

**TAMILNADU GENERATION & DISTRIBUTION  
CORPORATION LIMITED**

**1 X 800 MW NORTH CHENNAI STAGE-III BTG**

***VOLUME – II***

**TECHNICAL SPECIFICATION FOR  
LIGHTING FIXTURES, LAMPS AND MISCELLANEOUS ITEMS**

**SPECIFICATION NO : PE-TS-423-558-E006, REV-0**



**BHARAT HEAVY ELECTRICALS LIMITED  
POWER SECTOR  
PROJECT ENGINEERING MANAGEMENT  
NOIDA, UTTAR PRADESH, INDIA – 201301**



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**COMPLIANCE CERTIFICATE**

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.
2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'.
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in BOQ-Cum-Price schedule of the specification shall not be considered (i.e. technical description & quantities as per specification shall prevail).



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**SPECIFIC TECHNICAL REQUIREMENTS**

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## 1.0 SCOPE OF SUPPLY AND SERVICES

- 1.1 **SUPPLY:** Design, manufacture, assembly, inspection & testing at vendor's/ sub-vendor's works, proper packing and delivery to site of LIGHTING FIXTURES, LAMPS & MISCELLANEOUS ITEMS as mentioned in different sections of this specification, complete with all accessories for efficient and trouble-free operation.
- 1.2 **SYSTEM DESIGN ENGINEERING:** System Design Engineering is included in vendor's scope, which includes design of complete lighting system for indoor and outdoor areas of the power plant. Please refer the list of LLO/LDC/CLO/PDS drawings as per Annexure-B for the tentative areas to be covered by the lighting system. The aspect of engineering covers preparation of electrical distribution and control schemes, quantity estimation, luminaire layout drawings, conduit layout drawings, wiring schemes upto luminaires, cable schedules and all associated design work not specifically mentioned in the specification. The quantity estimation to include all items required for the complete lighting system viz. lighting fixtures, lamps, Lighting DBs, Welding DBs, lighting panels, conduits, PVC wires etc.
- 1.3 Supervision of Erection & Commissioning (as required by site) of lighting system is included in vendor's scope.
- 1.4 Although Erection and Commissioning is not included in vendor's scope, the vendor shall still not be absolved of his responsibility of establishing the correctness of engineering and equipment at site.
- 1.5 Standard technical requirements of the lighting fixtures, lamps & miscellaneous items and lighting system design requirements are indicated in Section-II. Project specific requirements/changes are listed in Section-I.
- 1.6 The stipulations of Section-I, followed by those of Data Sheet-A shall prevail and govern in case of conflict between the corresponding requirements of Section-I and Section-II.
- 1.7 Review of sub-vendor's documents by the purchaser shall not relieve the vendor from the responsibility of design & supply.
- 1.8 The documents shall be in English language and MKS system of units.
- 1.9 Make of all equipment and components shall be as per attached Sub-Vendor List enclosed as per Annexure-A to section- I.

## 2.0 BILL OF QUANTITIES:

- 2.1 Quantity requirements shall be as per BOQ-cum-price schedule as part of NIT.

## 3.0 STATUTORY AND REGULATORY REGULATION

- 3.1 Statutory and regulatory regulation shall be applicable as per Indian Electricity Rule, 1956 with amendment-3 Rule no. 35, 48, 49, 50, 61 & 64 for illumination & low voltage power services.

## 4.0 DOCUMENTATION

- 4.1 Documents required alongwith the technical offer:-



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- Signed & Stamped copy of Compliance certificate
- Duly filled in signed & stamped copy of scope matrix for broad activities
- Signed & stamped copy of unpriced price schedule with quoted indicated against all items.

4.2 Documents required after award of LOI/PO shall be as per Annexure -B (to be submitted by successful bidder).

**5.0 SPECIFIC TECHNICAL REQUIREMENTS**

**5.1**

| S.No. | Reference clause No. of Section-II                                           | Specific requirement/Change                                                                                                                                        |
|-------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | 5.2.1(n), Page-17                                                            | "The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall be not less than 70Lm/W" shall be read as "The LED chip efficacy shall be min 120 Lm/W" |
| 2     | Additional Clause no.6 to be added under annexure-I of section-II as below:- |                                                                                                                                                                    |

**6.0 LED Luminaires With Fitting (Integrated/ retrofitted LED lamp to be provided as a part of Luminaire)**

| Clause no. (Annex-I, Section-II) | Type of Luminaire | Description                                                                                                                                                                                                                                      | Total Luminous flux (Lumen)- Minimum value | Measured Electrical Input Power(Watt)- Maximum value |
|----------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------|
| 6.1                              | FC02(LED)         | Indoor LED batten suitable for conduit/surface/suspended mounting, aesthetically designed CRCA housing and frosted diffuser and having an integral driver. Fixtures suitable to meet the Utility Area aesthetic requirement, comparable to FC02. | 3780                                       | 42                                                   |
| 6.2                              | FC06(LED)         | Indoor LED batten suitable for conduit/surface/suspended mounting, aesthetically designed CRCA housing and frosted diffuser and having an integral driver. Fixtures suitable to meet the                                                         | 3780                                       | 42                                                   |



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|     |           | Switchgear Room aesthetic requirement, comparable to FC06.                                                                                                                                                                                                                                                                                                                                     |      |    |
| 6.3 | FC07(LED) | Indoor LED batten suitable for conduit/surface/ suspended mounting, aesthetically designed CRCA housing and frosted diffuser and having an integral driver. Fixture shall operate on 220V DC input supply. Necessary accessories like DC to AC convertor etc to be included accordingly, if required. Fixtures suitable to meet the Switchgear Room aesthetic requirement, comparable to FC07. | 1260 | 14 |
| 6.4 | FC26(LED) | Flat Panel (1200 mm X 300 mm) LED luminaire suitable for recess mounting in false ceiling, Aesthetically designed powder coated CRCA housing with high purity anodizes aluminium mirrors having an integral driver. Fixtures suitable to meet the Control Room aesthetic requirement, comparable to FC26.                                                                                      | 3780 | 42 |
| 6.5 | FC30(LED) | Flat Panel 600 mm X 600 mm LED luminaire suitable for recess mounting in false ceiling, aesthetically designed powder coated CRCA housing with high efficiency opal diffuser having an integral driver. Fixtures suitable to meet the Control Room aesthetic requirement, comparable to FC30.                                                                                                  | 3780 | 42 |
| 6.6 | FC32(LED) | Decorative, surface mounted with mirror optic having an integral driver. Fixture shall be suitable & comparable to FC32.                                                                                                                                                                                                                                                                       | 3780 | 42 |
| 6.7 | FC33(LED) | Decorative, recessed type with mirror optic having an integral driver. Fixture shall operate on 220V DC input supply. Necessary accessories like DC to AC convertor etc to be included accordingly, if required. Fixture shall be suitable & comparable to FC33.                                                                                                                               | 1260 | 14 |



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| 6.8  | FC34(LED) | Dust Proof totally enclosed type having an integral driver. Fixture shall operate on 220V DC input supply. Necessary accessories like DC to AC convertor etc to be included accordingly, if required. Fixture shall be suitable & comparable to FC34. | 1260  | 14  |
| 6.9  | FC81(LED) | Corrosion proof, totally enclosed type with sheet aluminium/ polycarbonate housing having an integral driver. Fixture shall be suitable & comparable to FC81.                                                                                         | 3780  | 42  |
| 6.10 | SS61(LED) | Street light with one piece cast aluminium body having an integral driver. Fixture shall be suitable & comparable to SS61.                                                                                                                            | 4680  | 52  |
| 6.11 | SS62(LED) | Street light with one piece cast aluminium body having an integral driver. Fixture shall be suitable & comparable to SS62.                                                                                                                            | 10080 | 112 |
| 6.12 | SS63(LED) | Street light with two piece cast aluminium body having an integral driver. Fixture shall be suitable & comparable to SS63.                                                                                                                            | 16920 | 188 |
| 6.13 | SB11(LED) | Industrial type LED fixture having an integral driver. Fixture shall be suitable & comparable to SB11.                                                                                                                                                | 10080 | 112 |
| 6.14 | SB02(LED) | Industrial type LED fixture having an integral driver. Fixture shall be suitable & comparable to SB02.                                                                                                                                                | 16920 | 188 |
| 6.15 | SB03(LED) | Industrial type LED fixture having an integral driver. Fixture shall be suitable & comparable to SB03.                                                                                                                                                | 27000 | 300 |



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| 6.16 | SF63(LED) | Flood light, heavy duty type LED fixture having an integral driver. Fixture shall be suitable & comparable to SF63.                                                                                                                        | 16920   | 188   |
| 6.17 | SF64(LED) | Flood light, heavy duty type LED fixture having an integral driver. Fixture shall be suitable & comparable to SF64.                                                                                                                        | 27000   | 300   |
| 6.18 | SF66(LED) | Flood light, heavy duty type LED fixture having an integral driver. Fixture shall be suitable & comparable to SF66.                                                                                                                        | 2X27000 | 2X300 |
| 6.19 | SW41(LED) | Well glass, vapour proof with vitreous enamelled/powder coated reflector type LED fixture having an integral driver. Fixture shall be suitable & comparable to SW41                                                                        | 4680    | 52    |
| 6.20 | SW42(LED) | Well glass, vapour proof with vitreous enamelled/powder coated reflector type LED fixture having an integral driver. Fixture shall be suitable & comparable to SW42.                                                                       | 10080   | 112   |
| 6.21 | MW96(LED) | Well glass, flame proof increased safety luminaire with vitreous enamelled reflector type LED fixture having an integral driver suitable for division-2, Group IIA/IIB of hazardous areas. Fixture shall be suitable & comparable to MW96. | 8460    | 94    |

**Notes:**

- 1) LED must comply all the parameters of IS 16105 or IESNA LM-80-08.
- 2) The Luminaire must comply all the parameters of IS 16106 or IESNA LM-79-08.
- 3) The LED driver should comply to IEC 61347-2-13, IS 15885: Part 2: Sec 13, IEC 62384, IS 16104 and CISPR 15.
- 4) The luminaire complete with all accessories shall comply to relevant specified standards.
- 5) The values of minimum luminous flux & maximum measured electrical input power are specified above for the luminaire (including any accessories like driver module etc). These values shall be measured as per IS 16106 & shall not be subject to any further tolerance.
- 6) All parameters mentioned in Section-II, Clause 5.2.1 are to be complied in totality.

|                                                                                   |                                                                                 |                                         |
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## 5.0 SPECIFIC TECHNICAL REQUIREMENTS (Continued)

### 5.2 LIGHTING SYSTEM DESIGN:

- 5.2.1 Lighting system will be designed to ensure adequate uniform visual performance, safety & reliability and will be free from excessive glare and flicker from discharge lamp. In main control room, particular attention will be given to ensure that illumination is proper and aesthetic. Control room lighting will be such as to prevent any glare/ luminous patch on control board /panel/ VDUs when viewed from an angle.
- 5.2.2 All fixtures shall be of a proven design for applications in power plant environment. All outdoor fixtures shall be weatherproof type.  
All outdoor fixtures shall be with DOP IP-55.  
All fluorescent fixtures, lamp & ballast shall be of following type:  
Fixture [Energy efficient]: T5 type  
Lamp: 28 W  
Ballast : Electronic ballast  
**Type of fixtures/ lux level shall be as per annexure-I**
- 5.2.3 LED medium bay fixtures will be installed in areas with sufficient minimum headroom of 5 meter.  
However, above minimum headroom may or may not be feasible in boiler/ HRSG area and fixture will be mounted on columns/bottom of platform as per site requirement. Separate mounting arrangement shall be provided that shall be supported from handrails provided on boiler platform walkway, if mounting structure is not available.
- 5.2.4 Flame proof LED lighting fixtures will be installed in hazardous area as per area classifications. All highbay fixtures will have vibration damper.
- 5.2.5 In general, the type of fixtures, type of luminaries and illumination levels to be achieved will be as per enclosed Annexure-I.
- 5.2.6 The lighting fixtures in the plant area will be group controlled from lighting panel. The lighting fixtures in office areas, control rooms, AC areas/Service building etc. will be controlled by switches.
- 5.2.7 Lighting panel (LP) for controlling lights with additional provision for manual control shall be provided:  
Indoor lighting panel: Without Timer  
Outdoor lighting panel: With Timer
- 5.2.8 Outdoor areas like Fuel oil tank area, open store etc. shall have flood light fixtures mounted on flood light poles.
- 5.2.9 Type of luminaries used for lighting of all indoor & Outdoor areas as per Annexure-I. For DC lighting & Hazardous areas LED type luminaries shall be used.

|                                                                                   |                                                                                                                                                                                           |                                         |
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| 5.3                                                                               | ILLUMINATION DESIGN CALCULATION:                                                                                                                                                          |                                         |
| 5.3.1                                                                             | Lighting design for indoor areas will be done by LUMEN method only.<br>For a given indoor area, number of luminaires is calculated as follows:                                            |                                         |
|                                                                                   | $\text{Number of luminaires} = \frac{L \times W \times \text{LUX LEVEL (Average)}}{\text{LUMEN} \times \text{COU} \times \text{MF}}$                                                      |                                         |
|                                                                                   | where,                                                                                                                                                                                    |                                         |
|                                                                                   | L= Length of room (Restricted to Max. 5 times of width)                                                                                                                                   |                                         |
|                                                                                   | W= Width of room                                                                                                                                                                          |                                         |
|                                                                                   | LUMEN= Lumen output of each lamp                                                                                                                                                          |                                         |
|                                                                                   | COU= Coefficient of Utilisation                                                                                                                                                           |                                         |
|                                                                                   | MF= Maintenance Factor                                                                                                                                                                    |                                         |
|                                                                                   | Coefficient of Utilisation (COU) is determined from the COU chart for a particular luminaire of the manufacturer, corresponding to selected reflection factors and calculated Room Index. |                                         |
|                                                                                   | The working plane from the floor level considered at : 0.85 meter                                                                                                                         |                                         |
|                                                                                   | The Room Index is calculated by the following formula:                                                                                                                                    |                                         |
|                                                                                   | $\text{Room Index} = \frac{L \times W}{(L + W) \times \text{MH}}$                                                                                                                         |                                         |
|                                                                                   | where, MH = Mounting height of luminaire.                                                                                                                                                 |                                         |
|                                                                                   | The Reflection Factor (RF) will be considered as given below:                                                                                                                             |                                         |
|                                                                                   | Ceiling (rc)                                                                                                                                                                              | Wall (rw) Floor (rf)                    |
|                                                                                   | 70                                                                                                                                                                                        | 50 10                                   |
|                                                                                   | For clear areas such as switchgear room/ control room etc                                                                                                                                 |                                         |
|                                                                                   | 50                                                                                                                                                                                        | 30 10                                   |
|                                                                                   | For Dusty area such as conveyor galleries/tunnels, TPs/ Crusher House etc                                                                                                                 |                                         |
|                                                                                   | Values of Maintenance Factor (MF), which includes the luminaire depreciation factor also as per IS-3646, will be considered as given below:                                               |                                         |
|                                                                                   | Boiler area 0.55                                                                                                                                                                          |                                         |
|                                                                                   | Air conditioned offices/ control rooms with false ceiling= 0.75                                                                                                                           |                                         |
|                                                                                   | Switchgear/MCC Rooms in TG Building/ Service Building= 0.65                                                                                                                               |                                         |
|                                                                                   | Other indoor areas= 0.6                                                                                                                                                                   |                                         |
| 5.3.2                                                                             | Lighting design for outdoor area, open area shall be done by computer programme as per standard norms for lighting design to meet the specified lux level.                                |                                         |
|                                                                                   | Average maintenance factor for outdoor and road lighting : 0.55                                                                                                                           |                                         |
|                                                                                   | For outdoor lighting and road lighting ratio of minimum to average illumination will not be less than 0.3 and for minimum to maximum will not be less than 0.05.                          |                                         |

