CMIT CNOOC.MOC.IDC.TPAO 中海油石化工程有限公司 CNOOC Petrochemical Engineering Co.,Ltd.	**WATER INJECTION STATIONS EXPANSION PROJECT**	Job No.	243007D0796	
		Doc. No.	EE00R06	
	SPECIFICATION FOR LIGHTING SYSTEM	Phase	DETAILED DESIGN	
		Rev.	0	Page 1 of 36

Company:	CNOOC IRAQ LIMITED
Project:	WATER INJECTION STATIONS EXPANSION PROJECT
Company's Doc. No.:	CMIT-230084-1-796-ELE-15.03-00-0006
Unit Name: `	GENERAL

ELE

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DOCUMENT REVISION HISTORY SHEET

REV	DATE	REVISION DETAILS
A	25/01/2025	First issue
B	17/03/2025	1. Add “Refer to Design Basis CMIT-230084-1-796-PCS-15.65-00-0001”. 2. Delete “CILBCFQ-710-SAF-10.65-10001 ” 3. Add “The Explosion-proof Certificate of lighting fixtures that located in the hazardous area shall be submitted”. 4. Update the specification document number. 5. Delete 4.10 and 4.11
0	27/03/2025	Issued for Construction

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1. GENERAL

MISSAN Oil Field is located in the SE of Iraq, close to Iran's border, about 175 km N-NW of BASRA City, and 350 km SE of Baghdad – the capital of Iraq.

MISSAN Oil Field includes three producing fields namely Abu GHIRAB, BUZURGAN and FAUQI. Abu GHIRAB and FAUQI fields extend beyond the Iranian border.

Since MISSAN Oil Field was built in 1976, it has suffered from the Iran-Iraq War and the Iraq War, so a lot of facilities needs to be upgraded and revamped.

The intended project is mainly concerned for the Water Injection Station(s) Expansion in Three Locations namely (BUN, FQS and BUS3).

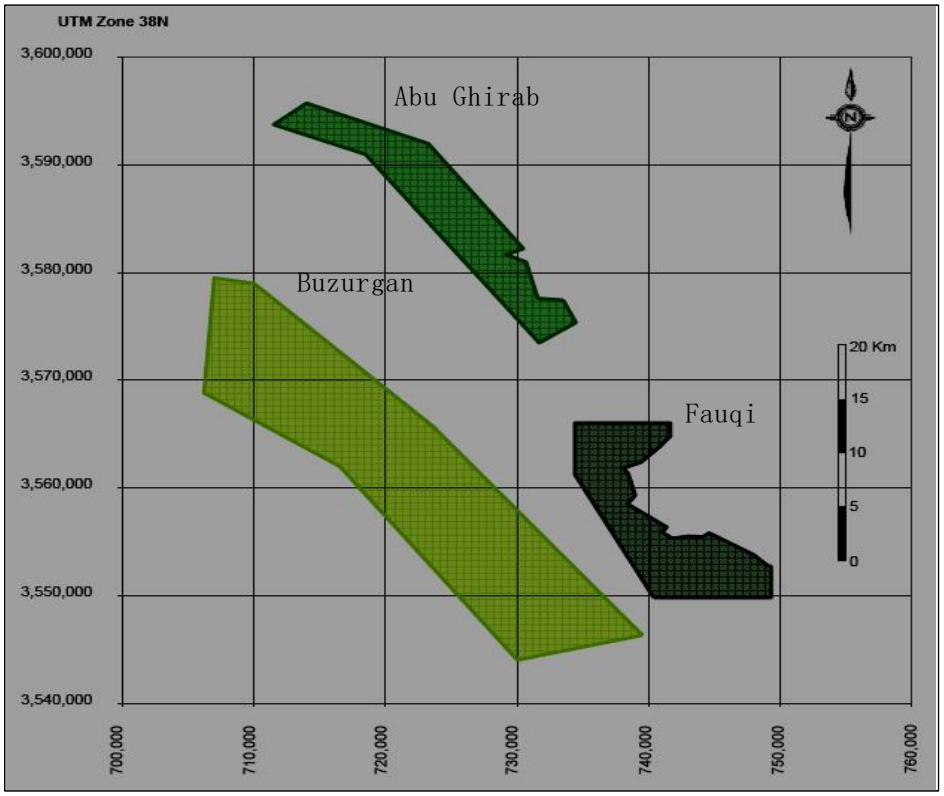

Figure 1.1-1 The overall MISSAN Oil Field

General Field Layout is shown in below figure:

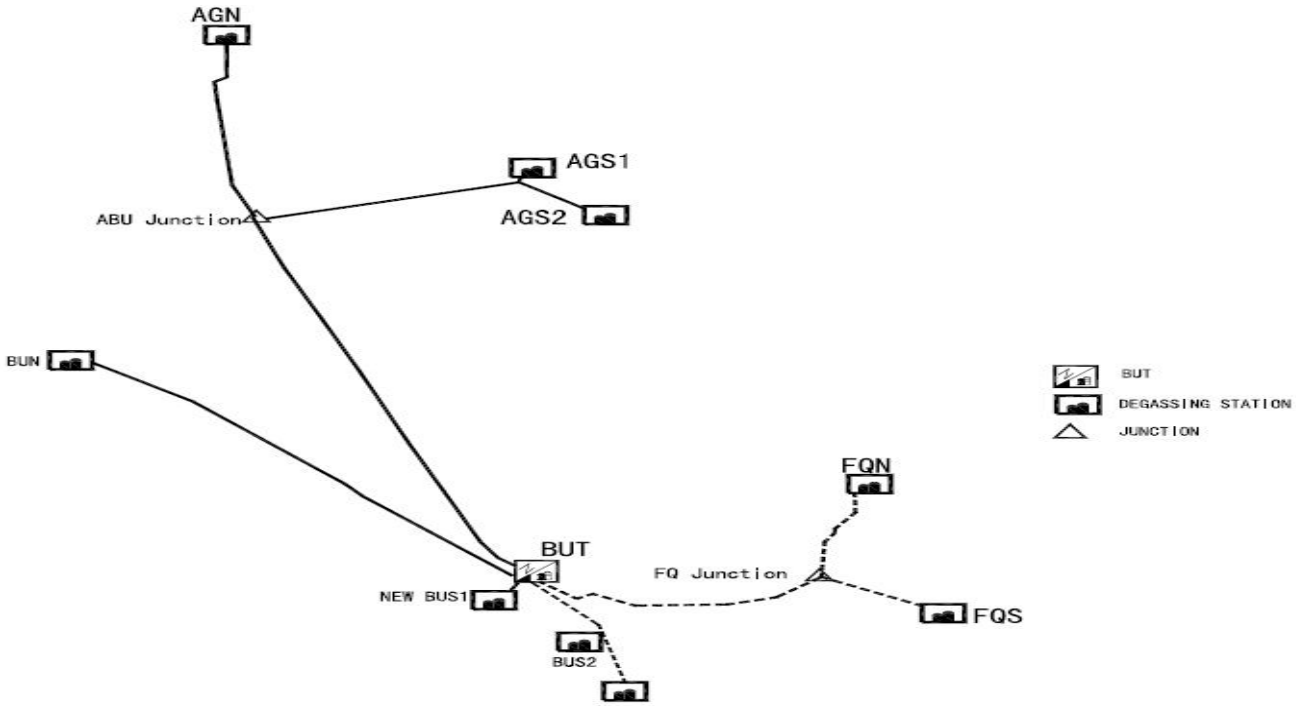

Figure 1.1-2 General Field Layout

1.1. Water Injection Stations (WIS):

A newly-established Water Injection Station are located at BUN, BUS3 and FQS areas adjacent to the newly-established Degassing Stations built therein.

