفتی بینک

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Status:

IDC: Inter-Discipline Check
IFC: Issued For Comment
IFA: Issued For Approval
AFD: Approved For Design
AFC: Approved For Construction
AFP: Approved For Purchase
AFQ: Approved For Quotation
IFI: Issued For Information
AB-R: As-Built for Company Review
AB-A: As-Built –Approved

REVISION RECORD SHEET

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1.0 INTRODUCTION

Binak oilfield in Bushehr province is a part of the southern oilfields of Iran, is located 20 km northwest of Genaveh city.

With the aim of increasing production of oil from Binak oilfield, an EPC/EPD Project has been defined by NIOC/NISOC and awarded to Petro Iran Development Company (PEDCO). Also PEDCO (as General Contractor) has assigned the EPC-packages of the Project to "Hirgan Energy - Design and Inspection" JV.

GENERAL DEFINITION

The following terms shall be used in this document.

D02

CLIENT:	National Iranian South Oilfields Company (NISOC)
PROJECT:	Binak Oilfield Development – General Facilities
EPD/EPC CONTRACTOR (GC):	Petro Iran Development Company (PEDCO)
EPC CONTRACTOR:	Joint Venture of : Hirgan Energy – Design & Inspection(D&I) Companies
VENDOR:	The firm or person who will fabricate the equipment or material.
EXECUTOR:	Executor is the party which carries out all or part of construction and/or commissioning for the project.
THIRD PARTY INSPECTOR (TPI):	The firm appointed by EPD/EPC CONTRACTOR(GC) and approved by COMPANY (in writing) for the inspection of goods.
SHALL:	Is used where a provision is mandatory.
SHOULD:	Is used where a provision is advisory only.
WILL:	Is normally used in connection with the action by COMPANY rather than by an EPC/EPD CONTRACTOR, supplier or VENDOR.
MAY:	Is used where a provision is completely discretionary.

2.0 SCOPE

This specification covers supply and installation of Earthing and Lightning System material. Only the general requirements are given in this specification. The specific requirements of individual cases will be given in material request for quotation and/or purchase order.

3.0 NORMATIVE REFERENCES

3.1 Local Codes & Standards

IPS (Iranian Petroleum Standard)

IPS-E-EL-100(1)	Electrical System Design (Industrial & Non-Industrial)
IPS-C-EL-115(1)	Construction Standard for Electrical Installation
IPS-D-EL-400	Reference Drawings for Grounding Installation Details
IPS-M-EL-161(2)	Material Standard for General Electrical Items

3.2 International Codes & Standards

IEEE (Institute of Electrical and Electronics Engineers)

IEEE-80:	Guide for Safety in AC Substation Grounding
IEEE-142:	Grounding of Industrial and Commercial Power Systems
IEEE-1050:	Instrumentation and Control Equipment Grounding in Generating Station

BS (British Standards Institution)

BS 6656: Code of Practice for Protection of Structures Against Lightning

BS 7430: Code of Practice for Earthing

NFPA (National Fire Protection Association)

NFPA 780 Installation of Lightning Protection System

*Note: The latest edition of above-mentioned standard and other standards and codes, which referred to, shall be considered in detail design engineering.

3.3 Project Documents

BK-GNRAL-PEDCO-000-EL-DC-0001	Electrical System Design Criteria

3.4 Environmental Data

The Earthing and Lightning System shall be designed for use under the conditions specified as below:

BK- GNRAL-PEDCO -000-PR-DB-0001	Process Basis of Design

For the ambient conditions special care will be paid to:

- Enclosures of equipment for outdoor installation
- Painting and coating of metal parts to resist to the severe environmental conditions
- Any environmental derating factors shall be considered by vendor before design.

D02

3.5 Order of Precedence

In case of conflict between requirements specified herein & the requirements of any other referenced document, the most approved stringent requirements of below listed items shall be considered based on the approval given by the owner's representative:

Purchase order

Material Requisition

MTO & Data Sheet

This Specification

Drawing & Other Specification

Reference Project Specification

Iranian Petroleum Standard (IPS)

Reference international Code & Standards

When the term "Authorized", Authorization", "Approval", or "Approved" are used in this specification, it shall mean authorization or Approval from OWNER.