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| <b>5.4 LIGHTING SYSTEM DESCRIPTION</b><br><br>Lighting system will be provided with AC normal, AC emergency and DC emergency as listed against various areas as per Annexure-II enclosed.<br><br>The sources of power lighting are as below :<br>(i) 415V AC Normal (ACN) Supply from different station PMCCs /MCCs<br>(ii) 415V AC Emergency (ACE) Supply from Emergency Board<br>(iii) 220V DC Emergency Supply from DC Distribution Board<br>(iv) 24V AC Supply for maintenance<br><br>For main plant area normally all AC luminaries will be in service on normal AC supply.<br>Approximately distribution of AC Luminaries on AC normal and AC emergency shall as below:<br>AC Normal (ACN) supply: 80 %<br>AC Emergency (ACE) supply: 20 %<br><br>Normally all DC luminaries shall be 'ON'. Upon failure of AC supply, DC luminaries will be 'ON' through DC supply. On restoration of AC Emergency supply through DG, ACE luminaries will be put-on.<br><br>For other auxiliary areas AC Normal lighting will provide 100% illumination level and normally all AC lighting fixture shall remain "ON" as long as normal AC supply is available. In DG room, in addition to DC emergency lighting, 100% AC emergency lighting will be provided.<br><br>Lighting level by DC emergency lighting will be provided for approximately 10% Lux level. DC fixtures will be located at strategic locations such as near entrance, staircase, landings etc. for safe personnel movement during emergency.<br><br>In off-site areas/odd locations (BHEL scope), for safe movement of personal during emergency, self contained battery operated emergency lighting units (ELUs) is envisaged.<br><br>Floor Mounted Main Lighting Distribution Board with lighting transformer shall be of MS type. However other area wise lighting DBs shall be of FRP type.<br><br>Junction boxes shall be of 16SWG sheet steel hot-dip galvanized, dust and damp proof, generally conforming to IP-66. Junction boxes for outdoor use shall be FRP weatherproof IPW-66 and those for hazardous location shall be flame-proof type.<br><br><b>5.4.1 AC Normal Lighting Systems:</b><br>AC Normal lighting fixtures are fed through a number of conveniently located AC Lighting panel (ACLP) which are fed from Lighting Distribution Board (LDB).<br><br>LDBs consisting of dry type isolation transformer housed in LDB with proper separation from distribution panels as per details indicated below is envisaged:<br>Transformer rating: 50 / 100 kVA<br>Transformer voltage ratio: 415 / 433 Volt, taps of +5% to -5% in steps of 2.5%.<br>Transformer type: Encapsulated<br>Distribution Panel type: Single front fixed type<br>LDB Configuration: Two incomer & buscoupler<br>Incomer type: TPN MCCB<br>Incomer rating: As per lighting transformer rating<br>Outgoing feeder type: TPN MCCB<br>Outgoing feeder rating: 63A<br><br>AC normal lighting panel as per details given below is envisaged:<br>Incomer type: TPN MCB<br>Incomer rating: 63A |                                                                                 |                                         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                 |  |                                         |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                 |  | Date: 25.10.2017                        |
| <div>Outgoing feeder type: SPN MCB</div> <div>Outgoing feeder rating: 20A</div> <div>Short circuit rating: 9kA</div> <div>ELCB in Incomer: Yes</div> <div>Street lighting panel as per details given below is envisaged:</div> <div>Incomer type: TPN MCCB</div> <div>Incomer rating: 100A</div> <div>Outgoing feeder type: TPN MCB</div> <div>Outgoing feeder rating: 20A</div> <div>Short circuit rating: 9kA</div> <div>ON/ OFF control With Timer &amp; photocell</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                         |
| <div>5.4.2 AC Emergency Lighting Systems:</div> <div>AC Emergency lighting fixtures are fed through a number of conveniently located AC Lighting panel (ACLP) which are fed from AC Emergency Lighting Distribution Board (ELDB).</div> <div>ELDBs consisting of non-encapsulated, dry type isolation transformer housed in ELDB with proper separation from distribution panels as per details indicated below is envisaged:</div> <div>Transformer rating: 50 / 100 kVA</div> <div>Transformer voltage ratio: 415 / 433 Volt, taps of +5% to -5% in steps of 2.5%.</div> <div>Transformer type: Encapsulated</div> <div>Distribution Panel type: Single front fixed type</div> <div>LDB Configuration: Two incomer &amp; buscoupler</div> <div>Incomer type: TPN MCCB</div> <div>Incomer rating: As per lighting transformer rating</div> <div>Outgoing feeder type: TPN MCCB</div> <div>Outgoing feeder rating: 63A</div> <div>AC emergency lighting panel as per details given below is envisaged:</div> <div>Incomer type: TPN MCB</div> <div>Incomer rating: 63A</div> <div>Outgoing feeder type: SPN MCB</div> <div>Outgoing feeder rating: 20A</div> <div>Short circuit rating: 9kA</div> <div>ELCB in Incomer: Yes</div> |                                                                                 |  |                                         |
| <div>5.4.3 DC Emergency Lighting Systems:</div> <div>DC Emergency lighting fixtures fed through suitable numbers of conveniently located DC Emergency Lighting panel (DCELP) which are fed through DC Lighting Distribution Board (DCLDB).</div> <div>The DCLDB shall be fed from two sources i.e. AC emergency lighting distribution board (ELDB) and DCDB. The emergency lighting fixtures connected to this system shall remain normally 'ON' all the time from AC supply &amp; on failure of AC supply they will automatically switch over to DC supply system. DCLDB shall be equipped with AC under voltage relay and contactor for emergency auto changeover scheme.</div> <div>DCLDBs as per details given below is envisaged:</div> <div>Distribution Panel type: Single front fixed type</div>                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                 |  |                                         |

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|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
|  | 1X800MW NORTH CHENNAI STAGE-III BTG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    | SPECIFICATION NO.<br>PE-TS-423-558-E006 |
|                                                                                   | TECHNICAL SPECIFICATION FOR LIGHTING FIXTURES, LAMPS<br>AND MISCELLANEOUS ITEMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                    | VOLUME II SECTION - I, REV-0            |
|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                    | Date: 25.10.2017                        |
|                                                                                   | DC Incomer type:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | DP Switchfuse unit with contactor                                                                                                  |                                         |
|                                                                                   | DC Incomer rating:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 125A                                                                                                                               |                                         |
|                                                                                   | AC Incomer type:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | TPN MCB with contactor                                                                                                             |                                         |
|                                                                                   | AC Incomer rating:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 63A                                                                                                                                |                                         |
|                                                                                   | Outgoing feeder type:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | DP Switchfuse unit                                                                                                                 |                                         |
|                                                                                   | Outgoing feeder rating:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 32A                                                                                                                                |                                         |
|                                                                                   | DCLPs as per details given below is envisaged:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                    |                                         |
|                                                                                   | Incomer type:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | DP Switchfuse unit                                                                                                                 |                                         |
|                                                                                   | Incomer rating:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 32A                                                                                                                                |                                         |
|                                                                                   | Outgoing feeder type:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | DP MCB                                                                                                                             |                                         |
|                                                                                   | Outgoing feeder rating:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 20A                                                                                                                                |                                         |
| 5.4.4                                                                             | All A.C Normal & Emergency Lighting shall be provided with Energy saving System. The energy saving sytem shall consists of loss less reactance coils with votage tapping, contactor to select the tap, Micro-processor based TIMER along with real time closck for activating the contactor at a pre-set time.The LDBs will be provided with voltmeter and ammeter along with selector switch, supply ON indicating lamps etc. All indicating lamps will be cluster LED type. The DOP for LDB will be IP-54 and for transformer cubicle IP-42. Where as the DOP for LP will be IP-54 for indoor and IPW-55 with canopy for outdoor. |                                                                                                                                    |                                         |
| 5.4.5                                                                             | <b>24V AC Supply system:</b><br>Each 24V AC supply module will have one no. dry type two winding, 1 phase transformer and necessary terminals for incoming and outgoing connections. The 240V terminals of 24V AC supply module will be fed from AC emergency lighting panels (ACELP). Details of 24V supply modules shall be as given below:                                                                                                                                                                                                                                                                                       |                                                                                                                                    |                                         |
|                                                                                   | Module type:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Portable type / Fixed type                                                                                                         |                                         |
|                                                                                   | Enclosure:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Steel sheet of 2MM Thickness with louvers                                                                                          |                                         |
|                                                                                   | Transformer rating:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 500 VA                                                                                                                             |                                         |
|                                                                                   | Transformer voltage ratio:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 240 / 24 Volt                                                                                                                      |                                         |
|                                                                                   | Primary side isolation:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | DP MCB with HRC fuse                                                                                                               |                                         |
|                                                                                   | Isolator rating:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 16A                                                                                                                                |                                         |
|                                                                                   | HRC fuse rating:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6A                                                                                                                                 |                                         |
|                                                                                   | Secondary side isolation:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | SPN MCB with HRC fuse                                                                                                              |                                         |
|                                                                                   | Isolator rating:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6A                                                                                                                                 |                                         |
|                                                                                   | HRC fuse rating:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 16A                                                                                                                                |                                         |
|                                                                                   | Fixed type 24V supply modules shall be provided in following areas:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |                                         |
|                                                                                   | Boiler/ HRSG area:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Near inspection manholes on boiler platforms and boiler drum.                                                                      |                                         |
|                                                                                   | TG Building:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Near HP & LP heaters, turbine flash tank, blow down tank, near condenser water box and near bus duct termination of generator end. |                                         |
|                                                                                   | ESP area:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Near inspection manholes.                                                                                                          |                                         |
|                                                                                   | other area:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Near Deaerator                                                                                                                     |                                         |
|                                                                                   | Suitable numbers of 24V portable halogen lamp unit along with flexible copper cable shall also be supplied as per details below:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                    |                                         |
|                                                                                   | Lamp wattage:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 40 W                                                                                                                               |                                         |
|                                                                                   | Cable size:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1.5 sq. mm                                                                                                                         |                                         |
|                                                                                   | Cable length:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 15 meter                                                                                                                           |                                         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                 |                                         |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | TECHNICAL SPECIFICATION FOR LIGHTING FIXTURES, LAMPS<br>AND MISCELLANEOUS ITEMS | VOLUME II SECTION - I, REV-0            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                 | Date: 25.10.2017                        |
| <p><b>5.5 Emergency EXIT lamps:</b><br/>Emergency exit lamps backed up by battery shall be provided at strategic locations of the building for safe exit of personnel. These exit lamps will remain ON all the time and normally received power supply from ACELP.<br/>Exit lamp unit shall contain maintenance free Ni-Cd battery with 4 hours backup capacity.</p> <p><b>5.5.1</b> ELUs shall contain maintenance free Ni-Cd battery with 4 hours backup capacity. Each ELU will have battery charger and 2x9W fluorescent lamp with test switch.</p> <p><b>5.6 STREET LIGHTING / OUTDOOR LIGHTING SYSTEM</b></p> <p><b>5.6.1</b> The design for roads within BHEL scope as per contract will be considered for lighting.</p> <p><b>5.6.2</b> Street lights / outdoor lighting will be fed from separate panel located at suitable places. Automatic switching ON/OFF of these circuits shall be done from street light panel.</p> <p><b>5.6.3</b> For street lighting, street light pole (09 / 11 meter) will be used for design purpose. For outdoor area lighting lighting if required flood light pole will be used.<br/>The poles shall be equipped with junction boxes and all other required accessories. The junction box for outdoor usage shall be FRP Type IPW 66.<br/>The poles will be located 1.5 M away from the road edge. The buried cable will run in hume pipe (100 mm dia) wherever it is crossing the roads.</p> <p><b>5.6.4</b> High mast will be used, if required. High mast will be 30 meter high, hot dip galvanised and polygonal shaped. The location of high mast will be decided during detailed engineering.</p> <p><b>5.6.5</b> The supply of lighting pole, mast &amp; hume pipe are not in bidder's scope</p> <p><b>5.7 LOW VOLTAGE POWER SERVICES</b></p> <p><b>5.7.1</b> Different type of receptacles as per details below will be provided:<br/>(i) Decorative receptacle:<br/>At least 01 number 5/15A, 3-Pin, 230V AC decorative socket will be provided in office, store, cabin etc.<br/><br/>For charging of 5A switch sockets, concealed type fixed wiring shall be provided for powering the switch/sockets units in the BHEL supplied modular furnitures.<br/>(ii) Industrial receptacle:<br/>At least 01 number 20A, 5-Pin, 240V AC industrial type receptacles will be provided at suitable location in plant building. The receptacles shall be provided at interval of 20m or part thereof. All receptacles will be controlled with a switch. In hazardous area receptacles will be of flameproof type.<br/><br/>(iii) Welding receptacle:<br/>63A, 3-phase, 415V AC welding receptacles with isolating switch will be provided at a) 2 nos. at each floor of TG Bldg. b) Total 06 nos. at five critical floors of Boiler platforms. Maximum 03 nos. receptacles will be fed through one feeder. In hazardous areas these receptacle will be located in MCC room. Each welding receptacle shall be provided with ELCB.<br/>(iv) 400 Amp Welding receptacle:<br/>400A, 3-phase, 415V AC welding receptacles with isolating switch will be provided with MCCB &amp; earthing for transformer oil filtration unit. The general construction of receptacle shall be similar to 63A welding receptacle.</p> <p><b>5.7.2</b> Transformer rating for welding distribution board shall be 100kVA. Other construction details shall be identical to AC LDB.</p> |                                                                                 |                                         |

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|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
|  | 1X800MW NORTH CHENNAI STAGE-III BTG                                                                                                                                                                                                                                                                                                                                                     | SPECIFICATION NO.<br>PE-TS-423-558-E006 |
|                                                                                   | TECHNICAL SPECIFICATION FOR LIGHTING FIXTURES, LAMPS<br>AND MISCELLANEOUS ITEMS                                                                                                                                                                                                                                                                                                         | VOLUME II SECTION - I, REV-0            |
|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                         | Date: 25.10.2017                        |
| 5.7.3                                                                             | Based on room size, suitable nos. of ceiling fans (1200mm sweep) with Stepped electronic regulator with minimum five steps shall be provided in office rooms, store rooms and social buildings which are not covered by air-conditioned and ventilation system. In the office premises, one fan per 10 sq. metres shall be provided. Pedestal fans shall also be provided, if required. |                                         |
| 5.7.4                                                                             | For the maintenance of lighting fixtures within the power house, 4 nos. free standing adjustable aluminium ladder, adjustable from 05M to 10M shall be provided and 3 nos. free standing adjustable aluminium ladder, adjustable from 0.5M to 1.5M shall be provided. For the maintenance of street lights, 01 no. of mini truck mounted adjustable hydraulic shall be provided.        |                                         |
| 5.8                                                                               | WIRING / CONDUITS/ EARTHING (For Design Purpose Only)                                                                                                                                                                                                                                                                                                                                   |                                         |
| 5.8.1                                                                             | Wiring of lighting system will be done as follows:                                                                                                                                                                                                                                                                                                                                      |                                         |
| (i)                                                                               | Wiring installation will be done by multi-stranded, PVC insulated, colour coded wires laid in GI conduits of 20 mm dia size (minimum) conforming to IS-9537. The thickness of conduits upto & including 25 mm dia will be 1.6 mm and conduits above 25 mm will be 2.0 mm.                                                                                                               |                                         |
| (ii)                                                                              | Conduits will be heavy-duty type hot dip galvanised steel conforming to IS-9537. Conduit accessories will be hot dip galvanised. In corrosive area, conduits will have suitable epoxy coating additionally.                                                                                                                                                                             |                                         |
| (iii)                                                                             | Flexible conduits made with bright, cold rolled annealed and electro galvanised mild steel strips and coated with PVC will be used where required.                                                                                                                                                                                                                                      |                                         |
| (iv)                                                                              | Conduits in control room, service building, laboratory building and other air-conditioned areas will be surface mounted on the roof above false ceiling, however vertical drops of conduits will be concealed along walls and finally plastered for better aesthetics.                                                                                                                  |                                         |
| (v)                                                                               | Filling area of wires in conduit shall not exceed 40% of the conduit area.                                                                                                                                                                                                                                                                                                              |                                         |
| (vi)                                                                              | Wiring for AC Normal, AC Emergency, and DC Emergency services will run in separate conduits.                                                                                                                                                                                                                                                                                            |                                         |
| (vii)                                                                             | Lighting and receptacles will be fed from separate circuits. No two different phase circuits will be run in the same conduit. However, different circuits of same phase may be laid in the same conduit.                                                                                                                                                                                |                                         |
| (viii)                                                                            | Maximum 03 numbers of 1-phase receptacles will be loop in & loop out in a circuit.                                                                                                                                                                                                                                                                                                      |                                         |
| (ix)                                                                              | PVC conduit and wire raceway will be provided for Control rooms/ Admin/ Service building.                                                                                                                                                                                                                                                                                               |                                         |
| 5.8.2                                                                             | Following sizes of 1100 V grade, PVC insulated, single core, stranded copper conductor wires will be used (Supply not in bidder's scope):                                                                                                                                                                                                                                               |                                         |
|                                                                                   | Lighting Panel to Fixtures:                                                                                                                                                                                                                                                                                                                                                             | 2.5 sq. mm (Cu)                         |
|                                                                                   | Lighting Panel to JB's/ Switches:                                                                                                                                                                                                                                                                                                                                                       | 2.5 sq. mm (Cu)                         |
|                                                                                   | JB's/ switches to Fixtures:                                                                                                                                                                                                                                                                                                                                                             | 2.5 sq. mm (Cu)                         |
|                                                                                   | Panel to First receptacles:                                                                                                                                                                                                                                                                                                                                                             | 4.0 sq. mm (Cu)                         |
|                                                                                   | First receptacles to looping other receptacles:                                                                                                                                                                                                                                                                                                                                         | 4.0 sq. mm (Cu)                         |
|                                                                                   | In case of only one receptacles in ckt., Panel to receptacles:                                                                                                                                                                                                                                                                                                                          | 4.0 sq. mm (Cu)                         |
|                                                                                   | Panel/ JB's to flood light fixtures:                                                                                                                                                                                                                                                                                                                                                    | 2 x 2.5 sq. mm (Cu)                     |
| 5.8.3                                                                             | Wiring in hazardous area, transformer yard, outdoor area (like Tank area, GT area) will be done using 3C-2.5 sq. mm (Cu), PVC insulated, FRLS PVC sheathed armoured cable.                                                                                                                                                                                                              |                                         |
| 5.8.4                                                                             | The earthing terminal for junction boxes, receptacles, fixtures, conduit etc. shall be suitable for 8 SWG GI wire. however, The junction box at each lighting pole is grounded at two (2) points from two (2) nos. earthing terminals by 16 SWG GI wire. One 16 SWG G.I wire shall be taken upto the junction box from lighting fixtures and connected to grounding point.              |                                         |
|                                                                                   | All junction boxes, receptacles, fixtures, conduit etc. shall be grounded in compliance with the provision of I.E. Rules.                                                                                                                                                                                                                                                               |                                         |
|                                                                                   | Junction boxes shall have following indelible markings :                                                                                                                                                                                                                                                                                                                                |                                         |
|                                                                                   | 1. Circuit nos. on top                                                                                                                                                                                                                                                                                                                                                                  |                                         |
|                                                                                   | 2. Circuit nos. with ferrules (inside) as per drawing                                                                                                                                                                                                                                                                                                                                   |                                         |
|                                                                                   | 3. DANGER sign in case of 415V circuit                                                                                                                                                                                                                                                                                                                                                  |                                         |
| 5.8.5                                                                             | The conduits & wires are excluded from bidder's scope of supply                                                                                                                                                                                                                                                                                                                         |                                         |