On the three stations, the established Water Injection Stations and the Degassing Stations have been completed since 2021.

BUN Water Injection Stations (WIS) have been equipped with Two Water Storage Tanks, Three Water Feed Pumps, Three Water Injection Pumps, Water Injection Manifold that delivering the pressurized water to its intended manifold or/and well.

FQS Water Injection Station has been equipped with Two Water Storage Tanks, One Water Feed Pump, One Water Injection Pump, Water Injection Manifold that delivering the pressurized water to its intended manifold or/and well.

BUS3 Water Injection Station has been equipped with Two Water Storage Tanks, Two Water Feed Pumps, Two Water Injection Pumps, Water Injection Manifold that delivering the pressurized water to its intended manifold or/and well.

In this project, those three Water Injection Stations will be expanded.

1.2. Abbreviation and Acronyms

1.2.1 Project Definitions

The following definitions shall apply to this document:

COMPANY: CNOOC IRAQ LIMITED

PMC:Project Management Consultant

CONTRACTOR :CNOOC Petrochemical Engineering Co.,Ltd (COPCL or CNOOCPEC).

WIS:Water Injection Station

WTP:Water Treatment Plant (Oily Water Treatment)

WIP:Water Injection Pump

DGS or **DS**: Degassing Station

BUT: BUZURGAN CPF Terminal

CNOOC: China National Offshore Oil Corporation

1.2.2 Abbreviation

AC	Alternating Current
DC	Direct Current
FEED	Front End Engineering Design
FPZ	Fire Protection Zone
HPS	High Pressure Sodium
HSE	Health Safety & Environment
ICAO	International Civil Aviation Organisation
IEC	International Electro-technical Commission
IP	Ingress Protection
ITP	Inspection and Test Plan
LDB	Lighting Distribution Board
LED	Light Emitting Diode

MLDB	Main Lighting Distribution Board
MMTPA	Million Metric Tonne Per Annum
PDB	Power Distribution Board
Ni-Cd	Nickel-Cadmium
PFC	Power factor Correction
QA	Quality Assurance
SDRS	VENDOR Documentation Requirements Schedule
SI	Système International d'Unités
SPIR	Spare Parts Interchangeability Record
UPS	Uninterruptible Power Supply

2. REFERENCE DOCUMENTS

The VENDOR shall comply with the requirements of Iraq laws, Project specifications, data sheets & drawings and the latest Revisions of the applicable portions of the Codes and Standards listed below.

Bare minimum relevant standards are listed below; however the equipment shall conform to the latest editions of all the applicable standards. It shall be the VENDOR' responsibility to be or to become knowledgeable of the requirements of applicable portions of these standards and codes. Any changes or alterations to the equipment to make it meet standards and codes requirements shall be at the expense of the VENDOR.

In the case of conflicting requirements, the following order of precedence shall apply (No. 1 is the top level governing document).

1. Iraq Laws and Regulations
2. Latest International Codes and Standards
3. Project referenced Codes Specifications and Standards

CONTRACTOR shall check HSE issues addressed in the Iraq regulations as part of the Regulatory review to ensure most stringent practices are adopted.

EUROPEAN DIRECTIVES, CODES AND STANDARDS

DOC NUMBER	TITLE
EN 60079	Electrical apparatus for explosive gas atmosphere
EN 60529	Protection given by enclosures
EN 61000	Electromagnetic compatibility

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

DOC NUMBER	TITLE
NFPA 70	National Electrical Code

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

DOC NUMBER	TITLE
IEC 60059	IEC standard current ratings
IEC 60061	Lamp caps and holders together with gauges for the control of interchangeability and safety
IEC 60079	Electrical apparatus for explosive gas atmospheres
IEC 60081	Double-capped fluorescent lamps - Performance specifications
IEC 60309	Plugs, socket outlets and couplers for industrial temperatures
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)
IEC 60598	Luminaires
IEC 60662	High-pressure sodium vapour lamps
IEC 60695	Fire hazard testing
IEC 60947	Low voltage switchgear and control gear
IEC 61000	Electromagnetic compatibility (EMC)
IEC 61231	International lamp coding system (ILCOS)
IEC 61547	Equipment for General Lighting Purposes

INTERNATIONAL STANDARDS ORGANISATION (ISO)

DOC NUMBER	TITLE
ISO 9001	Quality Management Systems - Requirements

Electrical system design and equipment specification shall be in accordance with the following order of precedence:

1. International Electrotechnical Commission (IEC) publications.
2. European Standards published by CENELEC.
3. Standards and codes (UTE, BS, VDE, etc.) when I.E.C publications have not yet been issued

VENDOR shall advise COMPANY / CONTRACTOR, any conflict between the referenced documents and any project specification. Resolution of any conflict shall be obtained from the COMPANY / CONTRACTOR in writing before proceeding.

3. GENERAL REQUIREMENTS

3.1. Operation and Design Life

Lighting fixtures shall be designed for minimum life duration of 30 years in the environment and for the duty specified herein and on the Project data sheets.

3.2. Service Conditions

The VENDOR shall take note of the climatic data and comply with the design requirement stated in the Basis of Design **CMIT-230084-1-796-PCS-15.65-00-0001**.

In addition to any requirement stated in this specification and related documents, appropriate operating conditions shall be used in the design and construction of this equipment.

3.3. Scope of Supply

Scope of supply shall be as specified in Material requisition which includes, but not limited to, the following equipment and requirements:

- Lighting Fixtures including flood lights comprising lamps, lighting fittings, control gear, diffusers, covers, brackets and other accessories as required
- Main Lighting Distribution Board, Lighting Distribution Board, Lighting Panels, Lighting Junction Box
- Street Lighting Pole/ Lighting mast

- Welding Receptacles
- Lighting wires/lighting feeder cables
- Inspection and Testing
- Protective coating
- Packaging, shipping and storage
- Spare Parts
- Special Tools
- Documentation, drawings and certification

The following will be provided by others, unless otherwise specified in the data sheets:

- Lighting Transformer
- Incoming cables required between lighting transformer & MLDBs or MLDBs & LDB/PDBs
- Lighting installation works.

