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		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	1 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

## SPECIFICATION FOR LIGHTING AND SMALL POWER

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		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER				Date:	1404.02.21

PAGE \ REV.	0	1	2	3	4	5	PAGE \ REV.	0	1	2	3	4	5	PAGE \ REV.	0	1	2	3	4	5
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33							68							103						
34							69							104						
35							70							105						

Owner: 	Client: 	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant: 	Supervisor: 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	3 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

## Contents

1- Introduction .....	4
2- Definitions.....	4
3- REFERENCE DOCUMENTS .....	4
3-1- Abbreviations .....	4
4- CODES AND STANDARDS .....	4
5- GENERAL .....	6
5-1- General .....	6
5-2- Environmental data .....	6
6- DESIGN REQUIREMENTS .....	6
6-1- Power supply.....	6
6-2- Lighting panels .....	6
6-3- Lighting distribution .....	7
7- EQUIPMENT REQUIREMENT-LIGHTING.....	9
7-1- Light Switches.....	9
7-2- Photo-cell units for outdoor lighting .....	9
7-3- Lighting fixtures – General .....	10
7-4- Fluorescent lights .....	11
7-5- Floodlights.....	12
8- INSTALLATION REQUIREMENTS .....	12
8-1- Street lighting.....	12
8-2- Lighting in operational area .....	12
8-3- Aircraft Warning Lights .....	13
8-4- Grounding .....	14
9- Design Equipment's Requirements – Power Outlets .....	14
9-1- General .....	14
9-2- Convenience Outlets.....	14
9-3- Welding Outlets.....	14
9-4- Location .....	14
9-5- Isolation .....	14
10- INSTALLATION ACCEPTANCE .....	14

Owner: 	Client: 	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant: 	Supervisor: 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	4 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

## 1- Introduction

"PAYA OIL OAYESH Commercial Co. intends to construct an Oil Product Terminal facility in Persian Gulf Port in Shahid Rajaee economic zone in Bandar-Abbass.

In this project Behin Tarh Paydar Consultant Co. will be responsible for basic and detail design phases. The purpose of the plant is to prepare required facilities in order to storage heavy and light product in tank and truck loading and unloading truck road and transfer product to jetty and ship.

## 2- Definitions

Client: PAYA OIL PAYESH Commercial Co.

Consultant: Behin Tarh Paydar Co. Consultant

Project: PAYA Oil product terminal in the Persian Gulf port.

## 3- REFERENCE DOCUMENTS

The following shall be read in conjunction with the following documents:

Site Condition

Specification for Earthing & Lightning Protection System

Specification for Painting





### 3-1- Abbreviations

AC	Alternating current
DC	Direct current
CT	Current Transformer
LED	Light-Emitting Diode
IP	Ingress Protection
ESD	Emergency Shut Down
PE	Protective Earthing
HP	High Pressure
P.M.O	Port & maritime organization

## 4- CODES AND STANDARDS

Systems shall comply with the latest edition of IEC standards and CENELEC publications and in particular with:

IEC 60364	Electrical installation in buildings
IEC 60064	Tungsten filament lamps for domestic and similar general lighting purpose
IEC 60081	Tubular fluorescent lamps for general lighting





Owner: 	Client: 	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant: 	Supervisor: 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	5 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

IEC 60529	Classification of degree of protection provided by enclosures
IEC 60357	Tungsten halogen lamps (non-vehicle)
IEC 60662	High pressure sodium vapour lamps
IEC 60309	Receptacles for industrial purpose
IEC 60188	High-pressure mercury vapour lamps - Performance specifications
IEC 60400	Lamp holders for tubular fluorescent lamps and starter holders
IEC 60432	Incandescent lamps - Safety specifications
IEC 60598	Luminaires
IEC 60921	Ballasts for tubular fluorescent lamps - Performance requirements
IEC 60927	Auxiliaries for lamps - Starting devices (other than glow starters) - Performance requirements
IEC 60929	AC and/or DC-supplied electronic control gear for tubular fluorescent lamps - Performance requirements
IEC 60969	Self-ballasted lamps for general lighting services - Performance requirements
IEC 61000-2-3	Electromagnetic compatibility (EMC)
IEC 61347	Lamp control gear
IEC 61547	Equipment for general lighting purposes - EMC immunity requirements
IEC 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
EN 1838	Lighting applications, Emergency lighting
EN 12464	Light and lighting, Light and lighting, Lighting of work places
EN 12665	Light and lighting, Basic Terms & criteria for specifying lighting requirements
EN 13032	Light and lighting, Measurement and presentation of photometric data of lamps and luminaires

Any equipment built in accordance with standards, regulation or codes other than I.E.C. standards or CENELEC publication, even when equivalent and any waiver to this Specification shall be submitted to CLIENT for approval.