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|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
|  | 1X800MW NORTH CHENNAI STAGE-III BTG                                                                                                                                                                                                                  | SPECIFICATION NO.<br>PE-TS-423-558-E006 |
|                                                                                   | TECHNICAL SPECIFICATION FOR LIGHTING FIXTURES, LAMPS<br>AND MISCELLANEOUS ITEMS                                                                                                                                                                      | VOLUME II SECTION - I, REV-0            |
|                                                                                   |                                                                                                                                                                                                                                                      | Date: 25.10.2017                        |
| 5.9                                                                               | <b>SWITCH &amp; SWITCH BOARD</b>                                                                                                                                                                                                                     |                                         |
|                                                                                   | a) Modular Switches, miniature circuit breakers (MCB), bus bars shall be fully rated for short circuit level at the point of application. MCB shall have back-up HRC fuse if its rating is less than the available short circuit current.            |                                         |
|                                                                                   | b) All switch boards/boxes shall be of bent steel construction, fabricated of 14 SWG M.S. sheet with 6 mm thick Bakelite cover.                                                                                                                      |                                         |
|                                                                                   | c) Switch boards/boxes located in control room and office areas shall be flush mounted type on brick wall with only the switch knob projecting outside.                                                                                              |                                         |
|                                                                                   | d) Switch boards / boxes shall have conduit knock outs on the sides. Adequate provision shall be made for ventilation of these boxes.                                                                                                                |                                         |
| 5.10                                                                              | e) Flush type receptacles where provided shall be so located that only the plug projects outside.                                                                                                                                                    |                                         |
|                                                                                   | f) Switches shall have quick-make and quick-break mechanism operated by a suitable external handle complete with position indicator.                                                                                                                 |                                         |
|                                                                                   | g) Occupancy switches shall be provided in service building.                                                                                                                                                                                         |                                         |
|                                                                                   | <b>5.10 EARTHING</b>                                                                                                                                                                                                                                 |                                         |
|                                                                                   | Earthing of lighting system will be done by using of following sizes of wire / flat:                                                                                                                                                                 |                                         |
|                                                                                   | Lighting Distribution Board:                                                                                                                                                                                                                         | GS Flat 35x6 mm                         |
|                                                                                   | Lighting Panels:                                                                                                                                                                                                                                     | Not Applicable                          |
|                                                                                   | Lighting fixtures, receptacles, conduits, junction boxes & switch boxes:                                                                                                                                                                             | 14 SWG GI wire                          |
|                                                                                   | Welding receptacles:                                                                                                                                                                                                                                 | GS Flat 35x6 mm                         |
|                                                                                   | Street light pole/ flood light pole:                                                                                                                                                                                                                 | Not Applicable                          |
|                                                                                   | High mast:                                                                                                                                                                                                                                           | GS Flat 50x6 mm                         |
|                                                                                   | Electrode for Pole :                                                                                                                                                                                                                                 | Not Applicable                          |
|                                                                                   | High mast earthing:                                                                                                                                                                                                                                  | 40 mm dia MS rod, 3 mtr long            |
|                                                                                   | Street lighting panel:                                                                                                                                                                                                                               | GS Flat 35x6 mm                         |
| 5.11                                                                              | <b>PAINTINGS</b>                                                                                                                                                                                                                                     |                                         |
|                                                                                   | All sheet steel enclosures shall be chemically cleaned, rinsed, phosphated, rinsed and dried. After the treatment, steel surfaces shall be given undercoats of primer and finished with two coats of sprayed-on enamel or lacquer of approved shade. |                                         |
|                                                                                   | All steel fabrication shall be given two coats of red-oxide primer followed by two coats of Siemens gray (RAL-7032).                                                                                                                                 |                                         |
| 5.12                                                                              | All equipment shall be given touch-up paint as required after installation.                                                                                                                                                                          |                                         |
|                                                                                   | <b>5.12 STATUTORY &amp; REGULATORY REQUIREMENT</b>                                                                                                                                                                                                   |                                         |
|                                                                                   | Statutory and regulatory regulation shall be applicable as per Indian Electricity Rule, 1956 with amendment                                                                                                                                          |                                         |
|                                                                                   | 3 Rule no. 35, 48, 49, 50, 61 & 64 for illumination & low voltage power services.                                                                                                                                                                    |                                         |

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|  | 1X800 MW NORTH CHENNAI STAGE-III BTG                                            |  | SPECIFICATION NO.<br>PE-TS-423-558-E006 |                   |
|                                                                                   | TECHNICAL SPECIFICATION FOR LIGHTING FIXTURES, LAMPS<br>AND MISCELLANEOUS ITEMS |  | VOLUME II                               | SECTION - I REV-0 |
|                                                                                   |                                                                                 |  |                                         | Date: 25.10.17    |

**ANNEXURE-I**

**AVERAGE LUX LEVEL & TYPE OF FIXTURES**

| S. No. | LOCATION                                                 | AVERAGE LUX LEVEL                 | TYPE OF LIGHTING FIXTURES                                                            |
|--------|----------------------------------------------------------|-----------------------------------|--------------------------------------------------------------------------------------|
| 01     | TG Hall operating floors                                 | 250                               | High bay LED Luminaire                                                               |
| 02     | TG hall ground, mezzanine floor                          | 200                               | LED High/ Medium bay, LED well glass fixture                                         |
| 03     | Switchgear/ Charger rooms                                | 250                               | Energy Efficient FTL                                                                 |
| 04     | Main control room, Computer room                         | 500                               | LED luminaire equivalent to Mirror optics with anti glare features type/ downlighter |
| 05     | Office areas, Conference rooms                           | 300                               | Decorative mirror optics LED Luminaire/ LED Downlighter                              |
| 06     | Battery rooms                                            | 200                               | Industrial corrosion proof energy efficient FTL.                                     |
| 07     | Cable Vault                                              | 100                               | Energy Efficient FTL                                                                 |
| 08     | Transformer yard                                         | 50 (General), 70 (Near Equipment) | Flood light/dust proof integral well glass type LED.                                 |
| 09     | Boiler area & Platforms                                  | 100                               | LED, well glass luminaire                                                            |
| 10     | ESP area & platforms                                     | 120                               | LED, well glass luminaire                                                            |
| 11     | ESP control room                                         | 400                               | Decorative recessed mounted type LED.                                                |
| 12     | DG room                                                  | 250                               | LED medium bay/ industrial type LED luminaire.                                       |
| 13     | Mill Reject Compressor room/ CST Pump House              | 200                               | LED medium bay/ industrial type LED luminaire.                                       |
| 14     | AC plant/ Air washer room                                | 200                               | LED luminaire, Totally enclosed vapour proof clear acrylic                           |
| 15     | Service/ Technical Building                              | 300                               | LED, medium bay, industrial type/ Decorative recessed/ surface mounted type LED.     |
| 16     | Fuel Oil Pump house                                      | 200                               | Flame proof LED type luminaire                                                       |
| 17     | Coal Bunker & Mill bay area, feeder floor, Tripler floor | 150                               | LED, well glass luminaire, Dust proof type                                           |
| 18     | Street lighting                                          | 20                                | LED street lights                                                                    |
| 19     | Corridors walk ways, staircase, toilets, wash rooms etc  | 100                               | LED Luminaire, industrial type                                                       |
| 20     | Toilet Wash room etc.                                    | 70                                | LED Luminaire, industrial type                                                       |
| 21     | Garage/ Car Parking                                      | 50                                | LED luminaire.                                                                       |
| 22     | Unloading and maintenance bay                            | 250                               | LED high bay/ industrial type LED luminaire.                                         |
| 23     | Elevator                                                 | 100                               | Energy Efficient FTL                                                                 |
| 24     | Aux. Boiler area                                         | 100                               | LED, well glass luminaire                                                            |
| 25     | CPU Regeneration Building                                | 250                               | LED, high bay, industrial type.                                                      |

- Note:**
- 1) The fixture will be suitable for Division-2, Group IIA/IIB of hazardous area as per IS-2148.
  - 2) Decorative type fixtures will be provided for false ceiling areas.
  - 3) For DC lighting & Hazardous areas LED type luminaires shall be used.
  - 4) Medium bay light shall be used if mounting height vary from 5Mtr to 8Mtr

## **1 X 800 MW NORTH CHENNAI TPS: LIGHTING SYSTEM**

### **Locations of Lighting Distribution Boards (Preliminary)**

| <b>S.No.</b> | <b>Location</b>          | <b>Type</b> | <b>Rating</b> | <b>Description</b> |
|--------------|--------------------------|-------------|---------------|--------------------|
| 1.           | LV Switchgear Room       | ACN         | 100 KVA       | 1UA                |
| 2.           | LV Switchgear Room       | ACN         | 100 KVA       | 1UB                |
| 3.           | LV Switchgear Room       | ACN         | 100 KVA       | 1UC                |
| 4.           | Boiler MCC Room          | ACN         | 100 KVA       | 1UD                |
| 5.           | Boiler MCC Room          | ACN         | 100 KVA       | 1UE                |
| 6.           | Boiler MCC Room          | ACN         | 100 KVA       | 1UF                |
| 7.           | ESP Switchgear Room      | ACN         | 100 KVA       | 1UG                |
| 8.           | ESP Switchgear Room      | ACN         | 50 KVA        | 1UH                |
| 9.           | LV Switchgear Room       | ACE         | 100 KVA       | 1UI                |
| 10.          | Boiler MCC Room          | ACE         | 100 KVA       | 1UJ                |
| 11.          | ESP Switchgear Room      | ACE         | 50 KVA        | 1UK                |
| 12.          | LV Switchgear Room       | DC          | 200 A         | 1UL                |
| 13.          | Boiler MCC Room          | DC          | 200 A         | 1UM                |
| 14.          | LV Switchgear Room - WDB | ACN         | 100 KVA       | 1UN                |
| 15.          | Boiler MCC Room - WDB    | ACN         | 100 KVA       | 1UO                |
| 16.          | Service Building         | ACN         | 100 KVA       | 0UA                |
| 17.          | CPU Regeneration Bldg.   | ACN         | 100 KVA       | 0UB                |
| 18.          | Service Building         | ACN         | 50 KVA        | 0UC                |
| 19.          | Auxiliary Boiler         | ACN         | 100 KVA       | 0UD                |
|              |                          |             |               |                    |

#### **NOTES:**

1. In addition to above, 1 no. 63A, 3-phase, 415V supply feeder for 63A, 5 pin welding socket to be provided in each off site building (in BHEL scope) away from BTG area.
2. WDB will be used to feed 63A welding sockets in BTG area. WDB will have two incomers.

#### **LEGEND:**

ACN : AC Normal LDB ,      ACE : AC Emergency LDB,      DC : DC LDB  
LDB : Lighting distribution board, WDB : Welding distribution board

#### **QUANTITY:**

Total 100 KVA LDB      =      12    Nos.  
Total 50 KVA LDB      =      3    Nos.  
Total DC LDB            =      2    Nos.  
Total 100 KVA WDB    =      2    Nos.



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**DATA SHEET –A**

| S. No.     | Description                                                           | Unit     | Value                                                                     |
|------------|-----------------------------------------------------------------------|----------|---------------------------------------------------------------------------|
| <b>1.0</b> | <b>SYSTEM DESIGN DATA</b>                                             |          |                                                                           |
| 1.1        | Design ambient                                                        | °C       | 50                                                                        |
| <b>1.2</b> | <b>AC Supply</b>                                                      |          |                                                                           |
| a)         | Rated voltage                                                         | V        | 415                                                                       |
| b)         | Rated frequency                                                       | Hz       | 50                                                                        |
| c)         | Voltage variation (permissible)                                       | %        | +10% to -10%                                                              |
| d)         | Frequency variation (permissible)                                     | %        | +5% to -5%                                                                |
| e)         | Combined voltage & frequency variation (sum of absolutes permissible) | %        | 10%                                                                       |
| f)         | System fault level & duration                                         | kA, sec. | 50kA for 1 sec.                                                           |
| <b>1.3</b> | <b>DC Supply</b>                                                      |          |                                                                           |
| a)         | Rated voltage                                                         | V        | 220                                                                       |
| b)         | Voltage variation (permissible)                                       | %        | +10% to -15%                                                              |
| c)         | System fault level & duration                                         | kA, sec. | 25kA for 1 sec.                                                           |
| <b>2.0</b> | <b>SCOPE OF SYSTEM DESIGN ENGINEERING</b>                             |          | Included in vendor's scope                                                |
| <b>3.0</b> | <b>Lighting Concept</b>                                               |          |                                                                           |
| 3.1        | Types of supplies considered (other than AC Normal)                   |          |                                                                           |
| a)         | AC emergency                                                          |          | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No       |
| b)         | DC emergency                                                          |          | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No       |
| c)         | DC Normal                                                             |          | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No       |
| 3.2        | Diversity Factor for Sockets                                          | %        | 25%                                                                       |
| <b>4.0</b> | <b>LUMINAIRES, LAMPS &amp; ACCESSORIES</b>                            |          |                                                                           |
| 4.1        | Type of false ceiling for recessed fluorescent luminaire              |          | Grid False ceiling (600mm X 600mm) / Aluminium false ceiling (for Control |