3.4. Proven Equipment Criteria

Only equipment of proven reliability in similar service conditions, shall be included in the VENDOR's Bid proposal. Prototypes shall not be offered by the VENDOR. The VENDOR shall provide the related necessary evidence (reference lists with installation dates and run hours accumulated by date, etc.). The units shall have equivalent design features to the units proposed.

3.5. Language

All documentation and communications shall be in the English language.

3.6. Units of Measurement

The units of measurement on all documentation and equipment shall be in SI system, unless otherwise specified.

3.7. Plant Utility Voltages

The plant utility voltages are shown in the table below:

Service	Rated Voltage (kV)	Phase/Wire	Earthing
Lighting fixtures	0.23	1 / 2 + PE	-
Convenient sockets	0.23	1/2 + PE	-
63A Welding (Power) sockets	0.4	3 / 4 + PE	-

AC uninterruptible power supply	0.23	1 / 2 + PE	Earthed

The supply variations at the feeding bus shall be limited under steady-state conditions to:

- supply voltage : +/- 10%
- supply frequency : +/- 3%
- combined voltage and frequency variation : 10% (absolute)

In addition to the above variations, the input voltage may be subject to transient comprising of voltage depressions up to 20% of the nominal voltage during motor starting, and to voltage interruptions during system short circuits. Transient, high frequency voltages may also be superimposed on the input voltage as a consequence of system switching operations etc.

Total harmonic voltage distortion shall not exceed 3 % at any point in the system. Individual odd harmonics will be allowed up to 2% and individual even harmonics will be restricted less than 1.5%. Users which generate harmonic currents shall be provided with harmonic filtration equipment if it is determined that the total harmonic voltage distortion would otherwise be unacceptable.

3.8. Voltage Drops

The maximum voltage drops in various sections of the electrical system shall be within the limits stated in the following table:

Serial No.	System Element	Maximum Permissible voltage Drop
1	Cables between MLDB and LDB	5 %
2	Circuit between LDB and lighting fixtures	
	General	5 %
	Far form Substation, Road lighting, etc.	10%

3.9. Materials

The materials of construction for the equipment shall be as specified in the equipment data sheets and this Specification. When materials are not specified, the materials proposed in the offer shall be suitable for the process fluid, operating / design conditions.

All materials, equipment or supplies furnished under this specification shall be the product of a manufacturer who is experienced in the design and construction of such materials, equipment,

or supplies, and who has furnished similar materials, equipment, or supplies that have been in satisfactory operation for a minimum of three years, preferably in similar environmental conditions, to establish its reliability.

In the case of materials which are specified in the Specification or reference documents, alternate materials may be offered. Any such alternatives shall be clearly indicated in the Bid, along with any cost adjustments and technical data supporting the alternative. Alternative materials shall be subject to COMPANY / CONTRACTOR's written approval.

All materials shall be new, free of defects and be identifiable against their certification.

Dissimilar metals shall not be coupled directly. Suitable insulation (for example: insulation washers/gaskets, fluorocarbon coated bolts and nuts) shall be used if dissimilar metal coupling can not be avoided.

Asbestos products shall not be used.

3.10. HSE Requirements

3.10.1 Noise Limits

The noise levels for each item of operating equipment (including drivers where applicable) shall be in accordance with Noise Control Philosophy and with any subsequent specific noise limitations to meet in plant and community noise limits as well as all the enquiry documentation including data sheets, specifications and codes and standards.

3.10.2 Hazardous Substances

Capacitor electrolytes shall be non-toxic and free from polychlorinated biphenyls (PCB's).

VENDOR shall identify any hazardous materials.

3.11. EMC Requirements

All equipment shall comply with the requirements for EMC as defined in IEC 61000, in order to ensure:

- Conducted emissions in both the power supply input and outputs are controlled within acceptable limits
- Any electromagnetic disturbance generated by the equipment and its individual components do not exceed a level which would affect the correct operation of both radio and telecommunications equipment

- The equipment has an adequate level of intrinsic immunity to external electromagnetic and conducted disturbance to enable it to operate as intended
- The design of the equipment should be of an adequate standard to maintain performance during its operational life in its installed environment.

3.12. Selection of Equipment in Hazardous Area

For classification of Hazardous Areas in the project, IP 15 (2005), 3rd edition can be used as a primary guide and the requirements of NFPA 59, NFPA 59A should also be taken into consideration.

For any equipment specified in Project data sheets to be suitable for installation in hazardous areas, the selection, installation and maintenance of those equipment shall be carried out in compliance with IEC 60079 and shall be suitable for gas group II B, temperature T3 minimum.

For electrical equipment in hazardous areas the minimum protection will be in accordance with the details given in the following table

Equipment	Zone - 1	Zone - 2	Safe area
	Group IIA/IIB/IIC	Group IIA/IIB/IIC	
Lighting Fixtures	Ex “d”	Ex “d” / Ex”e”	Industrial
Lighting Distribution Board, Lighting Panel	Ex “d” (if unavoidable)	Ex “d” / Ex “e” (if unavoidable)	Industrial
Cable Glands	Ex “d”	Ex “d”	Ex”d”
Junction Box	Ex “d”	Ex “e”	Industrial

Electrical equipment for use in plant hazardous areas shall be fully certified, by an approved national certifying authority (IECEx scheme member), for use in those defined areas for respective gas groups. The issue of a certificate of conformity shall confirm certification and the equipment shall bear the mark of the testing authority.

Test certificates shall be provided certifying the complete fixture. Partial certification covering lamp components shall not be acceptable.

The VENDOR shall provide details, at the time of tendering, of all electrical equipment systems together with the appropriate certification standards.

A dossier shall be provided with the Installation and Operating Manual to include the following:

- A schedule of electrical equipment which is certified for use in classified areas. The schedule should identify the manufacturer, type of equipment, category of explosion protection and hazardous area test certificate cross reference
- A file of certificates associated with the hazardous area equipment with suitable contents schedule which contains reference to the schedule of hazardous area electrical equipment in order to identify all equipment conforming to a particular certificate. All certificates shall be in the English language.
- **The Explosion-proof Certificate of lighting fixtures that located in the hazardous area shall be submitted.**

3.13. Ingress Protection

The levels of ingress protection for all electrical equipment shall comply with the relevant IEC Standards and shall be in accordance with the following:

Equipment to be installed in indoor areas : IP 31 (minimum)

Equipment to be installed in outdoor areas : IP 55 (minimum)

3.14. COMPANY / CONTRACTOR Interface

The equipment package shall be required to fall within the parameters defined in Project Drawings. These parameters may include any or all of the following:

- Maximum overall package dimensions
- Structural hard points / fixing locations
- Electrical and Instrument junction box / tie-in locations
- Maximum allowable weight.