In case of conflict between documents, the order of precedence shall be:

- this Specification
- the Data Sheets
- drawings and other documents
- I.E.C. standards
- CENELEC publications
- UTE, BS when I.E.C. publications have not yet been issued.

Owner: 	Client: 	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant: 	Supervisor: 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	6 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

## 5- GENERAL

### 5-1- General

Lighting and small power installation shall include.

- Lighting fixture installation, lighting panel design, and routing of cables.
- Emergency and vital safety lighting.
- Convenience outlets.
- Welding outlet.

All equipment and material for lighting installation as well as its preparation and assembly, shall be supplied.

Painting and colour shall comply with the Specification for Painting.

### 5-2- Environmental data

Environmental conditions shall be as stated in doc. Nevertheless, all equipment shall be capable of continuous operation at 40°C without deleterious effect.

## 6- DESIGN REQUIREMENTS

The lighting shall be split in to three main systems:

- Normal system (70% of total lighting)
- Essential system (30% of total lighting)
- Vital system (with self-contained battery).

### 6-1- Power supply

Lighting system shall be supplied from low voltage electric power 400/230V 3pH+N+PE.

Individual lighting circuits shall be 230V-connected phase and neutral and protected earth.

This voltage shall be obtained direct from the relevant low voltage 400V Switchboard:

- Main normal lighting panel fed from the normal 400V Switchboard.
- Emergency lighting panel fed from the emergency 400V Switchboard.





Each main normal and emergency lighting panel shall feed secondary panels for indoor/ outdoor lighting and small power services.

### 6-2- Lighting panels

#### 6-2-1- Main lighting panels

Main lighting panels shall be located in safe areas. Incomers shall be 4 poles switch with earth leakage relay.

Feeders to secondary lighting panels shall have 3 phases and neutral 4 poles, circuit breakers normally with earth leakage protection.

Owner: 	Client: 	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant: 	Supervisor: 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	7 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

## 6-2-2- Secondary lighting panels

Secondary lighting panels shall be located in safe areas or in hazardous areas in the plant units.

Location of secondary lighting panels shall be based on distance involved with their relevant distributed lighting circuits.

Panels shall be fitted with an enclosure with type of protection corresponding to the area classification, housing a 3 phases plus neutral 4 poles switch and 3 poles plus neutral bus bar to which the different outgoing shall be connected. In case of maintenance of the panel itself main isolation and locking shall be made at the supply on the main lighting panel. One phase and neutral outgoing circuits from the secondary panel shall have 2 pole circuit breakers, with earth leakage protection for convenience outlet circuits.

## 6-3- Lighting distribution

### 6-3-1- Load balance

The load of each lighting circuit shall normally be balanced over the 3 phases.

- 70% of all lighting shall be connected to normal circuit
- 30% of all lighting shall be connected to essential circuit

Vital lighting fixtures shall be fitted with integral batteries and connected to essential circuits.

### 6-3-2- Equipment

Equipment shall be provided with a class of protection corresponding to the classification of the area location.

- Outdoor equipment in safe areas shall be IP 55 and for standardization certain equipment shall also be certified as per requirements.
- In safe indoor areas equipment shall be IP 42

#### 6-3-2-1- Street lighting

Lighting of roads and street shall be

- High pressure sodium vapour lamps mounted on lampposts or LED system.





Road lighting and street lighting shall be controlled by photoelectric cells with manual overrides located at control check points.

Luminaires shall be high pressure sodium lamps or LED that angled to horizontal can be adjustable. They shall be suitable for pole mounting on 42-60mm diameter steel pipe.