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|     |                                                  |                  |                                                                                                           |
|-----|--------------------------------------------------|------------------|-----------------------------------------------------------------------------------------------------------|
|     |                                                  |                  | Room).                                                                                                    |
| 4.2 | Degree of protection for drip proof luminaires   |                  | IP55                                                                                                      |
| 4.3 | Flame proof luminaires                           |                  |                                                                                                           |
| a)  | Hazardous area classification                    |                  | IS-2148 Zone II Group-IIA & IIB                                                                           |
| b)  | Degree of protection                             |                  | IP55                                                                                                      |
| c)  | Mounting type for well glass                     |                  | <input checked="" type="checkbox"/> Eye-bolt<br><input type="checkbox"/> MS Galvanised Strap              |
| 4.4 | Non-integral controlgear box for HPMV/HPSV lamps |                  |                                                                                                           |
| a)  | Material                                         |                  | <input type="checkbox"/> CRCA sheet steel<br><input checked="" type="checkbox"/> Cast Aluminium LM6       |
| b)  | Sheet thickness                                  | mm               | <input type="checkbox"/> 2 for CRCA sheet<br><input checked="" type="checkbox"/> 3 for Cast Aluminium LM6 |
| c)  | Degree of protection                             |                  | IP55                                                                                                      |
| d)  | Surface treatment                                |                  | <input checked="" type="checkbox"/> Painted <input type="checkbox"/> Galvanized                           |
| e)  | If galvanized                                    |                  | NOT APPLICABLE                                                                                            |
|     | Process                                          |                  | -                                                                                                         |
|     | Weight of zinc                                   | g/m <sup>2</sup> | -                                                                                                         |
| f)  | If painted                                       |                  |                                                                                                           |
|     | Paint shade                                      |                  | RAL 7032                                                                                                  |
|     | Minimum paint thickness (DFT)                    | micron           | 50                                                                                                        |
| 4.5 | Lamps                                            |                  |                                                                                                           |
| a)  | Type of Fluorescent Lamps                        |                  | <input checked="" type="checkbox"/> Cool Daylight<br><input checked="" type="checkbox"/> White Light      |
| b)  | Type of cap for incandescent lamp                |                  | <input type="checkbox"/> Screw type<br><input type="checkbox"/> Pin type                                  |
| c)  | Type of HPMV lamp                                |                  | <input type="checkbox"/> Clear<br><input type="checkbox"/> Fluorescent powder coated                      |
| d)  | Type of cap for HPMV & HPSV lamp                 |                  | Screw type                                                                                                |
| e)  | Type of beam for                                 |                  |                                                                                                           |
|     | HPMV lamps                                       |                  | <input type="checkbox"/> Short beam                                                                       |



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|     |                                                                                       |       |                                                                                                                   |
|-----|---------------------------------------------------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------|
|     |                                                                                       |       | <input type="checkbox"/> Long beam<br><input type="checkbox"/> Both                                               |
|     | HPSV lamps                                                                            |       | <input type="checkbox"/> Short beam<br><input type="checkbox"/> Long beam<br><input type="checkbox"/> Both        |
| 4.6 | <b>Emergency Lighting Unit</b>                                                        |       |                                                                                                                   |
| a)  | Lamp type                                                                             |       | <input type="checkbox"/> FLT <input checked="" type="checkbox"/> CFL <input type="checkbox"/> LED                 |
| b)  | Nos. of Lamp                                                                          |       | 2                                                                                                                 |
| c)  | Lamp wattage                                                                          | W     | 9                                                                                                                 |
| d)  | Lumen output of lamp at rated voltage                                                 | Lumen | To furnished by Vendor.                                                                                           |
| e)  | Type of battery (Rechargeable type)                                                   |       | <input checked="" type="checkbox"/> Ni-Cd <input type="checkbox"/> Lead-Acid<br><input type="checkbox"/> Li-Ion   |
| f)  | AH capacity of battery                                                                | AH    | To furnished by Vendor.                                                                                           |
| g)  | Battery voltage                                                                       | V     | 9                                                                                                                 |
| h)  | Battery backup time                                                                   | Hr    | 4                                                                                                                 |
| i)  | In built charger                                                                      |       | Yes                                                                                                               |
| 4.7 | <b>Exit Sign</b>                                                                      |       |                                                                                                                   |
| a)  | Lamp type                                                                             |       | <input checked="" type="checkbox"/> FLT <input type="checkbox"/> CFL <input type="checkbox"/> LED                 |
| b)  | Nos. of Lamp                                                                          |       | 1                                                                                                                 |
| c)  | Lamp wattage                                                                          | W     | 20                                                                                                                |
| d)  | Lumen output of lamp at rated voltage                                                 | Lumen | To furnished by Vendor.                                                                                           |
| e)  | Type of battery                                                                       |       | <input checked="" type="checkbox"/> Ni-Cd <input type="checkbox"/> Lead-Acid<br><input type="checkbox"/> Li-Ion   |
| f)  | AH capacity of battery                                                                | AH    | To furnished by Vendor.                                                                                           |
| g)  | Battery voltage                                                                       | V     | To furnished by Vendor.                                                                                           |
| h)  | Battery backup time                                                                   | Hr    | 1/2                                                                                                               |
| 4.8 | <b>24V AC Supply Module (Fixed type &amp; portable type) For Quantities Refer BOQ</b> |       |                                                                                                                   |
| a)  | Enclosure                                                                             |       |                                                                                                                   |
|     | Enclosure material                                                                    |       | <input type="checkbox"/> Cast aluminium alloy<br><input checked="" type="checkbox"/> CRCA sheet steel             |
|     | Enclosure thickness                                                                   | mm    | <input type="checkbox"/> 3 for Cast aluminium alloy<br><input checked="" type="checkbox"/> 2 for CRCA sheet steel |



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|     |                                           |                  |                                                                                                                   |
|-----|-------------------------------------------|------------------|-------------------------------------------------------------------------------------------------------------------|
|     | Louvers provided                          |                  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                               |
| b)  | Surface treatment                         |                  | <input type="checkbox"/> Painted <input checked="" type="checkbox"/> Galvanized                                   |
| c)  | If galvanized                             |                  |                                                                                                                   |
|     | Process                                   |                  | Hot dip                                                                                                           |
|     | Weight of zinc                            | g/m <sup>2</sup> | 460 gm / mm <sup>2</sup> (65 microns)                                                                             |
| d)  | If painted                                |                  |                                                                                                                   |
|     | Paint shade                               |                  |                                                                                                                   |
|     | Minimum paint thickness (DFT)             | micron           |                                                                                                                   |
| e)  | Transformer                               |                  |                                                                                                                   |
|     | Rating                                    | VA               | 500                                                                                                               |
|     | Voltage ratio & Current Rating            | V                | 240 V/24V [6A/16A]                                                                                                |
|     | Class of insulation                       |                  | Class F, temperature rise limited to Class-B                                                                      |
| f)  | 24V Hand lamp unit                        |                  |                                                                                                                   |
|     | Lamp type                                 |                  | <input checked="" type="checkbox"/> Halogen <input type="checkbox"/> LED                                          |
|     | Lamp wattage                              | W                | 40                                                                                                                |
| g)  | No. of outgoing sockets                   |                  | 4                                                                                                                 |
| h)  | Whether cord coiling arrangement provided |                  | <input checked="" type="checkbox"/> Yes air cooled <input type="checkbox"/> No                                    |
| 5.0 | <b>Junction Box</b>                       |                  |                                                                                                                   |
| a)  | Enclosure material                        |                  | <input checked="" type="checkbox"/> FRP <input checked="" type="checkbox"/> CRCA Sheet.                           |
| b)  | Enclosure thickness                       | mm               | 1.6                                                                                                               |
| c)  | Galvanized<br>(applicable for CRCA sheet) |                  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                               |
| d)  | Degree of protection                      |                  | IP-66(indoor) / FRP Weather proof<br>IPW-66 for outdoor area &<br>Flameproof for hazardous area)                  |
| 6.0 | <b>Industrial/ Welding Receptacle</b>     |                  |                                                                                                                   |
| a)  | Enclosure material                        |                  | <input type="checkbox"/> Heavy duty cast aluminium alloy<br><input checked="" type="checkbox"/> CRCA sheet steel  |
| b)  | Enclosure thickness                       | mm               | <input type="checkbox"/> 3 for cast aluminium alloy<br><input checked="" type="checkbox"/> 2 for CRCA sheet steel |
| c)  | Surface treatment                         |                  | <input type="checkbox"/> Painted <input checked="" type="checkbox"/> Galvanized                                   |
| d)  | If galvanized                             |                  |                                                                                                                   |



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|      |                               |                  |                                                                                 |
|------|-------------------------------|------------------|---------------------------------------------------------------------------------|
|      | Process                       |                  | Hot dip                                                                         |
|      | Weight of zinc                | g/m <sup>2</sup> | 460 gm / mm <sup>2</sup> (65 microns)                                           |
| e)   | If painted                    |                  | NOT APPLICABLE                                                                  |
|      | Paint shade                   |                  |                                                                                 |
|      | Minimum paint thickness (DFT) | micron           |                                                                                 |
| f)   | Degree of protection          |                  | IP-42 / IP 62(dusty area)                                                       |
| 7.0  | <b>Decorative Receptacle</b>  |                  |                                                                                 |
| a)   | Enclosure material            |                  | [ ] Cast aluminium alloy<br>[√] MS Sheet                                        |
| b)   | Enclosure thickness           | mm               | [ ] 2 for cast aluminium alloy<br>[√] 1 for MS sheet                            |
| c)   | Surface treatment             |                  | [ ] Painted<br>[√] Galvanized/ Electro-plated                                   |
| d)   | If galvanized                 |                  |                                                                                 |
|      | Process                       |                  | Hot dip                                                                         |
|      | Weight of zinc                | g/m <sup>2</sup> | 460 gm / mm <sup>2</sup> (65 microns)                                           |
| e)   | If painted                    |                  | NOT APPLICABLE                                                                  |
|      | Paint shade                   |                  |                                                                                 |
|      | Minimum paint thickness       | micron           |                                                                                 |
| f)   | Degree of protection          |                  | IP-42 / IP 62(dusty area)                                                       |
| 9.0  | <b>Switch Box</b>             |                  |                                                                                 |
| a)   | Enclosure material            |                  | [ ] FRP [√] CRCA Sheet.                                                         |
| b)   | Enclosure thickness           | mm               | 2 MM CRCA sheet with 6mm thick Bakelite cover                                   |
| c)   | Galvanized                    |                  | [√] Yes [ ] No                                                                  |
| d)   | Painted                       |                  | [ ] Yes [√] No                                                                  |
| d)   | Degree of protection          |                  | IP-55                                                                           |
| 10.0 | <b>Conduit (Flexible)</b>     |                  |                                                                                 |
| a)   | Type                          |                  | [√] Electrogalvanized cold rolled annealed & coated with PVC<br>[ ] Lead coated |
| b)   | Size                          | mm               | 20                                                                              |
| c)   | Standard length               | m                | 25 to 50                                                                        |



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|      |                                             |         |                                                                                                                           |
|------|---------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------------|
| d)   | Thickness of Galvanization                  | microns |                                                                                                                           |
| 5.13 | <b>Cable Glands</b>                         |         | <b>By vendor for all incoming and outgoing cables</b>                                                                     |
| a)   | Type                                        |         | <input checked="" type="checkbox"/> Double compression<br><input type="checkbox"/> Single compression                     |
| b)   | Material                                    |         | Brass                                                                                                                     |
| c)   | Nickel Plating provided                     |         | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                       |
| d)   | Flameproof glands with flameproof equipment |         | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                       |
| 5.14 | <b>Cable Lugs</b>                           |         | <b>By vendor for all incoming and outgoing cables</b>                                                                     |
| a)   | Type                                        |         | Crimping type/ ring type                                                                                                  |
| b)   | Material                                    |         | Tinned copper                                                                                                             |
| 12.0 | <b>LADDERS</b>                              |         |                                                                                                                           |
| a)   | Type                                        |         | <input type="checkbox"/> Free standing<br><input type="checkbox"/> wheel mounted <input checked="" type="checkbox"/> both |
| b)   | Material                                    |         | <input type="checkbox"/> Steel <input checked="" type="checkbox"/> Aluminium                                              |
| c)   | Duty                                        |         | <input type="checkbox"/> Heavy <input checked="" type="checkbox"/> Medium                                                 |
| d)   | Surface treatment                           |         | <input checked="" type="checkbox"/> Galvanised <input type="checkbox"/> Painted                                           |
| e)   | Reference Standard                          |         | IS: 4571, 3696                                                                                                            |

**Note :**

1. Detailed luminaire and lamp data shall be placed by vendor after award of contract.
2. Galvanization wherever applicable shall be hot dip galvanized with weight of Zinc as 460g/m<sup>2</sup> (65micron).



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**LIST OF APPLICABLE STANDARDS**

**ILLUMINATION**

|                                                      |         |
|------------------------------------------------------|---------|
| Code of practice for interior illumination           | IS 3646 |
| Code of practice for industrial lighting             | IS 6665 |
| Code of practice for lighting of public thoroughfare | IS 1944 |

**LUMINAIRES**

|                                                                            |                  |
|----------------------------------------------------------------------------|------------------|
| Luminaires                                                                 | IS 10322         |
| Industrial luminaires with metal reflector                                 | IS 1777          |
| Industrial lighting fittings with plastic reflectors                       | IS 3287          |
| Decorative lighting outfits                                                | IS 5077          |
| Waterproof electric lighting fittings                                      | IS 3528          |
| Watertight electric lighting fittings                                      | IS 3553          |
| Dust-proof electric lighting fittings                                      | IS 4012          |
| Dust-tight electric lighting fittings                                      | IS 4013          |
| Flameproof electric lighting fittings - well glass & bulk head types       | IS 2206          |
| Electric lighting fittings for division 2 areas                            | IS 8224          |
| General & Safety requirement of Luminaire                                  | IS 1913          |
| General Lighting. LEDs and LED modules Terms and definitions               | IS 16101         |
| Self Ballasted LED Lamps for General Lighting Services.                    | IS 16102         |
| LED modules for General lighting Safety Requirements.                      | IS 16103         |
| Lamp control gear Part 2 particular                                        | IS 15885(Part 2) |
| Requirements d.c. or a.c. Supplied Electronic control gear for LED modules | IS 16104         |

**LAMPS**

|                                                                           |         |
|---------------------------------------------------------------------------|---------|
| Tungsten filament lamps for domestic and similar general lighting purpose | IS 418  |
| Tubular fluorescent lamps for general lighting service                    | IS 2418 |
| High pressure mercury vapour lamps                                        | IS 9900 |
| High pressure sodium vapour lamps                                         | IS 9974 |



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**LUMINAIRE COMPONENTS**

|                                                                                                                        |          |
|------------------------------------------------------------------------------------------------------------------------|----------|
| Ballast for fluorescent lamps for switch start circuits                                                                | IS 1534  |
| Ballast for high pressure mercury vapour lamps                                                                         | IS 15882 |
| Capacitors for use in tubular fluorescent high pressure mercury and low pressure sodium vapour discharge lamp circuits | IS 1569  |
| Bi-pin lamp holders for tubular fluorescent lamps                                                                      | IS 3323  |
| Methods of measurement of lamp cap temperature rise                                                                    | IS 8913  |
| Starters for fluorescent lamps                                                                                         | IS 2215  |
| Holders for starters for tubular fluorescent lamps                                                                     | IS 3324  |
| Cast acrylic sheets for use in luminaires                                                                              | IS 7569  |

**ASSEMBLED EQUIPMENT AND COMPONENTS**

|                                                                                                       |          |
|-------------------------------------------------------------------------------------------------------|----------|
| Low voltage switchgear and controlgear.                                                               | IS 60947 |
| Code of practice for selection, installation & maintenance of switchgear & control gear               | IS 10118 |
| Explosive atmospheres                                                                                 | IS 60079 |
| Classification of hazardous areas for electrical installations                                        | IS 5572  |
| Dry type transformers                                                                                 | IS 11171 |
| Electrical Accessories - circuit breakers for over protection for household and similar installations | IS 60898 |
| Low voltage Fuses for voltages not exceeding 1000 V ac or 1500 V dc                                   | IS 13703 |
| Indicator lamps (visual)                                                                              | IS 1901  |

**POLES, SOCKETS AND OTHER MISCELLANEOUS**

|                                                                                                                        |          |
|------------------------------------------------------------------------------------------------------------------------|----------|
| Plugs and socket outlets of rated voltage upto and including 250 volts and rated current upto and including 16 amperes | IS 1293  |
| Interlocking switch socket outlet                                                                                      | IS 4160  |
| Electric ceiling type fans and regulators                                                                              | IS 374   |
| Structural steel (Standard quality)                                                                                    | IS 2062  |
| Danger notice plates                                                                                                   | IS 2551  |
| Enclosures for accessories for household and similar fixed electrical installations                                    | IS 14772 |
| General construction in steel - Code of practice                                                                       | IS 800   |
| Wrought aluminium and aluminium alloy bars, rods, tubes and sections for electrical purposes                           | IS 5082  |



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|                                                                                                           |          |
|-----------------------------------------------------------------------------------------------------------|----------|
| Code of practice for phosphating of iron and steel                                                        | IS 6005  |
| Colour for ready mixed paints & enamels                                                                   | IS 5     |
| Recommended practice for hot dip galvanising of iron & steel                                              | IS 2629  |
| Method of testing uniformity of coating on zinc coated articles                                           | IS 2603  |
| Flexible steel conduits for electrical wiring                                                             | IS 3480  |
| Conduits for electrical installations                                                                     | IS: 9537 |
| Scaffolds & ladders - Code of safety                                                                      | IS: 3696 |
| Aluminium extension ladders                                                                               | IS: 4571 |
| General Requirement for enclosures for accessories for household & similar fixed electrical installations | IS: 5133 |