3.15. Deviations, Concessions and Change Control

VENDOR shall refer to the Bid documents for the procedure for raising deviations or concession requests to the technical content of this specification.

COMPANY / CONTRACTOR will consider all deviations and concession requests and approval may be granted at the discretion of the COMPANY / CONTRACTOR. No deviation or concession shall be implemented prior to approval being granted. Any deviations or concession implemented prior to approval shall be subject to rejection.

4. TECHNICAL REQUIREMENTS

The design shall be based on the specific requirements stated in this specification, Project Data Sheet(s) and other applicable documents inclusive of the applicable editions of codes and standards listed under clause 2.2.

Any deviations shall be submitted by the VENDOR together with the Bid in the format specified in the Material Requisition / Bid document. In the absence of this, it shall be construed that the VENDOR fully complies with this specification.

The lighting system provided in an installation shall be adequate to achieve the required illumination level in indoor and outdoor locations. Due consideration shall be given to the hazardous area classification while selecting the lighting fixtures for the hazardous areas.

Different types of lighting fixtures and lamps per clause 4.4 below shall be kept to a minimum in order to minimise different types of spare components and lamps.

Lighting calculation shall be performed by using recognised application lighting calculation software.

All external lighting shall be controlled by a photocell device located in the substation. The photocell shall control the contactors installed in the MLDB / LDB via an interposing relay panel. The interposing relay panel shall have an override switch for testing and maintenance purposes. The power for the operation of the photocell shall be derived from an emergency power source.

Internal lighting in the buildings shall be controlled by manual switching as detailed on the lighting layout drawings.

4.1. General Design Requirements

The lighting system shall be split in three main systems:

- Non essential system (70% of total lighting)
- Essential system (30 % of total lighting, fed from emergency generation)
- Critical / Vital system (lighting fittings with self contained battery supplied from essential system)

The normal and essential lighting network shall be fed from 3 phase 400/400-230V lighting transformers.

The basic equipment design for the lighting fixtures shall be the responsibility of the VENDOR.

VENDOR shall submit full technical details of his standard equipment with the Bid proposal, which most nearly meets the requirements detailed herein. Aspects of the requirements, which cannot be met or for which the VENDOR proposes new or alternative technology, shall be identified and the variances explained.

The lighting fixtures provided in an installation shall be adequate to achieve the required illumination level in indoor and outdoor locations. Due consideration shall be given to the hazardous area classification while selecting the lighting fixtures.

Different types of lighting fixtures and lamps shall be kept to a minimum in order to minimise different types of spare components and lamps.

All outdoor lighting shall be controlled by a photocell device located in the substation. The photocell shall control the contactors installed in the LDB via an interposing relay panel. The interposing relay panel shall have an override switch for testing and maintenance purposes. The power for the operation of the photocell shall be derived from an emergency power source.

Aircraft warning lights shall be installed on all structures 40 metres and above and in accordance with local aviation regulations. Bulbs used for aircraft warning lights shall be of long life type. Facility shall be provided to bring down the lighting fixtures for maintenance.

All indoor lighting luminaries (fed from normal, emergency & critical supply) shall be capable of being controlled by manual switching.

Critical lighting fixtures shall be provided for egress route lighting so as to lead personnel out of the building in case of black-out. These lighting fixtures shall be fluorescent tube light fixtures (of required enclosure protection based on the area of installation) comprising a self contained integral battery having 30 minutes autonomy. Integral battery shall be Ni-Cd type.

After completion of installation, COMPANY / CONTRACTOR will check lux levels at various points and if required, SUPPLER shall provide required assistance to take corrective measures.

4.2. Illumination Level Requirements

Lighting fixture arrangements shall be designed to provide the average in-service illumination levels as follows:

S. No.	Installation Location	Average Illumination Level (Lux)	Elevation	Remarks
1	**PROCESS AREAS**			
1.1	Outdoor pumps rows	50	Grade	
1.2	Main operation platforms	50	Floor	
1.3	Ordinary platforms	20	Floor	
1.4	Outdoor bulk storage	5	Ground	
1.5	Stairways & ladders			
1.5.1	Frequently used	30	Floor	
1.5.2	Others	10	Floor	
1.6	Compressor Shelter	200	Floor	
1.7	Yard areas	10	Grade	
2.	**INDOOR AREAS**			
2.1	Control room			Subject to requirements of ergonomic study
2.1.1	General	300	Floor	
2.1.2	Control & desks area	500	750 mm	
2.1.3	Panel vertical	500	1,500 mm	
2.1.4	Back of panels	100	1,200 mm	
2.2	Substation			
2.2.1	Switchgear Room	300	Floor	
2.2.2	Electronic Equipment Room	300	Floor	
2.2.3	PDC Room	300	Floor	
2.2.4	Battery Room	300	Floor	
2.2.5	Cable cellar / gallery	150	Floor	
2.2.6	HVAC room	300	Floor	
2.3	Admin/Quarters Building			
2.3.1	Canteens (dining areas)	150	Floor	

2.3.2	Catering areas (food preparation and serving)	400	Floor	
2.3.3	Communications rooms	400	750 mm	
2.3.4	Computer rooms	400	750 mm	
2.3.5	Conference / Prayer rooms	400	750 mm	With dimming arrangement
2.3.6	Corridors/Lobbies/Stairs	75	Floor	
2.3.7	First aid rooms	400	Floor	
2.3.8	Offices	400	750 mm	
2.3.9	Reception areas	300	Floor	
2.3.10	Recreation rooms and lounges	400	Floor	
2.3.11	Store rooms	50	Floor	
2.3.12	Toilets and locker rooms	100	Floor	
2.3.13	Rest rooms	150	Floor	
2.3.14	Car parks	3	Ground	
2.4	Workshops (mechanical, electrical, Instrument)			
2.4.1	Rough	300	750 mm	
2.4.2	Medium	500	750 mm	
2.4.3	Fine	750	750 mm	With local lighting
2.5	Other Indoor Areas			
2.5.1	Gatehouse/security	350	Floor	
2.5.2	Laboratory	500	750 mm	
2.5.3	Training rooms	400	750 mm	With dimming arrangement
2.5.4	Garage	150	750 mm	
2.5.5	Surgery	Specialist design	Specialist design	
2.5.6	Fire Station	250	Floor	
3	**MISCELLANEOUS**			
3.1	External Vehicle Search Area	50	Grade	

3.2	External Fire Training Area	50	Grade	
3.3	External Open Storage Area	10	Grade	

4.3. Construction Requirements

All fixtures shall be suitable for horizontal or vertical mounting, without any additional protection, and at any angle of tilt or rotation. Fixtures shall be provided with all mounting accessories.