In case of any conflict between the project documents, the most stringent one shall be considered.

4.0 EARTHING SYSTEM

4.1 Earthing System

The earthing protection system will be designed to protect against indirect contacts (due to failure of insulation), electrostatic discharges and lightning.

Earthing system type is TN-S as defined by IEC 60364-3. It will be designed considering equiptentialization of all earthing connection according to IEC 61024 and IEC 61312.

System earthed for each voltage level and type is as follows:

- Medium voltage system: resistance earthed
- Low voltage system: solidly earthed.

4.2 Earthing Resistance

Soil resistivity shall be adapted based on the Geotechnical study.

Electrical earthing network resistance to ground shall not exceed 1 Ohm.

Clean earth resistance to ground shall not exceed 0.5 Ohm.

Earthing resistance calculation is carried out based on the installation of earthing rods. Earthing rod material and specification shall be as per clause 6.1.

Method of calculation can be performed according to BS 7430 or any other relevant standard/calculation method.

4.3 Main Earthing Grid

Earthing system will consist of some smaller networks installed around all process units, buildings, major structures, distribution centers, electrical substation, etc.

Overall network for plant will consist of main conductor loops (70 mm2 Bare copper), earthing electrodes and equipment conductors.

Separated earthing systems will be provided at each control building for IS and NIS instrument system.

4.4 Design Criteria for Earthing System

Electrical and metal equipment earth lug (frame earth) shall be connected to main earthing grid directly or via earthing bus bars.

Underground splices will be made using exothermic welding (cad weld or thermo weld).

Above ground splices will be made using compression type connections.

All earthing conductors will be of bare stranded copper. Where earthing conductors would be exposed the green or green/yellow PVC insulated earthing conductors suitable for a power frequency voltage to earth of 250V (or conductor inside the plastic conduits) will be used.

4.4.1 Electrical Earthing Equipment

Minimum conductor size of earthing cable and number of earthing connection for each electrical equipment shall be as the following table (see IPS-D-EL-417) but will be finalized after earthing conductor sizing calculation.

Number of Electrical Earthing Connection

Electrical Equipment	Remark	No. of Grounding Points	Grounding Conductor Size (sq.mm.)
Transformer	Body	1	70 (min.)
Medium Voltage & High Voltage Switchgear	Switchgear	2	120 (min.)
	Lightning Arrestor	1	70
Low Voltage Switchgear, MCC or Panels	-	In Accordance with Layout	70 (min.)
Local Control Station	-	1	16
Local lighting/Small Power Distribution Boards	-	1	35
Motor	Up to 22kW	1	16
	23kW to 55kW	1	35
	More than 56kW	1	70
Welding Outlet	-	1	35
Main Loop	-	In Accordance with Layout	70
Substation Loop	-	In Accordance with Layout	120

Lighting fixtures and convenience outlets shall be connected to electrical earth of distribution panels through earth core of lighting cables.

One individual earthing rod shall be installed at the connection point of main earthing grid to neutral of each power transformers.

There are two majors sensitive Instrumentation and Electronic equipment (IS and Non-IS) that shall be earthed separately.

The interconnecting between instrument clean earth and electrical earthing system shall be equipped with suitable surge diverters to prevent damage to instrument equipment

4.4.2 Power, control & Communication Cables

Metallic layer of insulation screen or metallic armor of cables shall be earthed at both ends.

For single core cables, the switchgear side shall be insulated by insulation adaptor connected to cable gland to prevent the circulating currents which cause the reduction in cable current carrying capacity and consequential power losses in the armor.

Cares has to be taken to ensure the metal sheaths and armoring are interconnected at cable branches or joints.

4.4.3 Metallic Equipment Earthing

Static earth shall be connected to main earthing grid through directly or via earthing bus bars. Even if equipment is firmly connected to a metallic structure properly earthed, equipment shall be earth through earth bus bars.

Earthing connection will be made to apparatus with bolted connections. Foundation or base bolts will not permit to be used for earthing.