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**ANNEXURE – A**

**SUB-VENDOR LIST**

| S. NO. | ITEM                                        | VENDOR                                             |
|--------|---------------------------------------------|----------------------------------------------------|
| 1      | 24V SUPPLY MODULE WITH COMPLETE ACCESSORIES | POWER PACK ENTERPRISES                             |
|        | 24V SUPPLY MODULE WITH COMPLETE ACCESSORIES | INDCOIL                                            |
|        | 24V SUPPLY MODULE WITH COMPLETE ACCESSORIES | Ames Impex Electricals Pvt. Ltd                    |
| 2      | AC CONTACTORS                               | SIEMENS                                            |
|        | AC CONTACTORS                               | GE-POWER                                           |
|        | AC CONTACTORS                               | TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD. |
|        | AC CONTACTORS                               | L&T                                                |
|        | AC CONTACTORS                               | BCH                                                |
| 3      | AC MCCB                                     | C&S ELECTRIC LTD.                                  |
|        | AC MCCB                                     | SCHNEIDER ELECTRIC INDIA PVT. LTD.                 |
|        | AC MCCB                                     | SIEMENS                                            |
|        | AC MCCB                                     | GE-POWER                                           |
|        | AC MCCB                                     | L&T                                                |
|        | AC MCCB                                     | CROMPTON GREAVES                                   |
| 4      | AMMETER                                     | AUTOMATIC ELECTRIC LTD.                            |
|        | AMMETER                                     | RISHABH INST.PVT LTD                               |
| 5      | AUXILIARY RELAYS                            | ABB                                                |
|        | AUXILIARY RELAYS                            | ALSTOM LTD                                         |
|        | AUXILIARY RELAYS                            | JYOTI LTD.                                         |
|        | AUXILIARY RELAYS                            | OEN INDIA LTD                                      |
|        | AUXILIARY RELAYS                            | SIEMENS                                            |
| 6      | CABLE GLANDS                                | ALLIED TRADERS & EXPORTERS                         |
|        | CABLE GLANDS                                | ARUP ENGG & FOUNDRY WORKS                          |
|        | CABLE GLANDS                                | BALIGA LIGHTING EQPT PVT LTD                       |
|        | CABLE GLANDS                                | COMMET BRASS PRODUCTS                              |
|        | CABLE GLANDS                                | DOWELLS                                            |
|        | CABLE GLANDS                                | ELECTROMAC INDUSTRIES                              |
|        | CABLE GLANDS                                | INCAB                                              |
| 7      | CABLE LUGS                                  | DOWELLS                                            |
|        | CABLE LUGS                                  | UNIVERSAL MACHINES LTD.                            |
| 8      | CONTROL SWITCHES/ SELECTOR SWITCH           | KAYCEE                                             |
|        | CONTROL SWITCHES/ SELECTOR SWITCH           | GE-POWER                                           |
|        | CONTROL SWITCHES/ SELECTOR                  | ALSTOM LTD                                         |



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|    |                                                                   |                                                    |
|----|-------------------------------------------------------------------|----------------------------------------------------|
|    | SWITCH                                                            |                                                    |
|    | CONTROL SWITCHES/ SELECTOR SWITCH                                 | SCHNEIDER ELECTRIC INDIA PVT. LTD.                 |
|    | CONTROL SWITCHES/ SELECTOR SWITCH                                 | Shrenik & Co.                                      |
|    | CONTROL SWITCHES/ SELECTOR SWITCH                                 | RECOM PVT. LTD.                                    |
| 9  | D.C. MCCB                                                         | CROMPTON GREAVES                                   |
|    | D.C. MCCB                                                         | L&T                                                |
|    | D.C. MCCB                                                         | GE-POWER                                           |
|    | D.C. MCCB                                                         | SIEMENS                                            |
| 10 | DC CONTACTORS                                                     | SCHNEIDER ELECTRIC INDIA PVT. LTD.                 |
|    | DC CONTACTORS                                                     | BHEL (BHOPAL)                                      |
|    | DC CONTACTORS                                                     | ELECTROMAC INDUSTRIES                              |
|    | DC CONTACTORS                                                     | L&T                                                |
|    | DC CONTACTORS                                                     | SIEMENS                                            |
|    | DC CONTACTORS                                                     | TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD. |
|    | DC CONTACTORS                                                     | GE-POWER                                           |
| 11 | DC SWITCH                                                         | GE-POWER                                           |
|    | DC SWITCH                                                         | KAYCEE                                             |
|    | DC SWITCH                                                         | SIEMENS                                            |
| 12 | DICHORIC SPOT LIGHTING FIXTURE                                    | REPUTED MAKE                                       |
| 13 | EARTH LEAKAGE CB                                                  | L&T                                                |
|    | EARTH LEAKAGE CB                                                  | SIEMENS                                            |
|    | EARTH LEAKAGE CB                                                  | GE-POWER                                           |
|    | EARTH LEAKAGE CB                                                  | SCHNEIDER ELECTRIC INDIA PVT. LTD.                 |
|    | EARTH LEAKAGE CB                                                  | C&S ELECTRIC LTD.                                  |
|    | EARTH LEAKAGE CB                                                  | ABB                                                |
|    | EARTH LEAKAGE CB                                                  | INDO ASIAN                                         |
|    | EARTH LEAKAGE CB                                                  | MDS SWITCHGEAR LTD                                 |
|    | EARTH LEAKAGE CB                                                  | S&S POWER SWITCHGEAR LTD,                          |
| 14 | EMER. PORTABLE LTG. SET                                           | BAJAJ ELECTRICALS                                  |
|    | EMER. PORTABLE LTG. SET                                           | BAJAJ ELECTRICALS                                  |
| 15 | EMERGENCY LIGHTING UNIT ( FIXED & PORTABLE TYPE)- FLAME PROOF     |                                                    |
|    | EMERGENCY LIGHTING UNIT ( FIXED & PORTABLE TYPE)- NON FLAME PROOF | BAJAJ ELECTRICALS                                  |
|    | EMERGENCY LIGHTING UNIT ( FIXED & PORTABLE TYPE)- NON FLAME PROOF | PROLITE AUTOGLO LIMITED,                           |
| 16 | EXIT SIGN (FLAME PROOF)                                           | REPUTED MAKE                                       |
|    | EXIT SIGN (NON FLAME PROOF)                                       | REPUTED MAKE                                       |
| 17 | FLEXIBLE CONDUITS ( LEAD COATED)                                  | PLICA INDIA PVT. LTD.                              |



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|    |                               |                                           |
|----|-------------------------------|-------------------------------------------|
|    | FLEXIBLE CONDUIT (PVC COATED) | REPUTED MAKE                              |
| 18 | FUSE BASE                     | INDO ASIAN                                |
|    | FUSE BASE                     | GE-POWER                                  |
|    | FUSE BASE                     | L&T                                       |
|    | FUSE BASE                     | C&S ELECTRIC LTD.                         |
|    | FUSE BASE                     | SIEMENS                                   |
|    | FUSE BASE                     | ABB                                       |
|    | FUSE BASE                     | SPACEAGE SWITCHGEARS LTD.                 |
|    | FUSE BASE                     | SCHNEIDER ELECTRIC INDIA PVT. LTD.        |
|    | FUSE BASE                     | ALSTOM LTD                                |
|    | FUSE BASE                     | ESSEN DEINKI                              |
| 19 | GI CONDUIT (EPOXY PAINTED)    | BIS APPROVED MAKE                         |
| 20 | GI CONDUITS                   | BIS APPROVED MAKE                         |
| 21 | GI WIRE & FLAT                | Brahampuri Steels Limited                 |
|    | GI WIRE & FLAT                | INDIA ELECTRICALS SYNDICATE               |
|    | GI WIRE & FLAT                | INDMARK FORMTECH PVT. LTD.                |
|    | GI WIRE & FLAT                | PREMIER POWER PRODUCTS (CAL) PVT. LTD.    |
|    | GI WIRE & FLAT                | Patny Systems (P) Ltd.                    |
|    | GI WIRE & FLAT                | PASSIVE INFRA PROJECTS PVT. LTD.          |
|    | GI WIRE & FLAT                | RUKMANI ELECTRICAL & COMPONENTS PVT LTD   |
|    | GI WIRE & FLAT                | RATAN PROJECTS & ENGINEERING CO. PVT.LTD. |
|    | GI WIRE & FLAT                | RABI ENGINEERING WORKS PVT. LTD.          |
|    | GI WIRE & FLAT                | RAJASTHAN METAL SMELTING CO.              |
|    | GI WIRE & FLAT                | SARAL INDUSTRIES                          |
|    | GI WIRE & FLAT                | PARCO Engineers Pvt. Ltd.                 |
|    | GI WIRE & FLAT                | UNITECH FABRICATORS and ENGINEERS PVT LTD |
| 22 | HAND LAMP UNIT                | REPUTED MAKE                              |
| 23 | HRC FUSES                     | INDO ASIAN                                |
|    | HRC FUSES                     | GE-POWER                                  |
|    | HRC FUSES                     | L&T                                       |
|    | HRC FUSES                     | C&S ELECTRIC LTD.                         |
|    | HRC FUSES                     | SIEMENS                                   |
|    | HRC FUSES                     | ABB                                       |
|    | HRC FUSES                     | SPACEAGE SWITCHGEARS LTD.                 |
|    | HRC FUSES                     | SCHNEIDER ELECTRIC INDIA PVT. LTD.        |
|    | HRC FUSES                     | ALSTOM LTD                                |
|    | HRC FUSES                     | ESSEN DEINKI                              |
| 24 | HUME PIPE                     | REPUTED MAKE                              |
| 25 | IND.POWER & WLDG SOCKETS      | CROMPTON GREAVES                          |
|    | IND.POWER & WLDG SOCKETS      | CYCLO ELECTRIC DEVICE & SERV.CO.          |
|    | IND.POWER & WLDG SOCKETS      | BCH                                       |
|    | IND.POWER & WLDG SOCKETS      | BEST & CROMPTON                           |



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|    |                                  |                                         |
|----|----------------------------------|-----------------------------------------|
|    | IND.POWER & WLDG SOCKETS         | AJMERA INDUSTRIES & ENGG. WORKS         |
| 26 | INDICATING LAMPS                 | BCH                                     |
|    | INDICATING LAMPS                 | C&S ELECTRIC LTD.                       |
|    | INDICATING LAMPS                 | ESSEN DEINKI                            |
|    | INDICATING LAMPS                 | VAISHNO(HOTLINE SWGR.& CONTROL)         |
|    | INDICATING LAMPS                 | GE-POWER                                |
|    | INDICATING LAMPS                 | SIEMENS                                 |
|    | INDICATING LAMPS                 | SCHNEIDER ELECTRIC INDIA PVT. LTD.      |
| 27 | JUNCTION BOXES (FLAME PROOF)     | SUDHIR SWITCHGEAR                       |
| 28 | JUNCTION BOXES (NON FLAME PROOF) | JASPER ENGINEERS PVT. LTD.              |
|    | JUNCTION BOXES (NON FLAME PROOF) | Electro Controls & Devices              |
|    | JUNCTION BOXES (NON FLAME PROOF) | Shrenik & Co.                           |
|    | JUNCTION BOXES (NON FLAME PROOF) | PHOENIX MECANO LTD.,                    |
|    | JUNCTION BOXES (NON FLAME PROOF) | Adroit Control Engineers Pvt.Ltd.       |
|    | JUNCTION BOXES (NON FLAME PROOF) | PHOENIX MECANO LTD.,                    |
|    | JUNCTION BOXES (NON FLAME PROOF) | MIKA ENGINEERS                          |
|    | JUNCTION BOXES (NON FLAME PROOF) | PHOENIX MECANO LTD.,                    |
|    | JUNCTION BOXES (NON FLAME PROOF) | BAJAJ ELECTRICALS                       |
|    | JUNCTION BOXES (NON FLAME PROOF) | AJMERA INDUSTRIES & ENGG. WORKS         |
|    | JUNCTION BOXES (NON FLAME PROOF) | S.B. ELECTRICAL ENGINEERING CORPORATION |
| 29 | LADDER                           | REPUTED MAKE                            |
| 30 | LIGHTING FIXTURES ( LED)         | Neev Luminaries                         |
|    | LIGHTING FIXTURES ( LED)         | HAVELLS INDIA LIMITED                   |
|    | LIGHTING FIXTURES ( LED)         | BAJAJ ELECTRICALS                       |
|    | LIGHTING FIXTURES ( LED)         | SURYA ROSHNI LIMITED                    |
|    | LIGHTING FIXTURES ( LED)         | PHILIPS                                 |
|    | LIGHTING FIXTURES ( LED)         | HPL ELECTRIC & POWER PVT. LTD           |
|    | LIGHTING FIXTURES ( LED)         | INSTA POWER                             |
| 31 | LIGHTING FIXTURES (NON LED)      | BALIGA LIGHTING EQPT PVT LTD            |
|    | LIGHTING FIXTURES (NON LED)      | ELEXPRO ELECTRICALS PVT/ LTD.           |
|    | LIGHTING FIXTURES (NON LED)      | BAJAJ ELECTRICALS                       |
|    | LIGHTING FIXTURES (NON LED)      | CROMPTON GREAVES                        |
|    | LIGHTING FIXTURES (NON LED)      | EVERGREEN ENGG. CO.                     |



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|    |                                     |                               |
|----|-------------------------------------|-------------------------------|
|    | LIGHTING FIXTURES (NON LED)         | PHILIPS                       |
|    | LIGHTING FIXTURES (NON LED)         | WIPRO LTD.                    |
|    | LIGHTING FIXTURES (NON LED)         | HPL ELECTRIC & POWER PVT. LTD |
|    | LIGHTING FIXTURES (NON LED)         | SURYA ROSHNI LIMITED          |
|    | LIGHTING FIXTURES (NON LED)         | HAVELLS INDIA LIMITED         |
| 32 | LIGHTING FIXTURES ( FLAME PROOF)    | HAVELLS INDIA LIMITED         |
|    | LIGHTING FIXTURES ( FLAME PROOF)    | BAJAJ ELECTRICALS             |
|    | LIGHTING FIXTURES ( FLAME PROOF)    | BALIGA LIGHTING EQPT PVT LTD  |
| 33 | LIGHTING LAMP (LED)                 | HAVELLS INDIA LIMITED         |
|    | LIGHTING LAMP (LED)                 | SURYA ROSHNI LIMITED          |
|    | LIGHTING LAMP (LED)                 | BAJAJ ELECTRICALS             |
|    | LIGHTING LAMP (LED)                 | PHILIPS                       |
|    | LIGHTING LAMP (LED)                 | HPL ELECTRIC & POWER PVT. LTD |
|    | LIGHTING LAMP (LED)                 | INSTA POWER                   |
| 34 | LIGHTING LAMP (NON LED)             | WIPRO LTD.                    |
|    | LIGHTING LAMP (NON LED)             | ESSEN DEINKI                  |
|    | LIGHTING LAMP (NON LED)             | BAJAJ ELECTRICALS             |
|    | LIGHTING LAMP (NON LED)             | INSTA POWER                   |
|    | LIGHTING LAMP (NON LED)             | PHILIPS                       |
|    | LIGHTING LAMP (NON LED)             | HAVELLS INDIA LIMITED         |
|    | LIGHTING LAMP (NON LED)             | HPL                           |
| 35 | LIGHTING SWITCH , SOCKET & S/F UNIT | ELEXPRO ELECTRICALS PVT/ LTD. |
|    | LIGHTING SWITCH , SOCKET & S/F UNIT | ANCHOR                        |
|    | LIGHTING SWITCH , SOCKET & S/F UNIT | KAYCEE                        |
|    | LIGHTING SWITCH , SOCKET & S/F UNIT | L&T                           |
|    | LIGHTING SWITCH , SOCKET & S/F UNIT | SIEMENS                       |
|    | LIGHTING SWITCH , SOCKET & S/F UNIT | INDO ASIAN                    |
| 36 | LT- CURRENT TRANSFORMER             | SIEMENS                       |
|    | LT- CURRENT TRANSFORMER             | AUTOMATIC ELECTRIC LTD.       |
|    | LT- CURRENT TRANSFORMER             | INDCOIL                       |
|    | LT- CURRENT TRANSFORMER             | KAPPA ELECTRICALS             |
|    | LT- CURRENT TRANSFORMER             | PRAGATI ELECTRICALS           |
|    | LT- CURRENT TRANSFORMER             | PRECISE ELECTRICALS           |
|    | LT- CURRENT TRANSFORMER             | SILKAANS ELECT.MFG.CO.PVT.LTD |
|    | LT- CURRENT TRANSFORMER             | PRAYOG ELECTRICALS PVT. LTD.  |
|    | LT- CURRENT TRANSFORMER             | C&S ELECTRIC LTD.             |
| 37 | LT- POTENTIAL TRANSFORMER           | SIEMENS                       |