Fixtures shall be supplied complete with associated items such as radio suppressors, capacitors for power factor correction, internal wiring, terminal blocks, internal earthing screws, electronic ballasts, lamps, transparent guards etc. as required and as specified in Project Data Sheets.

All components shall be solid state. All components mounted within the housing shall be mounted on a base plate such that all components together can be removed as a unit.

All terminals shall be secured against loosening by vibration.

All external metal fixings, clips, screws and bolts shall be of stainless steel.

All fixtures shall be provided with an external reflector, of suitable corrosion resistant material and/or coating so as not to diminish the light output due to loss of reflectance.

All non-metallic fixtures shall be of non-combustible, anti-static materials.

All lighting fittings located in an FPZ must be capable of withstanding pressurised release jet physical impact.

4.3.1 Cable Entry

All Lighting Fixtures shall have a minimum of two M20 or M25 threaded cable entries.

Fluorescent fixtures shall have at least one cable entry provided at each end of the fixture and shall be provided with through-wiring for looping of lighting fixtures. Terminal blocks shall be provided at both ends of fixtures at cable entries. All internal wiring shall be suitably fixed.

4.4. Fluorescent Fixtures

All lighting fixtures shall be certified & type of protection shall be as specified in clause 3.12.

Cable entry shall be suitable for certified glands as specified in clause 3.12.

The level of ingress protection for indoor and outdoor fittings shall be as specified in clause 3.13

4.4.1 Standard Fluorescent

Lighting Fixtures shall contain two tubular fluorescent lamps of wattage specified on the Project Data Sheets operating independently such that one lamp remains functional if the other fails.

Lighting Fixtures shall be quick start, flicker free and light weight.

The design of the fixture shall feature a single flameproof path giving a rapid access for wiring, lamp replacement and to control gear.

Control gear shall be high frequency electronic and the power factor shall be no less than 0.9.

The enclosure shall preferably be constructed of LM6 die cast aluminium.

A fully interchangeable polycarbonate diffuser hinged to the enclosure shall be provided. The lamp shall be automatically de-energised when the diffuser is opened.

The Lighting Fixture shall be suitable for mounting on ceilings, walls and poles as specified on the Project Data Sheets.

4.4.2 Recessed Fluorescent

Lighting Fixtures shall contain four/two tubular fluorescent lamps of wattage specified on the Project Data Sheets operating independently such that part of the lamps remains functional if the others fail.

Recessed fluorescent Lighting Fixtures shall be suitable for flush mounting in suspended ceilings or enclosed cavities.

Lighting fixtures shall be suitable for various ceiling types and resistance to voltage fluctuation.

Control gear shall be high frequency electronic and the power factor shall be no less than 0.9.

The enclosure shall preferably be constructed of white polyester painted zinc coated steel body & frame along with silicon rubber gasket and polycarbonate diffuser.

4.4.3 Bulkhead Fluorescent

The enclosure of the fixture shall be aluminium alloy LM6 with all fastening made of stainless steel and glass bowl shall be toughened.

Luminaires shall contain a single compact fluorescent lamp of wattage specified on the Project Data Sheets.

Control gear shall be electronic and the power factor shall be no less than 0.9.

The luminaire shall be suitable for mounting on ceilings and walls as specified on the Project Data Sheets.

4.4.4 Emergency Fluorescent

Emergency Fluorescent luminaires shall be self-contained, battery-backed integral luminaires for emergency and escape route lighting.

Luminaires shall contain two tubular fluorescent lamps of wattage specified on the Project Data Sheets operating independently such that one lamp remains functional if the other fails.

Control gear shall be electronic and the power factor shall be no less than 0.9.

The enclosure shall preferably be constructed of LM6 die cast aluminium.

A fully interchangeable polycarbonate diffuser hinged to the enclosure shall be provided. The lamp shall be automatically de-energised when the diffuser is opened.

The luminaire shall be suitable for mounting on ceilings, walls and poles as specified on the Project Data Sheets.

An integral battery shall be capable of providing backup power for 30 minutes in the event of loss of external power supply. Battery circuits shall include an integral cut-off switch to automatically disconnect the battery from the load before the battery voltage falls below the minimum allowable value recommended by the battery manufacturer. The cut-off switch shall automatically reset on restoration of supply.

A reversible inverter shall be used as a battery charger during normal operation. On failure of the external power supply, the inverter and battery shall be capable of continuously supplying and maintaining one lamp at full illumination for the backup time. The inverter shall operate with the following requirements:

Output frequency regulation: ±5% of rated frequency

Output voltage regulation: ±5% for all loads over the permissible dc input range

The battery shall be mounted within the luminaries in a manner that is conducive to replacement / maintenance without dismantling or replacing other components.

Luminaries shall include external visual indication (i.e. LED or similar) to confirm rectifier/inverter operation and state of battery charge. The indicator shall be red in colour, clearly visible without removing any covers and located in a position which will be visible when the luminaire is mounted in any desirable attitude.

4.4.5 Recessed Emergency Fluorescent

Recessed Emergency Fluorescent luminaries shall be self-contained integral battery-backed luminaries for emergency and escape route lighting. They shall be suitable for flush mounting in suspended ceilings or enclosed cavities.

Lighting Fixtures shall contain four/two tubular fluorescent lamps of wattage specified on the Project Data Sheets operating independently such that part of the lamps remains functional if the others fail.

Control gear shall be electronic and the power factor shall be no less than 0.9.

The enclosure shall preferably be constructed of LM6 die cast aluminium.

An integral battery shall be capable of providing backup power for 30 minutes in the event of loss of external power supply. Battery circuits shall include an integral cut-off switch to automatically disconnect the battery from the load before the battery voltage falls below the minimum allowable value recommended by the battery manufacturer. The cut-off switch shall automatically reset on restoration of supply.

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The battery shall be mounted within the luminaries in a manner that is conducive to replacement / maintenance without dismantling or replacing other components.

Luminaries shall include external visual indication (i.e. LED or similar) to confirm rectifier/inverter operation and state of battery charge. The indicator shall be red in colour, clearly visible without removing any covers and located in a position which will be visible when the luminaire is mounted in any desirable attitude.

4.4.6 Exit Fluorescent

Exit fluorescent Lighting Fixtures shall be self-contained, integral battery backed Lighting Fixtures for “EXIT” or “ESCAPE ROUTE DIRECTION” indication.

Lighting Fixtures shall contain a single tubular fluorescent lamp of wattage specified on the Project Data Sheets illuminating an exit sign cover.

Control gear shall be electronic and the power factor shall be no less than 0.9.

The enclosure shall be constructed of die cast LM6 aluminium alloy.

Exit fluorescent fittings shall be suitable for horizontal ceiling mount or vertical wall mount applications.

An internal integral Ni-Cd battery shall be capable of providing backup power for minimum 30 minutes in the event of loss of external power supply. Battery circuits shall include an integral cut-off switch to automatically disconnect the battery from the load before the battery voltage falls below the minimum allowable value recommended by the battery manufacturer. The cut-off switch shall automatically reset on restoration of supply.