Conductor size of earthing cable and number of earthing connection of each metallic equipment shall be as the following table (see IPS-D-EL-417):

Number of Metallic Earthing Connection

Equipment	Remark	No. of Grounding Points	Grounding Conductor Size (sq.mm.)
Tank or Storage	≤ 10 m in diameter	2	35
	>10 m in diameter	One connection at maximum 30 m interval along the perimeter of the tank	35
Tower	<20 m in height	1	35
	≥20 m in height	2	35
Drum		1	35
Heat Exchanger		1	16
Steel Structure		2	70 or 35
Pipe Rack		Every 30 m (Min. 2)	70
Pipe		In Accordance with Layout	16
Ladder & Stairways		In Accordance with Layout	35

Tank cars have to be earthed by means of earthing clamps prior to any loading or unloading operations. (35 mm2 copper conductors can be applied)

4.4.4 Necessity of Pipe Bonding

All pipelines shall be earthed as follow:

- Flanges fastened by insulation bolts shall be provided with bonds, except for insulation flanges between A/G and U/G pipeline for cathodic protection.
- In case fastening bolts are not insulated, bond shall be provided every 30 meters and pipeline shall be earthed at the same portion.
- Bonding cable shall be connected to lug plates welded near flanges and shall not be connected to flange fastened bolts.
- Pipe lines shorter than 30 meters, which are connected to equipment, shall be regarded as a portion of the equipment and shall not be required to be bonded and/or earthed.

4.5 Separation from Cathodic Protection System

Metallic equipment that is protected against corrosion by cathodic protection shall not be bonded or earthed to avoid leakage of protection current to earth.

4.6 Earthing Cable Routing and Installation

Earthing cable shall be laid in cable trenches as possible.

Buried earthing conductor shall be installed at a depth of min. 500 mm.

At the place of entering or existing cable trenches, earth conductor will be protected by rigid galvanized steel conduit stub-ups, extending at least 500 mm above grade.

Routing and stud up of earthing cables can be commonly used with those of power cables for each consumer such as motor and panels, but separate conduits shall be used.

4.7 Earthing Rod Installation

Depth of the top of each earthing rod shall be minimum 450 mm below finish grade. Earthing rods shall be installed within the overall plant. Especially groups of rods shall be installed around the electrical substation to achieve required earthing resistance. The rods shall be connected to each other by min. 70 mm2 copper conductors. Detailed location and quantity of earthing rods shall be determined with coordination of the calculation result.

Connection between electrodes and grounding loops shall be arranged into inspection pits with covers to allow maintenance and testing of individual electrodes.

5.0 LIGHTNING PROTECTION

5.1 Lightning Protection System

The necessity of lightning protection system will be evaluated according to the BS 6651, NFPA 780 or equivalent IEC (TC 81) recommendations. In general, metallic structures will be connected to main grounding system via lightning rod.

All other buildings and structures, totally enclosed in the area, will not need its own lightning protection system.

The Lightning System will be designed in accordance with NFPA 780.

Lightning protection system shall have its own earthing system and interconnected to earthing network. The resistance to ground shall not exceed 5 Ohm.

5.2 Design Criteria for Lightning System

If a structure is not located within the zone of protection caused by other tall structure, it shall be protected against lightning.

5.2.1 Chimneys or Vent

According to NFPA 780 Chimneys or vent with metal thickness of 4.8 mm or more shall require only a connection to the lightning protection system. Such a connection shall provide two or more paths to ground as required for strike termination devices.

5.2.2 Buildings

Arrangement of air terminals, down conductors and earthing rods shall comply with NFPA 780, sec. 3- 8~13.

Each down conductor shall be provided with a test joint and should be connected to a dedicated earth electrode.

5.2.3 Tower & Vessels

Air terminals are not required. Towers and vessels shall be provided with dedicated earthing rods for lightning protection. These earthing rods shall be connected to main earthing grid.

5.2.4 Pipe Rack & Steel Structure

Metallic pipe rack and steel structures shall be provided with dedicated earthing rods for lightning protection every 30meter and min at two points. These earthing rods shall be connected to main earthing grid.

5.2.5 Pipes

Lightning protection of pipes is not required.

5.2.6 Tanks

A tank is bonded to earth through a minimum of two earth terminals at maximum 30 m intervals along the perimeter of the tank.

6.0 MATERIAL DESCRIPTION

The earthing materials shall be in accordance with the materials and installation requirement indicated in IPS-D-EL-400 series.