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|    |                              |                                         |
|----|------------------------------|-----------------------------------------|
|    | LT- POTENTIAL TRANSFORMER    | AUTOMATIC ELECTRIC LTD.                 |
|    | LT- POTENTIAL TRANSFORMER    | INDCOIL                                 |
|    | LT- POTENTIAL TRANSFORMER    | KAPPA ELECTRICALS                       |
|    | LT- POTENTIAL TRANSFORMER    | PRAGATI ELECTRICALS                     |
|    | LT- POTENTIAL TRANSFORMER    | PRECISE ELECTRICALS                     |
|    | LT- POTENTIAL TRANSFORMER    | SILKAANS ELECT.MFG.CO.PVT.LTD           |
|    | LT- POTENTIAL TRANSFORMER    | PRAYOG ELECTRICALS PVT. LTD.            |
| 38 | MCB                          | MDS SWITCHGEAR LTD                      |
|    | MCB                          | INDO ASIAN                              |
|    | MCB                          | SCHNEIDER ELECTRIC INDIA PVT. LTD.      |
|    | MCB                          | S&S POWER SWITCHGEAR LTD,               |
| 39 | MODULAR SWITCH BOARD         | ANCHOR                                  |
|    | MODULAR SWITCH BOARD         | ELEXPRO ELECTRICALS PVT/ LTD.           |
|    | MODULAR SWITCH BOARD         | HAVELLS INDIA LIMITED                   |
|    | MODULAR SWITCH BOARD         | ANCHOR                                  |
|    | MODULAR SWITCH BOARD         | ELEXPRO ELECTRICALS PVT/ LTD.           |
|    | MODULAR SWITCH BOARD         | HAVELLS INDIA LIMITED                   |
| 40 | PEDESTAL FAN & CEILING FAN   | REPUTED MAKE                            |
| 41 | PHOTOELECTRIC SWITCH         | REPUTED MAKE                            |
| 42 | PVC WIRES                    | BIS APPROVED MAKE                       |
| 43 | RECEPTACLE (FLAME PROOF)     | BALIGA LIGHTING EQPT PVT LTD            |
|    | RECEPTACLE (FLAME PROOF)     | SUDHIR SWITCHGEAR                       |
|    | RECEPTACLE (FLAME PROOF)     | FCG FLAME PROOF CONTROL GEAR            |
| 44 | RECEPTACLE (NON FLAME PROOF) | AJMERA INDUSTRIES & ENGG. WORKS         |
|    | RECEPTACLE (NON FLAME PROOF) | CROMPTON GREAVES                        |
|    | RECEPTACLE (NON FLAME PROOF) | CYCLO ELECTRIC DEVICE & SERV.CO.        |
|    | RECEPTACLE (NON FLAME PROOF) | BCH                                     |
|    | RECEPTACLE (NON FLAME PROOF) | BEST & CROMPTON                         |
| 45 | RECEPTACLES - DECORATIVE     | ANCHOR                                  |
|    | RECEPTACLES - DECORATIVE     | ELEXPRO ELECTRICALS PVT/ LTD.           |
|    | RECEPTACLES - DECORATIVE     | BAJAJ ELECTRICALS                       |
|    | RECEPTACLES - DECORATIVE     | AJMERA INDUSTRIES & ENGG. WORKS         |
| 46 | SWITCH BOX                   | ANCHOR                                  |
|    | SWITCH BOX                   | ELEXPRO ELECTRICALS PVT/ LTD.           |
|    | SWITCH BOX                   | BAJAJ ELECTRICALS                       |
|    | SWITCH BOX                   | AJMERA INDUSTRIES & ENGG. WORKS         |
|    | SWITCH BOX                   | S.B. ELECTRICAL ENGINEERING CORPORATION |
| 47 | TERMINAL BLOCKS              | WAGO-CONTROLS                           |
|    | TERMINAL BLOCKS              | CONNECT WELL                            |
|    | TERMINAL BLOCKS              | ELMEX CONTROLS PVT. LTD.                |
|    | TERMINAL BLOCKS              | ESSEN DEINKI                            |
|    | TERMINAL BLOCKS              | TECHNOPLAST                             |



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|----|---------------------|----------------------------------------------------|
|    | TERMINAL BLOCKS     | PHOENIX MECANO LTD.,                               |
| 48 | TIMERS - ELECTRONIC | ESSEN DEINKI                                       |
|    | TIMERS - PNEUMATIC  | BCH                                                |
|    | TIMERS - PNEUMATIC  | ALSTOM LTD                                         |
|    | TIMERS - PNEUMATIC  | L&T                                                |
|    | TIMERS - PNEUMATIC  | TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD. |
|    | TIMERS - PNEUMATIC  | SCHNEIDER ELECTRIC INDIA PVT. LTD.                 |
|    | TIMERS - PNEUMATIC  | ELECTRONIC AUTOMATION PVT. LTD.                    |
|    | TIMERS - PNEUMATIC  | ELECTRONIC AUTOMATION PVT. LTD.                    |
| 49 | VOLTMETER           | AUTOMATIC ELECTRIC LTD.                            |
|    | VOLTMETER           | RISHABH INST.PVT LTD                               |

**NOTE:** This list is tentative. Addition/deletion of sub-vendor shall be after customer approval without price implication.



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**ANNEXURE – B  
DOCUMENTS REQUIRED AFTER AWARD OF LOI**

| S. NO. | DRAWING NO.        | DRAWING TITLE                            | CATEGOR<br>Y |
|--------|--------------------|------------------------------------------|--------------|
| 1      | PE-V0-423-558-E020 | GA DRAWING OF FIXTURE TYPE (FC02)        |              |
| 2      | PE-V0-423-558-E021 | GA DRAWING OF FIXTURE TYPE (FC02) EQ LED |              |
| 3      | PE-V0-423-558-E022 | GA DRAWING OF FIXTURE TYPE (FC06)        |              |
| 4      | PE-V0-423-558-E023 | GA DRAWING OF FIXTURE TYPE (FC06) EQ LED |              |
| 5      | PE-V0-423-558-E024 | GA DRAWING OF FIXTURE TYPE (FC07) EQ LED |              |
| 6      | PE-V0-423-558-E025 | GA DRAWING OF FIXTURE TYPE (FC26) EQ LED |              |
| 7      | PE-V0-423-558-E026 | GA DRAWING OF FIXTURE TYPE (FC30) EQ LED |              |
| 8      | PE-V0-423-558-E027 | GA DRAWING OF FIXTURE TYPE (FC32) EQ LED |              |
| 9      | PE-V0-423-558-E028 | GA DRAWING OF FIXTURE TYPE (FC33) EQ LED |              |
| 10     | PE-V0-423-558-E029 | GA DRAWING OF FIXTURE TYPE (FC34) EQ LED |              |
| 11     | PE-V0-423-558-E030 | GA DRAWING OF FIXTURE TYPE (FC81)        |              |
| 12     | PE-V0-423-558-E031 | GA DRAWING OF FIXTURE TYPE (SF63) EQ LED |              |
| 13     | PE-V0-423-558-E032 | GA DRAWING OF FIXTURE TYPE (SF64) EQ LED |              |
| 14     | PE-V0-423-558-E033 | GA DRAWING OF FIXTURE TYPE (SF66) EQ LED |              |
| 15     | PE-V0-423-558-E034 | GA DRAWING OF FIXTURE TYPE (SB11) EQ LED |              |
| 16     | PE-V0-423-558-E035 | GA DRAWING OF FIXTURE TYPE (SB02) EQ LED |              |
| 17     | PE-V0-423-558-E036 | GA DRAWING OF FIXTURE TYPE (SB03) EQ LED |              |
| 18     | PE-V0-423-558-E037 | GA DRAWING OF FIXTURE TYPE (SS61) EQ LED |              |
| 20     | PE-V0-423-558-E038 | GA DRAWING OF FIXTURE TYPE (SS62) EQ LED |              |
| 21     | PE-V0-423-558-E039 | GA DRAWING OF FIXTURE TYPE (SS63) EQ LED |              |
| 22     | PE-V0-423-558-E040 | GA DRAWING OF FIXTURE TYPE (SW41) EQ LED |              |
| 23     | PE-V0-423-558-E041 | GA DRAWING OF FIXTURE TYPE (SW42) EQ LED |              |
| 24     | PE-V0-423-558-E042 | GA DRAWING OF FIXTURE TYPE (MW96) EQ LED |              |
| 25     | PE-V0-423-558-E043 | GA DRAWING OF SWITCH BOARD-TYPE SWB1     |              |
| 26     | PE-V0-412-558-E050 | GA DRAWING OF SWITCH BOARD-TYPE SWB2     |              |
| 27     | PE-V0-412-558-E051 | GA DRAWING OF SWITCH BOARD-TYPE SWB3     |              |
| 28     | PE-V0-412-558-E055 | GA DRAWING OF JB TYPE- JB-F              |              |
| 29     | PE-V0-412-558-E056 | GA DRAWING OF JB TYPE- JB-FE             |              |
| 30     | PE-V0-412-558-E058 | GA DRAWING OF RECEPTACLE RA              |              |
| 31     | PE-V0-412-558-E059 | GA OF FLAME PROOF RECEPTACLE TYPE RA     |              |
| 32     | PE-V0-412-558-E060 | GA DRAWING OF RECEPTACLE RB              |              |
| 33     | PE-V0-412-558-E062 | GA DRAWING OF RECEPTACLE RC              |              |



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|----|--------------------|----------------------------------------------------------------|--|
| 34 | PE-V0-412-558-E063 | GA DRAWING OF 400A RECEPTACLE                                  |  |
| 34 | PE-V0-412-558-E065 | GA DRAWING OF CEILING FAN 1200MM                               |  |
| 35 | PE-V0-412-558-E066 | GA DRAWING OF PEDESTAL FAN                                     |  |
| 36 | PE-V0-412-558-E067 | GA DRAWING OF EMERGENCY LIGHTING UNIT                          |  |
| 37 | PE-V0-412-558-E068 | GA DRAWING OF 24V AC SUPPLY MODULE-FIXED                       |  |
| 38 | PE-V0-412-558-E069 | GA DRAWING OF 24V AC SUPPLY MODULE-PORTABLE                    |  |
| 39 | PE-V0-412-558-E071 | GA DRAWING OF HAND LAMP                                        |  |
| 40 | PE-V0-412-558-E072 | GA DRAWING OF 5A,24V INDUSTRIAL TYPE SOCKET                    |  |
| 41 | PE-V0-412-558-E073 | GA DRAWING OF EMERGENCY EXIT LAMP                              |  |
| 42 | PE-V0-412-558-E074 | MOUNTING ARRANGEMENT OF LIGHTING FIXTURE IN FALSE CEILING AREA |  |
| 43 | PE-V0-412-558-E075 | MOUNTING ARRANGEMENT OF WELL GLASS FIXTURE                     |  |
| 44 | PE-V0-412-558-E076 | MOUNTING ARRANGEMENT OF BULK HEAD FIXTURE                      |  |
| 45 | PE-V0-412-558-E077 | MOUNTING ARRANGEMENT OF HIGH/ MEDIUM BAY FIXTURE               |  |
| 46 | PE-V0-412-558-E078 | MOUNTING ARRANGEMENT OF FLOOD LIGHT FIXTURE                    |  |
| 47 | PE-V0-412-558-E079 | MOUNTING ARRANGEMENT OF SWITCH/ RECEPTACLE BOXES               |  |
| 48 | PE-V0-412-558-E080 | GA DRAWING OF FREE STANDING LADDER                             |  |
| 49 | PE-V0-412-558-E081 | GA DRAWING OF STEP LADDER                                      |  |
| 50 | PE-V0-412-558-E411 | Technical Data Sheet-C for LUMINAIRES                          |  |
| 51 | PE-V0-412-558-E412 | Technical Data Sheet-C for MISC ITEMS                          |  |
| 52 | PE-V0-412-558-E413 | Type test report for LUMINARIES                                |  |
| 53 | PE-V0-412-558-E414 | Type test report for MISC ITEMS                                |  |
| 54 | PE-V0-412-558-E901 | MQP FOR LUMINARIES                                             |  |
| 55 | PE-V0-412-558-E905 | MQP FOR MISCELLANEOUS ITEMS                                    |  |
| 56 | PE-V0-412-558-E912 | FIELD QUALITY PLANT FOR LUMINARIES                             |  |
| 57 | PE-V0-412-558-E913 | FIELD QUALITY PLANT FOR MISC ITEMS                             |  |
| 58 | PE-V0-423-558-E101 | LDC MV SWITCHGEAR ROOM                                         |  |
| 59 | PE-V0-423-558-E102 | LDC LV SWITCHGEAR ROOM                                         |  |
| 60 | PE-V0-423-558-E103 | LDC MAIN / COMMON CONTROL ROOM                                 |  |
| 61 | PE-V0-423-558-E104 | LDC BOILER SWITCHGEAR ROOM                                     |  |
| 62 | PE-V0-423-558-E105 | LDC BELOW MV SWGR ROOM                                         |  |



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| 63 | PE-V0-423-558-E106 | LDC BELOW LV SWGR ROOM               |  |
| 64 | PE-V0-423-558-E107 | LDC BELOW MAIN / COMMON CONTROL ROOM |  |
| 65 | PE-V0-423-558-E108 | LDC BELOW BOILER SWITCHGEAR ROOM     |  |
| 66 | PE-V0-423-558-E109 | LDC 220V DC BATTERY ROOM             |  |
| 67 | PE-V0-423-558-E110 | LDC UPS BATTERY ROOM                 |  |
| 68 | PE-V0-423-558-E111 | LDC SWAS ROOM                        |  |
| 69 | PE-V0-423-558-E112 | LDC AC PLANT ROOM                    |  |
| 70 | PE-V0-423-558-E113 | LDC TG HALL BELOW 8.5M FLOOR         |  |
| 71 | PE-V0-423-558-E114 | LDC TG HALL BELOW 17.0M FLOOR        |  |
| 72 | PE-V0-423-558-E115 | LDC TG HALL OPERATING FLOOR          |  |
| 73 | PE-V0-423-558-E116 | LDC DEARATOR FLOOR                   |  |
| 74 | PE-V0-423-558-E117 | LDC TG HALL MEZZANINE FLOOR          |  |
| 75 | PE-V0-423-558-E118 | LDC AHU ROOM                         |  |
| 76 | PE-V0-423-558-E119 | LDC ESP CONTROL ROOM                 |  |
| 78 | PE-V0-423-558-E120 | LDC ESP PLATFORMS                    |  |
| 79 | PE-V0-423-558-E121 | LDC BOILER EL0.0M & MILL AREA        |  |
| 80 | PE-V0-423-558-E122 | LDC ID & PA FAN AREA                 |  |
| 81 | PE-V0-423-558-E123 | LDC BOILER PLATFORMS                 |  |
| 82 | PE-V0-423-558-E124 | LDC TRANSFORMER YARD                 |  |
| 83 | PE-V0-423-558-E125 | LDC ROADS                            |  |
| 84 | PE-V0-423-558-E126 | LDC DG BUILDING                      |  |
| 85 | PE-V0-423-558-E127 | LDC MRS COMPRESSOR HOUSE             |  |
| 86 | PE-V0-423-558-E128 | LDC FUEL OIL UNLOADING PUMP HOUSE    |  |
| 87 | PE-V0-423-558-E129 | LDC CPU REGEN. BUILDING              |  |
| 88 | PE-V0-423-558-E130 | LDC AIR WASHER BUILDING              |  |
| 89 | PE-V0-423-558-E131 | LDC AUX. BOILER                      |  |
| 90 | PE-V0-423-558-E132 | LDC OIL FILTRATION BUILDING          |  |
| 91 | PE-V0-423-558-E133 | LDC SERVICE BUILDING                 |  |
| 92 | PE-V0-423-558-E201 | CLO MV SWITCHGEAR ROOM               |  |
| 93 | PE-V0-423-558-E202 | CLO LV SWITCHGEAR ROOM               |  |
| 94 | PE-V0-423-558-E203 | CLO MAIN / COMMON CONTROL ROOM       |  |
| 95 | PE-V0-423-558-E204 | CLO BOILER SWITCHGEAR ROOM           |  |
| 96 | PE-V0-423-558-E205 | CLO BELOW MV SWGR ROOM               |  |
| 97 | PE-V0-423-558-E206 | CLO BELOW LV SWGR ROOM               |  |
| 98 | PE-V0-423-558-E207 | CLO BELOW MAIN / COMMON CONTROL ROOM |  |
| 99 | PE-V0-423-558-E208 | CLO BELOW BOILER SWITCHGEAR ROOM     |  |