A reversible inverter shall be used as a battery charger during normal operation. On failure of the external power supply, the inverter and battery shall be capable of continuously supplying and maintaining one lamp at full illumination for the backup time. The inverter shall operate with the following requirements:

- Output frequency regulation: ±5% of rated frequency
- Output voltage regulation: ±5% for all loads over the permissible dc input range

The battery shall be mounted within the lighting fixture in a manner that is conducive to replacement / maintenance without dismantling or replacing other components.

Lighting fixtures shall include external visual indication (i.e. LED or similar) to confirm rectifier/inverter operation and state of battery charge. The indicator shall be red in colour, clearly visible without removing any covers and located in a position which will be visible when the Lighting Fixture is mounted in any desirable altitude.

4.5. High Pressure Sodium Luminaires

All lighting fixtures shall be certified & type of protection shall be as specified in clause 3.12.

Cable entry shall be suitable for certified glands as specified in clause 3.12.

The level of ingress protection for indoor and outdoor fittings shall be as specified in clause 3.13.

Control gear shall be provided with radio interference suppressors.

4.5.1 HPS Bulkhead Fixtures

The enclosure of the fixture shall be aluminium alloy LM6 with all fastening made of stainless steel and glass bowl shall be toughened.

Lighting Fixtures shall contain a single high pressure sodium (HPS) lamp of wattage specified on the Project Data Sheets.

Control gear shall be electronic with power factor correction capacitor and the power factor shall be not less than 0.85.

Luminaires shall be suitable for mounting on ceilings and walls as specified on the Project Data Sheets and all mounting accessories shall be supplied by the VENDOR.

4.5.2 HPS Well glass Fixtures

The enclosure of the fixture shall be aluminium alloy LM6 with all fastening made of stainless steel and glass bowl shall be toughened.

Lighting Fixtures shall contain single high pressure sodium (HPS) of wattage specified on the Project Data Sheets.

Control gear shall be electronic with power factor correction capacitor and the power factor shall be not less than 0.85.

The Lighting Fixture shall be suitable for mounting on poles, ceilings and walls as specified on the Project Data Sheets and all mounting accessories shall be supplied by the VENDOR.

4.5.3 HPS Floodlight

The fixture shall be made from aluminium alloy LM6, with all the fastenings made of stainless steel with toughened glass window.

The reflector shall be asymmetrical beam with made of high purity anodized aluminium. There shall be exceptional photometric efficiency with reduced glare.

Lighting Fixtures shall contain single high pressure sodium (HPS) of wattage specified on the Project Data Sheets.

Control gear shall be electronic with power factor correction capacitor and the power factor shall be not less than 0.85.

Luminaires shall be suitable for mounting on walls, stanchions and poles as specified on the Project Data Sheets and all mounting accessories (including stirrup mounting bracket) shall be supplied by the VENDOR.

4.6. MLDBs, LDBs. PDBs and Lighting Panels

These shall comply with the applicable clauses of the Specification – Switchboard/MCC, document number **CMIT-230084-1-796-ELE-15.03-00-0001**.

MLDBs shall be fixed type with a double front design. Incoming MCCB feeders of MLDB and all the outgoing feeders of MLDB rated above 100A shall be provided with 96x96 mm sq. analogue ammeter, voltmeter and corresponding selector switches.

MLDB will feed lighting and socket outlets in the vicinity and also the LDBs and PDBs to be provided for complete lighting & power distribution adequate for the plant.

MLDB shall be located inside substation, unless specified otherwise.

The number of LDBs and Lighting panels shall be considered based on location / area served and total loading. LDBs and Lighting Panels will generally be installed in indoor areas like Substations, Instrument Technical Rooms, Administration Buildings and Control Room. If required in outdoor areas, the LDBs and Lighting panels shall preferably be installed in safe areas. In case it is necessary to install them in hazardous area, the same shall be certified as specified in clause 3.12.

For LDBs, incomer shall be provided with load break switch and outgoings shall be with MCBs for control and protection of lighting circuits.

Lighting Panels shall be wall mounted with load break switch on incoming side and MCBs on outgoing sides.

For PDBs, incomer shall be provided with load break switch and outgoings shall be provided with MCCB/MCBs.

All MLDBs and LDBs shall have 400/230V, 3 phase/neutral+earth, single bus with two sections, viz uncontrolled section and photo cell controlled section. The photo cell controlled section shall be controlled by a unit as specified in clause 4.10. All the indoor lighting fixtures shall be fed from uncontrolled section and all the outdoor lighting fixtures shall be fed from photo cell controlled section. Wherever the area wise lighting loads are less, MLDB itself shall cater to the indoor and outdoor lighting fixtures.

Each circuit shall be rated to 16A. A minimum of 25% of MCBs of each board shall be left as spares.

Wiring in hazardous area shall be done by using minimum 2.5mm² copper conductor armoured cable. Circuit wiring feeding hazardous areas shall be controlled by two pole MCBs (for phase as well as neutral isolation). Correct type of lighting equipment (fixtures and lighting JBs) with regard to enclosure protection as specified elsewhere shall be installed for the areas classified as Zone 1, Zone 2 etc.

Necessary conduits shall be provided for exposed / concealed wiring.

4.7. Convenience Socket Outlets and Welding Receptacles

Enclosures of the convenience receptacles shall be suitable for individual areas of site conditions such as weather proof, dust proof, flame proof, corrosion resistant etc. Necessary interlocks and Earthing facilities shall be provided in accordance with safety requirements.

The welding receptacle shall be 63A, 400V, TPNE type. Separate circuit shall be provided for each welding receptacle. Welding receptacles shall be fed from LV Switchboard.

16A, 230V, single phase, 2 Wire + E sockets shall be provided.

Outdoor receptacles shall be provided with canopies.

Socket outlets and their associated plugs operating at different voltage levels shall not be interchangeable. There shall be no interchangeability between receptacles and plugs certified or approved for hazardous areas and those meant only for non-hazardous areas. Socket

outlets shall be fed from the section of the MLDB / LDB, which shall not be controlled from photocell.

Socket outlets shall be supplied from the circuit having earth leakage protection.

4.8. 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.

4.9. 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.

4.10. Lighting Cables and Wires

VENDOR shall supply the lighting cables and wires, as required by Material Requisition / Project data sheets.

Lighting cables shall be stranded annealed copper conductor, XLPE insulated, steel wire armoured, PVC outer-sheathed cables.

Lighting wires shall be stranded annealed copper conductor, with extruded PVC outer-sheath. However, PVC insulated 3 core (phase, neutral and earth) copper conductor armoured cable shall be used for hazardous areas.