6.1 Rod

Earthing rod shall comprise of:

6.1.1 Driving Head

Driving head shall be made of high strength steel with good contact with rod, so that driving force is transferred directly to the rod allowing power hammer to be used for deep driving.

6.1.2 Coupling

Coupling shall be made of aluminum bronze counter bored to completely enclose treads and protecting them from damage and corrosion.

6.1.3 Rods

The rods shall be extensible, made from pure electrolyte copper molecularly bonded onto low carbon steel core with high tensile strength highly resistant and hard to bend, allowing power hammer to be used for deep driving.

To ensure strength and uniform layer of copper threads shall be rolled onto the rods.

The rods shall have 19 mm nominal diameter and 2*1.5 meters length with provision for extension(s) where required so.

6.1.4 Clamps

Clamps body shall be fabricated from silicon aluminum and the screw to be made from phosphor bronze to ensure strength and resistance to corrosion.

6.2 Conductor Clamp

Conductor clamps (Bronze/Phosphate) are used for connecting Earth conductor to Earth rod according to IPS-D-EL-401 (size of conductor shall be indicated in the relevant requisition/purchase order)

6.3 Ground Bus-Bar Station

Ground bus-bar stations shall be tinned high conductive copper bar, 300x50x5 mm, minimum 8 holes, brass bolt, nut & washer and all accessories for connection to steel structure.

6.4 Earth Lug

Earth lug shall be in accordance to IPS-D-EL-413.

6.5 Cable Lug (Compression Type)

Compression type cable lugs shall be tinned copper with hole suitable for the conductor size.

6.6 Conductor Clamp

Conductor clamp shall be according to IPS-D-EL-413 suitable for conductor size.

6.7 Stainless Steel Bolts 12x30

Stainless steel bolts 12x30 mm shall be applied to connect lug on main earthing terminal, complete with:

- Hexagonal nuts
- Washer
- Lock washer

6.8 Stainless Steel Bolts 12x80

Stainless steel bolts 12x80 mm shall be applied to fit main earthing terminal, complete with:

- Hexagonal nuts
- Grower type washer
- Plane type washer

6.9 Thermoweld (Cadweld)

Thermoweld (Cadweld) connection shall be complete with necessary moulds, powder, etc. and shall be 3 ways (Tee).

6.10 Interchangeable Handle Clamp

Interchangeable handle clamp will be used for cadweld connections.

6.11 Flint Gun

Flint gun will be applied for starting the cadweld reaction.

6.12 Set of Cleaning Tools

Set of cleaning tools will be applied for cleaning conductors and mould after the cadweld reaction.

6.13 Parallel Connector or “C” Connector

Parallel connector or “C” connector shall be in accordance to IPS-D-EL-402.

6.14 Earthing Conductor

Earthing conductor shall be strip copper tape conductor.

6.15 Air Terminals

Air terminals shall be Nickel-chrome plated, 500 mm long, 16 mm diameter.

6.16 Down Conductor

Lightning down conductor shall be 25x3 mm2 copper strip.

6.17 Test Joint

Test joint shall be brass.

7.0 INSPECTION

The Client or his authorized representatives shall be permitted access to the Vendor's works, at no cost to the client, at all reasonable times, to ensure that the equipment is being constructed in accordance with the terms of this specification.

The equipment with the accessories to be inspected shall be prepared readily and easily accessible for the inspection.

After inspection it is imperative that an inspection report is set up and signed by the vendor and purchaser (EPC Contractor) or his authorized representative.

Visual inspection shall be as follow:

- Compliance with specification
- Compliance with drawings
- Compliance with codes / standards
- Surface defects
- Dimensional accuracy
- Proper coating / painting
- Checking of Parameters

8.0 SPARE PARTS

Together with the supply of all resistor assemblies, the necessary spare parts (if any) for commissioning shall be supplied, and also recommended spare parts list for two years of operation shall be included. The supplied spare parts shall comply with the same specification as the original parts.

9.0 DOCUMENTATION

The Vendor shall submit at least the following documents:

General documents or drawings are not acceptable unless they are revised accordingly:

- Equipment lists
- Recommended spare parts lists (if any)
- Test reports
- Installation and maintenance instruction
- Catalogue and Dimensional drawing