The luminaire body shall be die cast aluminium which is electro statically stove enamelled. All bolts/fixings shall be of stainless steel.

Reflector shall be of anodized 99.9% pure aluminium and bowl shall be of clear glass.

Luminaires shall have a suitable terminal block to allow connection of the internal wiring and incoming supply cable into which standard cross-linked polyethylene cable can be connected.

Owner: 	Client: 	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant: 	Supervisor: 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	8 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

Lighting poles shall be made of hot dip galvanised steel pipe and suitable to accommodate the high-pressure discharge lamps with accessories.

#### 6-3-2-2- Vital safety lighting

Vital Safety lighting shall be provided to allow minimum lighting of obstacles.

Fittings shall normally be ON, fed from AC with the battery being charged. The battery shall supply the fitting on loss of AC.

Number and location of safety lights shall be designed in accordance with safety requirements.

#### 6-3-3- Convenience outlets

Convenience outlets shall be provided for maintenance and general purpose use.

Size shall be 16A – 1 phase plus neutral and earth.

Outlets shall be supplied from normal lighting / Socket panels.

Socket outlets shall be spaced such that each one can reach with a cable cord any point located within 25 meters in operational area.

#### 6-3-4- Gauge glass lighting

Gauge glass lighting shall be fed by lighting/ Socket panels in the same conditions are the socket outlets.

Essential lighting shall be fed by the essential circuit (from emergency lighting panels).

Gauge glasses light shall have a dedicated switch and shall not be switched by photocell.

#### 6-3-5- Aircraft warning lights

Warning light selection and location shall be designed and arranged in accordance with the recommendations of ICAO, Chapter 6.3, and Annex 14. Unless otherwise specified, Medium Intensity Obstruction Light, Type B (Red colour, flashing) shall be used in combination with intermediate light of Low Intensity Type B (Red colour, fixed).

Aircraft warning light fixtures shall be constructed in accordance with applicable IEC standards.





An aircraft warning light control panel, approved by an internationally recognized authority for use with aviation obstacle lights, shall be provided. Aircraft warning light fixtures shall consist of two red lights. In case of one light failure, the other light shall be energised by automatic transfer. Light failure alarm shall be provided.

Multi LED Lamps used for aircraft warning lights shall be of long life type.

Power supply to the warning light shall be from emergency lighting distribution board. The lights shall be automatically controlled by a photoelectric control system and equipped with by pass switch. Warning light shall be suitable for operation at 230V, 50Hz.

Aircraft warning lights shall have cable entries compatible with their specified class of enclosure. The cable entry shall be threaded in accordance with ISO metric.



Owner: 	Client: 	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant: 	Supervisor: 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	9 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

The aircraft warning lights shall be provided with an earthing terminal for connection to earthing network.

#### 6-3-6- Fence lighting

Same philosophy as for street lighting shall be applied.

#### 6-3-7- Illumination levels

The illumination levels shall be in accordance with API/RP 540 or other international approved standards. About the illumination levels of roads and operational area the minimum requirement of P.M.O. shall be achieved.

Maintained illuminance ( $E_m$ ) for vital safety lighting shall be as:

- 6 lux average, with a minimum of 0.6 lux at any point on the escape routes.
- In control buildings (panel room and monitoring room) and substations (switchgear room and diesel generator room), separate to the above, maintained illuminance on the plane of work (reference plane) shall be not less than 15 lux average.
- For open areas no vital safety lighting may be used

### 7- EQUIPMENT REQUIREMENT-LIGHTING

#### 7-1- Light Switches

All lighting switches shall be designed and constructed for a minimum of 16A at 230 VAC.

Lighting switches shall be suitable for supply of discharge and fluorescent lamps at the rated current and site conditions.

For outdoor and industrial area the switches shall be of corrosion proof cast metal and threaded conduit entries. These switches shall be suitable for surface mounting and shall have ground terminals provided.

For indoor areas the switches shall be of moulded insulating material with threaded conduit entry. The switches shall be suitable for surface or flush mounting (with box) as required.

In all buildings the light switch shall be mounted at a height of 1200 mm.

Outdoor lighting circuits shall be equipped with Photo-cell units and by-pass switches.