All cables and wires supplied by the VENDOR shall comply with the applicable clauses of the Specification – Power, Control and Earthing Cables, document number **CMIT-230084-1-796-ELE-15.03-00-0005**.

Lighting power will generally be distributed from MLDB / LDB by 3 phase + neutral, stranded annealed copper conductor, XLPE insulated, steel wire armoured, PVC outer-sheathed cables, to Lighting Panel / Junction Box (except for smaller loads, where single phase supply is given to Lighting Panel / Junction Box). Outgoing from Lighting Panel / Junction Box shall be distributed as single phase circuit using lighting wires with stranded annealed copper conductor and extruded PVC outer-sheath, except that in hazardous areas, PVC insulated 3 core (phase, neutral and earth) copper conductor armoured cable shall be used.

4.11. Junction Boxes

Junction Boxes shall have six rail-mounted terminals in a single row, arranged in linked pairs, with segregated dividing plates between each linked pair.

Power terminals shall be raising screw clamp type, rating as per Project data sheets. Each terminal shall be suitable for a wide range of stranded copper conductor sizes as shown on Project data sheets. Only one conductor shall be used each side of terminal.

Terminals to be marked L, N & PE/E using pre marked plastic letters.

The earth terminal shall have an additional clamp mechanism to bond to the terminal rail and shall be used to connect to the earth continuity plate.

The junction boxes shall be fitted with a M10 internal/external earth stud. This is to be bonded internally to the earth continuity plate and the terminal rails with a 2.5mm² earth conductor.

All junction boxes to be installed outdoors shall have ingress protection specified in clause 3.13.

The minimum certification requirements for socket outlets and plugs installed in a hazardous outdoor area shall be according to clause 3.12.

Certified outdoor junction boxes installed in hazardous areas shall comply with the requirements under the relevant IEC Standards.

The certified enclosures shall be provided complete with the installation hardware/accessories required.

All cable glands entering into a certified enclosure shall do so through threaded entries. Threaded entries shall be ISO metric tapped. Cable entries shall be provided as specified on the Project Data Sheets.

All entries into certified enclosures shall be on the bottom or side of the enclosure, however bottom entry is preferred. Top entry is not allowed.

All unused entries into certified enclosures for hazardous areas shall be sealed with suitably certified plugs with at least five (5) threads engaged in the entry to ensure the certification is maintained. Plugs shall be dual-certified Ex ''de'' type, and shall maintain the ingress protection (IP) of the equipment.

Means shall be provided to preserve the electrical continuity of the armouring and/or metallic sheaths of cables by bonding the cable glands to each other and to earth. This can be achieved internal to the enclosure, preferably via an earth continuity plate, or by means of suitable proprietary earth connected by an earthing conductor to the enclosure earth.

5. EQUIPMENT QUALITY ASSURANCE, INSPECTION & TESTING

For the activities listed below, VENDOR shall comply with the requirements specified in relevant clauses of the Material Requisition/ Bid Document, in addition to the following:

5.1. Quality Assurance

The VENDOR shall demonstrate that they operate a quality system in accordance with an internationally recognized standard. The effectiveness of the quality system and the VENDOR's compliance with it shall be subject to monitoring by COMPANY / CONTRACTOR and in addition, may be audited following an agreed period of notice.

The VENDOR shall submit a quality control program for COMPANY / CONTRACTOR review at the time of Bid.

The VENDOR shall provide facilities for, and cooperate with, COMPANY / CONTRACTOR and Inspectors during manufacturing, assembly and testing.

5.2. Inspection

The COMPANY / CONTRACTOR or its authorised representatives shall be permitted at all times free access to all parts of VENDOR's workshops that concern the construction and testing of the lighting fixtures.

5.3. Testing

All testing shall be carried out at the manufacturer's test facility. Test equipment shall be supplied by the VENDOR and shall be calibrated within six months of the test date. The minimum scope of testing is summarised below. The VENDOR shall supply an ITP with the Bid.

The VENDOR shall provide the COMPANY / CONTRACTOR with advance notice as per the provisions of the Material Requisition, to witness tests performed in either the VENDOR's shop or his sub- VENDOR's shops.

5.3.1 Type Tests

Type Tests for lighting fixtures shall be carried out with supervision and certification by a recognized testing authority. The tests shall comply with the requirements of IEC 60598. Type test certificates shall be submitted with the Bid.

On completion of tests and before dispatch of Lighting Fixtures from the VENDOR's works, the VENDOR shall supply a full set of test documents to the COMPANY / CONTRACTOR. The test documents shall include, but not be limited to, all of the test data for the following Type Tests:

- Discharge Test (Emergency Fixtures)
- Photometry tests

Where previous type testing has been completed on equipment of identical design, type test documentation may be submitted in lieu of performing each of the listed type tests.

Type Tests for lighting distribution boards / panels shall be carried out with supervision and certification by a recognized testing authority. The tests shall comply with the requirements of IEC 61439.

On completion of tests and before dispatch of Distribution Boards from the VENDOR's works, the VENDOR shall supply a full set of test documents to the CONTRACTOR. The test documents shall include, but not be limited to, all of the test data for the following Type Tests:

- Temperature rise test
- Short-Circuit withstand tests
- Dielectric type tests
- Lightning Impulse test. Where the standard allows the choice of two impulse levels, these tests shall be at the lower level

Where previous type testing has been completed on equipment of identical design, type test documentation may be submitted in lieu of performing each of the listed type tests.

5.3.2 Routine Tests

Prior to delivery, each Lighting Fixture shall undergo the following routine tests and checks. Tests shall comply with the requirements of IEC 60598. All tests may be witnessed by the COMPANY / CONTRACTOR. Full written test reports shall be submitted to the COMPANY / CONTRACTOR on completion of the tests.

- Functional test

Prior to delivery, each Lighting Distribution Board / panel shall undergo the following routine tests and checks. Tests shall comply with the requirements of IEC 60439. All tests may be witnessed by the CONTRACTOR. Full written test reports shall be submitted to the CONTRACTOR on completion of the tests.

- Point to point continuity tests
- Separate source voltage withstand test
- Measurement of insulation resistance to earth
- Verification of all protection devices
- Visual inspection of overall finish, painting, welds, metal works, lifting lugs, terminal fastening, insulation, terminations, fixings etc
- Dimensional checks – mounting, terminals, leakage paths, centre lines, overall dimensions and weight
- Check of distribution board auxiliaries and accessories against specification requirements including function testing
- Check of the rating plate, nameplate and any additional markings and labels required by the specification

5.4. Inspection and Test Plan (ITP)

The VENDOR shall submit Inspection and Test Plan, in accordance with the Material Requisition, along with the Bid documents. The ITP shall list all inspections and tests proposed for the equipment by the VENDOR, between the date of ordering and the date of delivery.

The VENDOR shall be responsible for the planning and execution of all inspections and tests, but the COMPANY / CONTRACTOR's representative shall have the right to witness any or all of the manufacturing, inspection or tests.