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| 100 | PE-V0-423-558-E209 | CLO 220V DC BATTERY ROOM             |  |
| 101 | PE-V0-423-558-E210 | CLO UPS BATTERY ROOM                 |  |
| 102 | PE-V0-423-558-E211 | CLO SWAS ROOM                        |  |
| 103 | PE-V0-423-558-E212 | CLO AC PLANT ROOM                    |  |
| 104 | PE-V0-423-558-E213 | CLO TG HALL BELOW 8.5M FLOOR         |  |
| 105 | PE-V0-423-558-E214 | CLO TG HALL BELOW 17.0M FLOOR        |  |
| 106 | PE-V0-423-558-E215 | CLO TG HALL OPERATING FLOOR          |  |
| 107 | PE-V0-423-558-E216 | CLO DEARATOR FLOOR                   |  |
| 108 | PE-V0-423-558-E217 | CLO TG HALL MEZZANINE FLOOR          |  |
| 109 | PE-V0-423-558-E218 | CLO AHU ROOM                         |  |
| 110 | PE-V0-423-558-E219 | CLO ESP CONTROL ROOM                 |  |
| 111 | PE-V0-423-558-E220 | CLO ESP PLATFORMS                    |  |
| 112 | PE-V0-423-558-E221 | CLO BOILER EL0.0M & MILL AREA        |  |
| 113 | PE-V0-423-558-E222 | CLO ID & PA FAN AREA                 |  |
| 114 | PE-V0-423-558-E223 | CLO BOILER PLATFORMS                 |  |
| 115 | PE-V0-423-558-E224 | CLO TRANSFORMER YARD                 |  |
| 116 | PE-V0-423-558-E225 | CLO ROADS                            |  |
| 117 | PE-V0-423-558-E226 | CLO DG BUILDING                      |  |
| 118 | PE-V0-423-558-E227 | CLO MRS COMPRESSOR HOUSE             |  |
| 119 | PE-V0-423-558-E228 | CLO FUEL OIL UNLOADING PUMP HOUSE    |  |
| 120 | PE-V0-423-558-E229 | CLO CPU REGEN. BUILDING              |  |
| 121 | PE-V0-423-558-E230 | CLO AIR WASHER BUILDING              |  |
| 122 | PE-V0-423-558-E231 | CLO AUX. BOILER                      |  |
| 123 | PE-V0-423-558-E232 | CLO OIL FILTRATION BUILDING          |  |
| 124 | PE-V0-423-558-E233 | CLO SERVICE BUILDING                 |  |
| 125 | PE-V0-423-558-E301 | LLO MV SWITCHGEAR ROOM               |  |
| 126 | PE-V0-423-558-E302 | LLO LV SWITCHGEAR ROOM               |  |
| 127 | PE-V0-423-558-E303 | LLO MAIN / COMMON CONTROL ROOM       |  |
| 128 | PE-V0-423-558-E304 | LLO BOILER SWITCHGEAR ROOM           |  |
| 129 | PE-V0-423-558-E305 | LLO BELOW MV SWGR ROOM               |  |
| 130 | PE-V0-423-558-E306 | LLO BELOW LV SWGR ROOM               |  |
| 131 | PE-V0-423-558-E307 | LLO BELOW MAIN / COMMON CONTROL ROOM |  |
| 132 | PE-V0-423-558-E308 | LLO BELOW BOILER SWITCHGEAR ROOM     |  |
| 133 | PE-V0-423-558-E309 | LLO 220V DC BATTERY ROOM             |  |
| 134 | PE-V0-423-558-E310 | LLO UPS BATTERY ROOM                 |  |
| 135 | PE-V0-423-558-E311 | LLO SWAS ROOM                        |  |



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|-----|--------------------|-----------------------------------|--|
| 136 | PE-V0-423-558-E312 | LLO AC PLANT ROOM                 |  |
| 137 | PE-V0-423-558-E313 | LLO TG HALL BELOW 8.5M FLOOR      |  |
| 138 | PE-V0-423-558-E314 | LLO TG HALL BELOW 17.0M FLOOR     |  |
| 139 | PE-V0-423-558-E315 | LLO TG HALL OPERATING FLOOR       |  |
| 140 | PE-V0-423-558-E316 | LLO DEARATOR FLOOR                |  |
| 141 | PE-V0-423-558-E317 | LLO TG HALL MEZZANINE FLOOR       |  |
| 142 | PE-V0-423-558-E318 | LLO AHU ROOM                      |  |
| 143 | PE-V0-423-558-E319 | LLO ESP CONTROL ROOM              |  |
| 144 | PE-V0-423-558-E320 | LLO ESP PLATFORMS                 |  |
| 145 | PE-V0-423-558-E321 | LLO BOILER EL0.0M & MILL AREA     |  |
| 146 | PE-V0-423-558-E322 | LLO ID & PA FAN AREA              |  |
| 147 | PE-V0-423-558-E323 | LLO BOILER PLATFORMS              |  |
| 148 | PE-V0-423-558-E324 | LLO TRANSFORMER YARD              |  |
| 150 | PE-V0-423-558-E325 | LLO ROADS                         |  |
| 151 | PE-V0-423-558-E326 | LLO DG BUILDING                   |  |
| 152 | PE-V0-423-558-E327 | LLO MRS COMPRESSOR HOUSE          |  |
| 153 | PE-V0-423-558-E328 | LLO FUEL OIL UNLOADING PUMP HOUSE |  |
| 154 | PE-V0-423-558-E329 | LLO CPU REGEN. BUILDING           |  |
| 155 | PE-V0-423-558-E330 | LLO AIR WASHER BUILDING           |  |
| 156 | PE-V0-423-558-E331 | LLO AUX. BOILER                   |  |
| 157 | PE-V0-423-558-E332 | LLO OIL FILTRATION BUILDING       |  |
| 158 | PE-V0-423-558-E333 | LLO SERVICE BUILDING              |  |

Note: The above list of drawings and documents is indicative. LDC, CLO & LLO drawings may vary as per project requirements.



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**ANNEXURE – C**

**SCOPE MATRIX FOR BROAD ACTIVITIES**

| SCOPE MATRIX FOR BROAD ACTIVITIES |                                                                                                   |            |           |                 |
|-----------------------------------|---------------------------------------------------------------------------------------------------|------------|-----------|-----------------|
| Sl. No.                           | Activities                                                                                        | Contractor | Associate | Remark (if any) |
| 1                                 | System Design                                                                                     |            |           |                 |
| 2                                 | Supply: -<br>(a) Fixtures & Lamps<br>(b) Other Items (as required for System completion)          |            |           |                 |
| 3                                 | Supervision of Erection & commissioning                                                           |            |           |                 |
| 4                                 | Design review & changes based on site feedback for establishing correctness of the system at site |            |           |                 |

Notes: -

1. Bidder to indicate Division of work (DOW)/ scope matrix between contractor & associate by indicating “Yes”/ “No” against each activity in the appropriate column, same to be furnished duly signed & stamped along with technical offer.



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  - 2.0 CODES & STANDARDS
  - 3.0 LIGHTING SYSTEM DESCRIPTION (CONCEPTUAL VIEW)
  - 4.0 SYSTEM DESIGN ENGINEERING
    - 4.1 ENGINEERING INPUTS
    - 4.2 DESIGN CRITERIA
    - 4.3 ENGINEERING OUTPUTS
  - 5.0 LUMINAIRES, ACCESSORIES AND LAMPS
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    - 5.2 LUMINAIRE & OTHER ITEMS
    - 5.3 CONTROLGEAR BOX (NON-INTEGRAL TYPE)
    - 5.4 REFLECTORS
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    - 5.12 RECEPTACLES
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    - 5.14 LIGHTING CONTROL SWITCHBOXES
    - 5.15 CABLE GLANDS
    - 5.16 CABLE LUGS
    - 5.17 FLEXIBLE METALLIC CONDUITS AND FITTINGS
    - 5.18 PVC CONDUITS
  - 6.0 SURFACE TREATMENT
  - 7.0 PACKING
  - 8.0 GUARANTEED PERFORMANCE REQUIREMENTS
  - 9.0 INSPECTION & TESTING
  - 10.0 SPARES
  - 11.0 TOOLS & TACKLES
  - 12.0 DOCUMENTATION
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**1.0 INTENT OF SPECIFICATION**

- 1.1 The requirements given in specification for supply of equipment and system design engineering shall be fully complied with.
- 1.2 For the equipment of supply in vendor's scope, the "design" shall broadly cover the selection of components, materials, sizes etc. and complete responsibility of establishing the correctness of equipment design rests with the vendor.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship, and shall be capable of performing required function in a manner acceptable to Purchaser, who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgement is not in full accordance herewith.
- 1.4 Make of all equipment and components shall be to the approval of Purchaser. Bidder to comply to Sub-vendor list enclosed as Annexure to Section I, however same shall be subjected to end client approval without any commercial implication.

**2.0 CODES & STANDARDS**

- 2.1 The material shall comply with all currently applicable safety codes and statutory regulations of India as well as of the locality where the material is to be installed.
- 2.2 The material, construction, manufacture, inspection and testing shall conform to the latest revisions of standards as specified in Data Sheet-A.
- 2.3 In case of conflict between the applicable reference standard and this specification, stringent requirement shall govern.

**3.0 LIGHTING SYSTEM DESCRIPTION (CONCEPTUAL VIEW)**

- 3.1 All areas of plant (indoor and outdoor) shall be provided with suitable lighting arrangement to meet the functional requirements by use of various types of luminaires so as to achieve the desired quality and level of illumination.
- 3.2 Lighting system shall also cover the low voltage power services such as power receptacles and single phase feeders.
- 3.3 Lighting system shall be fed through various power sources such as AC Normal, AC Emergency and DC Emergency supply to achieve the desired reliability.
- 3.4 Power tapped from various sources shall be distributed through lighting distribution boards and lighting panels upto the various luminaires and power outlet sockets / feeders.



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#### **4.0 SYSTEM DESIGN ENGINEERING**

Engineering shall be done by the vendor only during the contract engineering stage as the same is covered in his scope. During tender stage, bidder shall make his quotation on the basis of BOQ furnished by the purchaser with the tender document.

**4.1 ENGINEERING INPUTS :** Complete engineering shall be done by the vendor on the basis of documents listed below. The engineering inputs shall be furnished by purchaser. However, furnishing of these inputs shall not absolve the vendor of responsibility to visit site and get acquainted with actual site conditions.

##### **4.1.1 Indoor Areas**

- a) Room dimensions (details as covered in various layout drawings)
- b) Lighting System Design Data (LSDD) covering typical values for various types of indoor areas, indicating :
  - i. Required average illumination level
  - ii. Reflection factors for walls, ceiling and floor
  - iii. Maintenance factor
  - iv. Type of luminaire
  - v. Mounting height of luminaire
  - vi. Height of working plane
- c) AC Emergency lighting requirements
- d) DC lighting requirements
- e) Requirement of sockets
- f) Requirement of exhaust fans and fan points

##### **4.1.2 Outdoor Areas**

- a) Area geometry (details as covered in various layout drawings)
- b) Lighting System Design Data (LSDD) covering typical values for various types of outdoor areas, indicating:
  - i. Average illumination level
  - ii. Type of luminaire
  - iii. Pole heights / mounting height
  - iv. AC Emergency lighting requirement



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- v. DC lighting requirements
- vi. Maintenance factor
- c) Requirement of sockets

**4.1.3 Other inputs**

- a) Plot plan, Main equipment plan and TG hall floor plans (to assess quantum of area lighting drawings)
- b) Suggestive location of LDBs
- c) Suggestive power distribution scheme (SLDs)
- d) Control schemes
- e) Single phase feeder details
- f) No. of sockets / criteria for computation of no. of sockets / location of sockets etc.
- g) LDB/WDB details
- h) LP details
- i) Poles & Masts details
- j) Conduit sizes
- k) Wire sizes
- l) Earthing material sizes

**4.2 DESIGN CRITERIA:**

**4.2.1 General Requirements of Design**

- a) Lighting system shall be provided to ensure adequate visual performance, safety and reliability and shall be free from excessive glare and flicker from discharge lamps. Particular attention shall be paid to ensure that level of illumination is satisfactory in all respects including viewing of all instruments, alarms, annunciations and indicating lamps.
- b) Complete system design shall be done on the basis of inputs provided by the purchaser and in line with the laid down criteria.
- c) Requirements of sockets shall be as per the criteria / number of sockets given by the purchaser during detailed engineering stage.



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- d) Complete power distribution system shall be designed keeping following criteria in view :
- Simplicity
  - Controlled voltage drop
  - Cost effectiveness

#### **4.2.2 Sources of Power Supply**

- a) The illumination of various indoor and outdoor areas in the main plant and off site areas shall comprise of one or more of the following systems:
- Normal AC Lighting System
  - Emergency AC Lighting System
  - DC Lighting System
- b) Arrangement and distribution of power shall depend upon the functional requirements of areas and therefore supply from all types of power sources shall not be made available to all areas. Lighting & LV power services in different areas shall be provided as per Annexure-B enclosed.
- c) 24V AC lighting for maintenance purposes (for hand lamps and/or hand operated tools) shall be supplied from 240/24V fixed/ portable lighting module.

#### **4.2.3 Lighting philosophy**

##### **a) Normal AC Lighting System**

Normal AC lighting system 415V, 3 phase, 4 wire, will be fed from lighting panels (LPs) which in turn will be fed from the lighting distribution boards (LDBs). Street lights/ flood lights shall be fed from Street Lighting Panel (SLP), Welding receptacles shall be fed from Welding DB/ MCC in offsite areas.

##### **b) Emergency AC Lighting System**

This system shall be provided for certain important areas in the main plant. The lighting fixtures connected to this system shall be normally "ON" along with the normal AC system. These will be fed from emergency lighting panels (ELPs) which in turn will be fed from 3-phase, 4-wire supply from the emergency lighting distribution boards (ELDB'S). These lights will go off for a few seconds in case of AC supply failure at Emergency Switchgear, but shall be automatically restored when Emergency Switchgear is energized by Diesel generator set.

##### **c) DC Lighting System**

At strategic locations in the main plant, a few lighting fixtures fed from 220V DC supply, shall be provided to enable safe movement of operating personnel and access to important control points during an emergency, when both the normal AC and Emergency Lighting system fail. These lighting fixtures will be fed from 220V DC LPs which in turn will be fed from DC LDBs.



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The supply to the DC lighting panels shall be automatically switched ON in case of loss of AC supply at station service switchgear as well as Emergency switch-gear. The DC supply will be automatically switched OFF after about 3 minutes following the restoration of supply to normal AC or emergency AC lighting system.

In auxiliary /off site buildings, emergency DC lighting is to be provided through self contained DC emergency fixture at strategic locations. The fixtures shall be switched 'ON' automatically in case of failure of AC supply.

**d) Street Lighting/ Flood Lighting**

Street lights / flood lights will be fed from Street Lighting Panel (SLP). The number of street lights / flood lights shall be grouped in such a way that they will be fed from the nearest SLP available. Street lights shall have provision of automatic switching ON and OFF in any one of the following modes and as per the purchaser's scheme:

- i. Manual
- ii. Automatic through 00 - 24 hrs time switch
- iii. Automatic through combination of 00 - 24 hrs time switch and a remote sensing device for monitoring external illumination level. Each SLP shall be provided with a time switch and a remote light sensing device.

**4.2.4 Number of Luminaires**

- a) All calculations shall be done as per the input data covered under "Engineering Inputs".
- b) Total AC luminaires

Total number of AC luminaires for indoor and outdoor areas shall be calculated on the basis of point to point method by an established computer program. Optimisation criteria shall form part of street lighting calculations.

For AC emergency lighting, a specified percentage of total AC luminaires shall be considered as AC emergency luminaires. The percentage shall be informed during detail engineering.

**4.2.5 Layout Considerations**

**a) General Layout Considerations**

- i. Layout of equipment such as LDBs and LPs shall be on the basis of following criteria :
  - Ease of operation
  - Maintainability
  - Aesthetics
- ii. Luminaires shall be located to meet the functional requirements of the area. Aesthetics shall form part of layout considerations.
- iii. Due considerations shall be given to the mounting arrangement depending upon location and type of area.