#### 7-2- Photo-cell units for outdoor lighting





Photo cell units shall be designed and constructed for a minimum 5A, 230V, 50 Hz.

Photocell units shall be the type not sensitive for operation under lightning or lightly clouded skies.

Photocell units shall be fail-safe operation type, that is, the load circuit remains energized in the event of electronic failure.

The sensitivity without adjustable mask shall be 10 or 30 foot-candles and with adjustable 10 or 250 foot candles.

The sensitive window shall be unidirectional type.

Owner: 	Client: 	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant: 	Supervisor: 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	10 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

### 7-3- Lighting fixtures – General

General requirements of overall lighting fixtures are as follows:

The term “luminaire” shall mean a lighting fitting complete with lamp, related control gear (capacitors, starters, chokes etc.) and other accessories.

The exposed metallic parts of the luminaires shall be factory finished stove enamelled with a suitable corrosion resistant paint capable of resisting the severe local climatic conditions in addition to the heat emitted by the lamp during continuous operation even, if necessary, under full sunlight conditions.

Luminaries shall be so designed that the heat generated is efficiently dissipated. Lights for fitting in panels shall have a metal base to deflect and evacuate the heat generated by the light source.

Enclosures shall be of metal or of flame retardant insulating materials.

Luminaires shall be designed and constructed for recess, flush or surface mounting as required.

All equipment with a conductive (metal) body shall be provided with an internal earthing lug. All metal parts of a luminaire shall be electrically bonded together.

All high pressure sodium type of luminaires shall have proper ventilation facilities.

All luminaires shall have cable entries compatible with their specified class of enclosure. All cable entries shall be threaded and plugged. Threads shall be in accordance with ISO metric. Cable glands shall be provided for all cable entries.

All high intensity high pressure sodium and mercury vapour bulbs shall be of screw cap type E40 preferably or E27 in accordance with IEC 60238.

Essential lighting fittings shall be identified by a red band, 10 mm wide painted on the external of the fittings.

Control gear shall be suitable for operation at 230V, 50Hz, power factor compensated to at least 0.9. The ballast shall be matched to the lamps selected. The lamp shall be able to start with at least plus or minus ten percent of the voltage value and continue in normal operation with dips attaining 20 percent for four seconds.

Reactors, capacitors and other auxiliaries are not to be mounted on surfaces that are subject to high temperatures.

Inductors and high reactance transformers are to be installed as close as practical to the associated discharge lamp.





Radio interference suppression for fluorescent light fittings shall be of degree K = 43.

Incandescent lamps shall not be used anywhere.

Special attention shall be paid to avoid stroboscopic effects on rotating machinery if using HID lamps. In these cases lighting circuit shall be supplied from three phase low voltage system.

Minimum terminal size shall be 2.5 sq. mm and through wiring shall be provided.

All lighting fixtures shall have internal wiring with heat resistance flex to 105°C.

Owner: 	Client: 	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant: 	Supervisor: 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	11 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

#### 7-4- Fluorescent lights

All fluorescent tubes shall be 36W, 1200 mm in length, 26mm diameter or 18W and shall have bi-pin lamp contacts unless otherwise stated.

Fluorescent tubes shall be "day light" type unless stated otherwise.

##### 7-4-1- Indoor Fluorescent Luminaires

The types of indoor fluorescent luminaires are as follows.

1. Surface mounted fluorescent luminaires shall be equipped with an anodized aluminium louvre, stove enamelled, with heat resistant wiring ready for connection and complete with electronic ballast, 4 pole terminal block and earth connection. Lamps above mirrors shall be wall mounted type.
2. Recessed fluorescent luminaires shall be equipped with anodized aluminium louver, white stove enamelled, with surrounding rim 6mm high, knockouts at each end, with heat resistant wiring ready for connection and complete with electronic ballast, 4 pole terminal block and earth connection

##### 7-4-2- Safety Lighting Fluorescent Luminaires in Buildings

Safety lighting shall be complete with self-contained batteries and fully automatic in operation. They shall operate on 230V AC single phase 50Hz system and upon failure of the normal power system shall be battery backup.