The COMPANY / CONTRACTOR and the VENDOR shall sign off the final version of the ITP, which, thereafter, shall form part of the contract documents.

The VENDOR shall provide the COMPANY / CONTRACTOR with advance notice as per the provisions of the Material Requisition, of the date on which any of the inspections or tests nominated as Hold or Witness points on the ITP are due to be carried out.

Certificates of Test shall be provided for each item of equipment to prove it has been satisfactorily tested to meet all requirements of its appropriate manufacturing standards, whether or not witnessed by the COMPANY / CONTRACTOR.

Where appropriate, test certificates shall state values for all test results. Tests for which the results are indicated as pass or fail shall be qualified by the relevant acceptance criteria.

5.5. Commissioning and Start-Up

The VENDOR, in their Bid, shall identify any special requirements or recommendations for VENDOR support during commissioning and start up of the equipment supplied. The COMPANY / CONTRACTOR's final acceptance of the equipment will be subject to a performance test once the equipment has been installed and commissioned.

5.6. Training and After Sales Support

The VENDOR shall comply with the relevant provisions of the Material requisition / Bid document for training and other activities.

The VENDOR, in their Bid, shall provide details of their after sales support capability. VENDOR shall advise their nearest service representative and nearest service facility to the project fabrication yard and the facility location.

6. PROTECTIVE COATINGS

All surface preparation, painting and protective coatings shall be in accordance with the document, **CMIT-230084-1-796-PAI-15.03-00-2001**, titled SPECIFICATION FOR PAINTING.

Where the manufacturer's standard painting is offered, the VENDOR shall submit the standard paint specification with the Bid for COMPANY / CONTRACTOR's approval. Where the COMPANY / CONTRACTOR deem the standard painting specification as insufficient, alternative requirements will be negotiated during the Bid evaluation.

Exterior surfaces of equipment shall be finish coated to the colours specified in specified in Project Data Sheet.

All electrical equipment and conductors in contact with the atmosphere shall be suitably protected to prevent deterioration in the adverse environmental conditions utilising suitable plating, encapsulation, varnish and materials with anti-fungal and anti-tracking properties.

VENDOR shall supply paint for the field touch-up after installation of equipment.

7. RATING PLATE

Each Lighting Fixture & DBs, UPS etc. shall be provided with a stainless steel rating plate fitted in a visible position. Entries on the rating plate shall be indelibly marked, by etching, stamping or engraving. Rating plates shall be secured by stainless steel screws or rivets.

The following information shall be given in all cases:

- Manufacturer's Name
- Manufacturer's Serial Number
- Year of Manufacture
- IP Rating
- Lamp type / wattage
- Supply voltage / frequency
- Hazardous Area Certification

8. PACKING, SHIPPING AND STORAGE

The VENDOR shall ensure that detailed and specific instructions for the preservation and maintenance of equipment while stored at the construction site, from receipt at site to operational start-up, shall be delivered to construction site with the equipment. Such instructions shall include as a minimum the preservation and maintenance schedule, preservative materials, lubricants to be used etc.

Preparation for shipment and storage, as well as handling of equipment shall be in accordance with the VENDOR's standard procedures, which shall be subject to approval. However, the following are the minimum requirements.

a. Each shipping container shall be clearly identified with the contents, purchase order number and item number.
b. Any exposed equipment that may be damaged by slings and lifting equipment during transportation and installation shall be removed and protected. All temporary supports and bracings required for transporting or lifting condition shall be provided by the VENDOR and shall be painted red. Where it is necessary to employ spreader beams to lift and handle large equipment packages, the VENDOR shall quote this equipment as an option to the basic package scope of supply.
c. Equipment and materials shall be preserved and protected to withstand road and sea transit and an extended period of storage on the job site of 12 months. Equipment shall be protected to safeguard against all adverse environment conditions that may be encountered during shipment, storage and installation.
d. All parts shall be properly marked and conditioned for shipment and thoroughly cleaned of loose scale, dirt and other foreign material before shipment.
e. All liquids used for cleaning or testing shall be completely drained and all units dried inside prior to shipping.
f. Exposed bolted connections shall be protected by wooden cover plates and threaded connection shall be protected by steel plugs or caps.
g. All items subject to internal preservation shall be tagged and marked, so to be identified. Tagging shall indicate the type of preservation used.
h. All exposed unpainted surfaces shall be coated with approved preservatives either wrapped with Denso tape or equivalent.
i. Location of lifting points, the weight and the centre of gravity shall be clearly marked on all shipping containers.
j. Where items are required to be dismantled for shipping, instructions shall be provided for reassembly of sections in the field.
k. The VENDOR shall separately pack any miscellaneous equipment that must be removed for shipment.
l. All cable entries shall be sealed to IP55 for shipping.
m. Load test certificates shall be shipped with all lifting equipment, spreader bars, slings and shackles.

All equipment shall have been fully tested and inspected prior to packaging. No packaging activities shall commence without the prior consent of the COMPANY / CONTRACTOR. The COMPANY / CONTRACTOR shall be notified of the dates of packaging with sufficient notice to allow attendance for completion of inspection and release certificates without affecting the required delivery schedule.

No equipment shall be allowed to leave the VENDOR's premises without such certificate being signed, or a written waiver issued.

9. SPARE PARTS & SPECIAL TOOLS

9.1. Spares

The VENDOR shall comply with the requirements stipulated in the applicable Bid document.

The VENDOR shall identify the following spares:

- Pre-commissioning, commissioning and start-up spares
- Recommended spares list for two years trouble free operation

Spares shall be itemised and priced with the Bid.

The COMPANY / CONTRACTOR shall agree Spares to be included in Purchase Order.

The VENDOR shall complete the Spare Parts interchangeability Record (SPIR) Form to be supplied by the COMPANY / CONTRACTOR.

The VENDOR shall clearly state location of factory which manufactures quoted spares.

9.2. Special Tools

The VENDOR shall identify all necessary special tools required to perform routine maintenance and any other recommended tools for specialised procedures.

Special tools shall be itemised and priced with the Bid.

The COMPANY / CONTRACTOR shall agree the Special Tools to be included in Purchase Order.

The equipment Operation and Maintenance Manuals shall include a list of special tools and instructions how to use them.

10. DOCUMENTATION

The VENDOR shall be responsible for providing all documentation in accordance with Material requisition and the applicable documents like VENDOR Data Requirements Schedule (SDRS) provided by the COMPANY / CONTRACTOR.

All documentation shall be forwarded to COMPANY / CONTRACTOR's nominated address.

Fabrication of any equipment shall not commence until the COMPANY / CONTRACTOR has reviewed and approved calculations, drawings and any other design documentation.

As part of his Bid the VENDOR shall include the information requested with Bid and as instructed in the SDRS.