The luminaires shall normally be supplied with main power and shall be fed by the emergency generator on main power loss. On total power loss, the luminaries shall be supplied from their internal battery, for a minimum of 90 min at not less than 87.5% of normal battery voltage.

The units shall be equipped with a fully automatic charger to maintain the battery fully charged at all times and a test switch to indicate operating status of the unit.

##### 7-4-3- Outdoor Fluorescent Luminaires





The luminaries shall be suitable for operation in safe area classification, as a minimum.

The types of outdoor fluorescent luminaires are as follows.

All luminaires shall have anti UV body and bulb, it should be with reflector, protective bowl, and be suitable for direct or pendant mounting, with heat resistant wiring ready for connection and complete with electronic ballast, 4-pole terminal block and ground connection.

##### 7-4-4- Safety Lighting Fluorescent Luminaires in External Areas

The luminaries shall be complete with self-contained batteries and fully automatic in operation. They shall operate on 230V AC single-phase 50Hz system and upon failure of the normal power system shall be battery backup.

Owner: 	Client: 	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant: 	Supervisor: 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	12 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

The luminaires shall normally be supplied with main power and shall be fed by the emergency generator on main power loss. On total power loss, the luminaries shall be supplied from their internal battery, for a minimum of 90 min at not less than 87.5% of normal battery voltage.

The units shall be equipped with a fully automatic charger to maintain the battery fully charged at all times and a test switch to indicate operating status of the unit.

#### 7-5- Floodlights

Floodlights shall be wide beams with symmetrical pattern of light.

Floodlights shall be high-pressure sodium or mercury vapour lamps.

Floodlights shall be equipped with integral ignition and control gear.

Floodlights shall have wiring with heat resistance, with silicone insulation and exterior connection box.

Ignition unit shall be incorporated in the junction box.

The housing for floodlights shall be stainless steel or die cast aluminium with an anodized aluminium reflector. All bolts/fixings shall be of stainless steel.

The painting finish of all parts of the floodlight shall be powder coated and stove enamelled.

### 8- INSTALLATION REQUIREMENTS

#### 8-1- Street lighting

Lampposts carrying lanterns shall be fitted with a base plate for fixing to the concrete by means of anchor bolts. A separate standalone junction box shall be mounted next to the pole foundation suitable for looping the feeder cable and for the supply cable to the lights. A pipe sleeve shall be incorporated in the concrete base for the supply cable.

Height of lighting sources shall suit width of the street and type of source.

Lanterns shall be fitted with HP sodium vapour lamps with supply ballasts incorporated in the lanterns. Lanterns shall be protected by MCB.

Supply to lanterns shall be from the lighting panel by cable along roads at the foot of the lampposts.

Cable shall be run inside the lamppost, between junction box and lantern, and shall consist of 3core 2.5 sqmm conductors (1 phase+1neutral+1ground).

Lantern loads shall be balanced between phases (1 lantern out of 3 per phase).

Lighting poles shall be made of hot dip galvanised steel pipe according to ASTM standard and suitable to accommodate the high-pressure discharge lamps with accessories.





The luminaire angle shall be adjustable.

#### 8-2- Lighting in operational area

Unit lighting shall be fluorescent or HP sodium lighting.

In steel structure such as workshops, the lighting fixtures shall be with 250W or 400W, 230V high pressure mercury vapour lamps, complete with ballast, aluminium reflector and grounding terminal.

Culverts with walkways shall be provided with lights.

<b>Owner:</b> 	<b>Client:</b> 	<b>GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT</b>  <b>PAYA OIL PRODUCTION TERMINAL</b>			<b>Consultant:</b> 	<b>Supervisor:</b> 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	13 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

Lighting circuits shall not be loaded to more than 80% if the circuit rating.

Lighting cables shall be routed with power cables.

Single phase outgoing circuits from lighting panels shall consist of 3 core cables (1 phase + neutral + ground) 2.5 sqmm minimum cross section.

Voltage drop between furthest light fixture and source of supply (LV switchboard) shall not exceed 5%. In plant areas the location of luminaries, socket outlet, JB's, etc. shown on lighting and small power layouts are approximate only. The installation CONTRACTOR shall determine the final location to ensure that equipment is clear of all obstructions. Consideration shall be taken to re-lamping. Relocation to be approved by the site engineer.

Attachment fittings shall be selected depending on local facilities (hanger, console, lamppost, etc.).

Floodlights shall preferably be installed on structures or flat roofs, in locations that are accessible from platforms.

Branch connections shall be made with junction boxes fitted with fixing lugs containing the connection terminals and grounding terminals; class of protection shall be selected to suit the classification area.

Termination of cables at lighting panel boards, junction boxes and lighting fixtures shall be achieved by means of cable glands suitable for the equipment. For all terminals, wire crimp shall be used.

Lighting cables shall be routed as follows:

- Aboveground cables

Cables shall be run on perforated cable trays or ladders or conduit compliant. Cables shall be maintained in position by clips. Width of cable trays or ladders shall allow later installation of additional cables.

Cables trays shall be provided with covers where there is high risk of mechanical damage during normal operation or maintenance periods.

- Underground cables

These shall be considered as power cables and shall be installed in the same manner as power cables.

Short routes (up to 10 meters) and less than 3 cables shall be in steel tube conduits throughout their length.

The principle of installation described above, shall also be applied to the lighting and small power systems for buildings and gauge glasses.





### 8-3- Aircraft Warning Lights

Permanent easy access to aircraft warning lights shall be provided.

Aircraft warning lights shall be so arranged that they can be seen from all directions.

Warning light shall be provided for the following equipment as a minimum:

- 1) Lighting Towers
- 2) All building or structure higher than 30 m.

Owner: 	Client: 	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant: 	Supervisor: 
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	14 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

#### 8-4- Grounding

Refer to Specification for Earthing & Lightning Protection System.

### 9- Design Equipment's Requirements – Power Outlets

#### 9-1- General

Outlets shall be standardized for each rating and type and shall have an earth connection incorporated. Outlets shall comply with IEC standards.

Outlets in working areas shall be of rigid casing design in order to prevent mechanical damages.

#### 9-2- Convenience Outlets

Convenience outlets shall be provided for maintenance and general purpose use. Size shall be 16A – 230V, 1 phase plus neutral and earth (3 pin socket). The Outdoor outlets shall have a switch.

There shall be no more than 8 outlets on each circuit. Each circuit shall be protected against earth fault by means of RCCB. The setting will be 30 mA.

#### 9-3- Welding Outlets

Welding outlets shall be provided. Size shall be 63A – 400V, 3 phase plus neutral and earth (5 pin socket).

Outlets shall be supplied from normal switchboards.

Each circuit shall be protected against earth fault by means of RCCB. The setting shall be 10% In.

Welding outlets shall be spaced such that each one can reach with a cable cord any point located within 50 meters in operational area.

#### 9-4- Location

Outlets in external areas shall not be located in zone 1 areas. Outlet in other areas shall comply with electrical installation and materials in Hazardous areas.





Outlets installed outdoors shall have a degree of protection at least IP55 either when the plug is removed or fully inserted. Outlets located indoors shall be IP42. All plugs and outlets throughout for 50% of the outlets provided.

#### 9-5- Isolation

On detection of any gas release, all convenience and welding outlets in external areas shall be isolated by F&G system via the ESD system.

### 10- INSTALLATION ACCEPTANCE

All equipment shall be subject to inspection and test witnessed by COMPANY CLIENT or his appointed representative.

Owner:  وزارت نیرو و برق و انرژی و صنایع	Client:  شرکت پالایش نفت پارسیا (پشنی)	GENERAL AUTHORITY OF HORMOZGAN PERSIAN GULF PORT  PAYA OIL PRODUCTION TERMINAL			Consultant:  پیش طرح پایدار	Supervisor:  تدبیر ساحل پارس مهندسی مشاور
		Client Doc. No.:	POT-150-BE-EL-SPE-3010	Rev. 1	Page:	15 of 15
Document Title: SPECIFICATION FOR LIGHTING AND SMALL POWER					Date:	1404.02.21

After completion of installation, tests shall be carried out in conformity with the inspection and test plan. The tests shall be approved and signed by both contractor and COMPANY CLIENT and shall include:

- Verification of equipment compliance with the requirements
- Classification and certification for hazardous area
- Protection degree
- Rated voltage and power