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- iv. While preparing lighting system layout drawings for air conditioned control rooms/areas having false ceilings, the vendor shall be required to interface with the Air Conditioning / Ventilation Duct layout and false ceiling layout drawings to avoid fouling / interference.
- v. The poles shall be located 1.5m away from the road edge. The buried cable shall run in hume pipe / duct bank wherever it is crossing the roads.
- vi. 240V AC, 5/15A universal socket (at least two number) shall be provided in office, store, cabin etc. The receptacles shall be provided at interval of 20m or part thereof for hand tools etc. One no. 20A, 240V AC industrial type receptacle shall be provided at suitable location in all other area as required. The receptacles shall be controlled through switch/MCBs. In hazardous area, receptacles shall be flame proof.
- vii. Suitable nos. of 63A/125A, 3 phase, 415V industrial receptacle with switch shall be provided at specific points in power plant area for welding purposes. At least one 63A/125A receptacle shall be provided in each off-site building.
- viii. 1200mm/ 1400mm sweep ceiling fans with stepped electronic regulator shall be provided for office room, store rooms and social buildings which are not covered by air-conditioned and ventilation system.
- ix. All fans including pedestal fans shall comply to relevant IS.

**b) Conduit System**

- i. Unless indicated otherwise, conduits shall originate from respective lighting panels and shall continue upto the luminaires for all indoor areas.
- ii. Conduits shall run in straight runs, parallel to building columns, walls etc. as far as practicable.
- iii. Unnecessary bends and crossings shall be avoided.
- iv. In the corrosive environment, conduit installations shall be made with corrosion proof conduits. Such requirements shall be clearly indicated while preparing BOQ.
- v. Conduits in control room and other air-conditioned areas shall be surface mounted on the roof above false ceiling. However vertical drops of conduits shall be through column flanges or grooved to the wall, finally covered for better aesthetics.

**c) Wiring**

- i. Each circuit from LP shall be taken in a separate conduit.
- ii. Wiring of AC normal, AC emergency & DC emergency lighting system shall be carried out in separate conduits.



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- iii. Receptacle wiring shall be distinct from lighting conduits. No two phase circuits shall be run in the same conduit. However different circuits of same phase may be laid in the same conduit.
- iv. Maximum three nos. of receptacles shall be loop-in & loop-out in a circuit.
- v. Filling area of wires in conduit shall not exceed 40% of the conduit area.
- vi. Wiring shall be done with following conductor sizes:
  - Luminaires – 2.5 sq. mm
  - 5A plug & socket – 2.5 sq. mm
  - 5/15A and 20A plug & socket – 4 sq.mm
- vii. Wiring shall be designed for the uniformly distributed spread of luminaires on each phase i.e. R,Y,B. Distribution of luminaires on these phases shall be such so that there is generally uniform light intensity in the event of failure of one or two phases.
- viii. Luminaires located in offices, stores, laboratories, toilets etc. shall be individually or group controlled.

**d) Cabling**

- i. Cables shall be considered wherever it is not desirable to run the insulated wires due to long runs or for any other valid reason.
- ii. Cable Schedule shall be prepared for all cable connections.

**4.3 ENGINEERING OUTPUTS:**

Vendor shall prepare and submit following documents and drawings for purchaser's approval :

- a) Lighting calculations for indoor areas covering details such as room dimensions (length, width, height), illumination level, reflection factors (walls, ceiling, floor), maintenance factor, type of luminaire, mounting height of luminaire, room index, coefficient of utilisation, no. of luminaires (AC Normal & AC Emergency), lumen output of each luminaire, reference drawings and remarks.
- b) Lighting calculations for outdoor areas covering average illumination level, type of luminaire, chart for illumination level at various points in the area; location (coordinates), number and height of poles; type, number (normal + emergency) and orientation of luminaires etc. Calculated values of average and minimum illumination level as obtained through computer package shall also be furnished. Dot density plots for lux level shall be furnished if available in the computer package.
- c) Single line diagrams of power distribution upto Lighting Panels. Separate drawing for complete lighting distribution shall also be prepared by vendor.



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- d) Loads on each phase of LP and LDB with consideration of diversity factor for sockets.
- e) Layout drawings for each indoor area indicating location of luminaires, sockets, fan points, exhaust fans, LDBs and LPs. Details of type of luminaires, source of power supply (AC Normal, AC Emergency, DC Normal and DC Emergency). Bill of Material shall also be covered which shall include unit wise requirements of luminaires and other items.
- f) Layout drawings for each outdoor area indicating location of poles / towers, orientation of luminaires, sockets and LPs. Details of pole height / mounting height, type of luminaires, source of power supply (AC Normal, AC Emergency, DC Emergency). Bill of Material shall also be covered for various types of luminaires.
- g) Conduit layout drawings with wiring and load distribution details as superimposed on the area layout drawings indicated above. Drawings shall include Bill of Material for conduits, wires etc.
- h) Wiring and load distribution details for outdoor areas.
- i) Master Bill of Material (to be submitted at regular intervals of engineering progress) including all items required for the complete lighting system viz. lighting fixtures, lamps, Lighting DBs, Welding DBs, lighting panels, conduits, PVC wires etc.
- j) In case of revised inputs or site feedback, preparation and submission of revised engineering outputs shall also be in the scope of vendor.
- k) Calculation for selection of number and size of containers
- l) Packing procedures and drawings.

## **5.0 LUMINAIRES, ACCESSORIES AND LAMPS**

### **5.1 GENERAL REQUIREMENTS OF LUMINAIRES**

- a) All luminaires and accessories shall be designed for continuous operation and shall be suitable for the system design data given in Data Sheet A.
- b) Luminaires shall be complete with accessories mounted inside the luminaire assembly. Lamps shall be supplied separately as per BOQ.
- c) All luminaires and accessories shall be suitable for operation in the atmospheric conditions prevailing at site.
- d) Power factor for fluorescent lamp luminaires shall be 0.9 or more and that for HPMV/ HPSV luminaires shall be 0.85 or more. Power factor correction capacitors shall be provided for this purpose.



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- e) Luminaires shall be designed for minimum glare. No bright spots should appear from the lamp or from the reflectors.
- f) All accessories shall be wired upto a terminal block or a separate weather proof metallic terminal box suitable for 2.5 sq. mm. copper wire termination.
- g) All internal wiring shall be of PVC or silicon rubber insulation, capable of withstanding the maximum temperature to which it will be subjected under specified service conditions without deterioration.
- h) All luminaires and accessories including the breathing holes shall be vermin proof.
- i) Surface Treatment:
  - All surfaces after manufacture shall be thoroughly cleaned and degreased. Pre-treatment of surfaces shall be as per the applicable standard. Pretreated surfaces shall be free from rust, sharp edges, scales and burrs.
  - Finish of surfaces shall be non-porous, smooth and unfaded.
- j) All metal parts of the luminaires shall be bonded and connected to the earthing terminal. Earthing terminal shall be suitable for connecting 14 SWG GI wire.
- k) Flood lights shall be provided with base frame / base plate for mounting on structural steel members / wall.
- l) All weather proof luminaires shall have the control gear housed in a weather proof enclosure with necessary gaskets, mounting bracket, locking screws etc.

## **5.2 LUMINAIRE TYPES & OTHER ITEMS**

5.2.1 General requirements depending upon type of luminaire are listed below. Specific requirements of each luminaire are indicated in "Luminaire Details" enclosed as Annexure-I.

### **a) Channel Mounted Luminaires (Fluorescent Luminaires)**

- Channel mounted luminaires, except the special purpose luminaires, shall have CRCA sheet steel base plate / rail / channel / box / side panels / housing as per "Luminaire Details". Sheet shall be completely stove enameled unless mentioned vitreous enameled in "Luminaire Details". Colour of enamel shall be grey on all non-reflecting surfaces and white on reflecting surfaces.
- Twin fluorescent luminaires shall be wired in lead-lag circuit to minimise stroboscopic effect.
- Luminaires suitable for surface mounting shall also be suitable for pendant mounting. Knockouts of 20mm ET conduit fixation shall be provided for this purpose.



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**b) Decorative Fluorescent Luminaires**

- Decorative luminaires shall be provided with one of the following as per “Luminaire Details” :
  - i. Perspex acrylic diffuser.
  - ii. High purity, anodised aluminium, mirror optic reflectors with anodised aluminium matt finish transverse fins to control glare.
  - iii. Opal polystyrene louvers and sheet steel side panels.
  - iv. Vertical metallic louvers finished in stove enamelled white and with sheet steel side panels.
- End plates of decorative luminaires shall be of high impact polystyrene or sheet metal finished in black colour.
- Diffusers and louvers for the fluorescent lamps shall be made of high impact polystyrene sheet and shall have no yellowing property over a prolonged period of use.
- Recessed type decorative luminaires shall be suitable for mounting with gypsum boards / luxalon / plaster of Paris/aluminium frame false ceiling of standard size as per Data Sheet A and “Luminaire details”.

**c) Industrial Fluorescent Luminaires (General Purpose)**

- Additional reflectors, wherever provided, shall be easily removable type.

**d) Industrial Fluorescent Luminaires (Special Purpose)**

- Luminaires for chemical vapour (acidic / alkaline) laden environment shall be of cast aluminium controlgear box and end boxes. Controlgear housing shall have detachable, one piece neoprene gasket cover to make it weather proof. Design shall be suitable for chemically charged environment.
- Luminaires for corrosive and dust laden environment shall be made of tray type sheet steel housing and transparent acrylic visor supported by a galvanised sheet steel frame, fitted to the housing with gasket all around. Cable entry shall be from the side of luminaire. Luminaire shall be totally dust and vapour proof.
- Luminaires for highly corrosive environment shall have with sheet aluminium/ polycarbonate housing. controlgear housing, CRCA sheet steel controlgear tray with a stove enamelled white reflector. A clear acrylic cover of dish shape, secured to canopy by stainless steel toggle and neoprene gasket lining, shall be provided at the bottom.



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- Luminaires for drip proof environment such as street lighting fluorescent luminaire shall have sheet aluminium canopy, a detachable reflector-cum-controlgear housing, clear ribbed acrylic cover held in aluminium frame. Luminaire shall have the degree of protection IP:55 unless mentioned otherwise in Data Sheet A. Luminaire shall be suitable for side entry mounting with the pole bracket arm.

**e) Bay Type Luminaires**

- Luminaires shall be designed for following indoor applications:
  - i) High bay
  - ii) Medium bay
  - iii) Low bay
- Luminaires shall have top mounted, cast aluminium controlgear housing. Housing shall have cooling fins and canopy for easy access to the components. Canopy shall be hinged at one end and wing screw bolted at the other end.
- Controlgear shall be connected to the detachable lamp housing at the bottom such that heat dissipation is proper and distributed.
- Lamp housing-cum-reflector shall be made from spun aluminium, electrochemically brightened and anodised.
- Lamp housing for the dust laden environment shall be totally enclosed type. A clear toughened glass cover shall be attached to the lamp housing with an aluminium frame and neoprene gasket. Luminaire shall be provided with a safety chain for toughened glass.
- Mounting arrangement shall consist of MS brackets with an anti-vibration eye-bolt.
- Side mounted controlgear box shall be provided for low bay luminaires, if mentioned in "Luminaire Details".

**f) Well Glass Luminaires**

- Well glass luminaires shall be suitable for dust and vapour laden environment.
- Luminaires shall be provided with a die-cast aluminium canopy and heat resistant well glass, fitted with a ring type gasket.
- All well glass luminaires shall be provided with vitreous enamelled reflector.
- Zinc plated MS wire guard shall be provided for protection of well glass.



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- Separate side mounted and top connected control gear box shall be provided for use with HPMV & HPSV lamps.
- Integral control gear box, where applicable, shall be of die cast aluminium material with one piece neoprene gasket between the box and its cover to make it dust and vapour proof.
- Luminaires shall be conduit mounted type for incandescent lamps and surface mounting type for HPMV & HPSV lamps.

**g) Flame Proof Well Glass Luminaires**

- Housing material shall be cast aluminium alloy LM6. Housing outer surface shall be provided with cooling fins.
- Flame proof luminaires shall be provided with heavy toughened well glass cemented in a retaining ring.
- Zinc-coated / chrome-plated MS chain connected to the main body and glass retaining ring shall be provided.
- A detachable terminal box at the top shall be provided.
- Neoprene gaskets, where needed, shall be provided for weather proof construction and indoor and outdoor application.
- Two cable entries of 20mm ET conduit shall be provided with one flame proof plug.
- Luminaires shall be suitable for the hazardous areas as classified in Data Sheet A. Design of flame proof luminaire shall be supported by the type test report for flame proofness from a government or government approved independent laboratory.

**h) Street Lighting Luminaires (Other than Fluorescent Luminaire)**

- These luminaires shall be suitable for street lighting and general purpose outdoor area lighting.
- Luminaire housing shall be one piece cast aluminium alloy to accommodate lamp housing and controlgear for lamp wattage upto 150 watts. For lamp wattage above 150 watts, controlgear housing shall be of cast aluminium alloy whereas lamp housing shall be of deep drawn aluminium.
- Inside finish of the lamp housing shall be stove enamelled white. Optical control shall be provided with two high purity, electro brightened and anodised side reflectors.



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- Clear acrylic bowl fitted with a rubber gasket and easily removable type shall be secured to the lamp housing.
- Provision shall be made for adjustment of lamp location for proper focussing.
- Luminaires shall be suitable for mounting with pole bracket arm.

**i) Flood Lighting Luminaires**

- Flood light lamp housing and reflector shall be separate from controlgear box. Requirements of controlgear box are specified elsewhere.
- Lamp reflectors shall be of high purity spun aluminium attached to the cast aluminium lamp holder housing at the rear. Lamp holder housing shall be provided with cooling fins.
- Reflector shall be closed from the front by heat resistant toughened glass and synthetic "S" type weather proof gasket.
- Luminaire shall be provided with special lamp centering and focussing device ensuring good beam control.
- MS mounting bracket shall allow fixation of the flood light in any position in a horizontal plane and the flood light can be locked in at any set angle in the vertical plane. Cast iron base and / or two protector scales shall also be provided where specified in "Luminaire Details"
- Design shall permit replacement of lamp from the rear without disturbing the previously set aiming angles. Special guide pins shall also be provided for protecting the lamps from damage while replacing.

**j) Halogen Flood Lighting Luminaire**

- Luminaires shall be compact in design with aluminium alloy housing and three piece highly polished and anodised reflector assembly.
- Toughened glass panel in the front shall be provided with silicon gaskets.
- Lamp replacement from the front is also acceptable.

**k) Post Top Lanterns**

- Luminaire shall comprise of a spun aluminium canopy, opal acrylic diffuser and a cast aluminium spigot.
- Controlgear shall be integral type and shall be housed in the spigot.
- Luminaire shall be supplied without mounting pole.



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**l) Bulk Head (Flame Proof)**

- Bulk head luminaires shall be used for the locations where explosion or fire hazard exists.
- Luminaire shall be made of cast iron housing with integral terminal box.
- Front of the luminaire shall be covered with flat toughened glass cemented into a retaining ring.
- Lamp replacement shall be from the front.
- Controlgear box for HPMV lamps shall be integral to the housing.
- MS fixing straps shall be provided for mounting.
- Luminaire shall be stove enameled grey outside and white inside.
- Terminal box shall be provided with 20 mm ET conduit entry.
- Complete luminaire shall be suitable for the hazardous area as classified in Data Sheet A. Type test certificate for flame proofness test from government or government approved independent laboratory shall be submitted.

**m) Bulk Head (Weather Proof)**

- Luminaire shall be suitable for indoor / outdoor applications having weather proof features.
- The luminaire shall comprise of die cast aluminium alloy body of dish shape.
- Luminaire shall have a heat resistant prismatic cover held in a weather proof gasket.
- Luminaire shall be stove enamelled grey outside and white inside.
- Glass cover shall have a galvanised wire protection.
- Luminaire shall be provided with locking arrangement with Allen key to prevent pilferage.
- Luminaire shall be suitable for use with incandescent lamp upto 100W.
- Provision for 20 mm ET conduit entry shall be provided at the bottom.



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**n) LED type Luminaires:**

- LED Luminaires shall be used for the lighting if specified in BOQ as part of NIT.
- In false ceiling area LED luminaires shall be recessed mounting type & in non-false ceiling area the LED luminaires shall be surface mounting type.
- The individual lamp wattage for LED shall be upto 3 watt.
- The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall be not less than 70Lm/W.
- The LED used in the luminaires shall have colour rendering index (CRI) of Min 65. Colour designation of LED shall be “cool day light” (min 5700K) type.
- The LED luminaire shall have minimum life of 25,000 burning hours with 80% of lumen maintenance at the end of the life.
- The beam angle for LED chip shall be 120 degrees.
- The max. junction temperature of LED shall be 85 deg C, further the lumen maintenance at this temperature shall be min 90%.
- The THD of LED Luminaires shall be less than 10%. Further the EMC shall be as per IS 14700. The power factor of the luminaire shall not be less than 0.9.
- The marking on luminaire & safety requirements of luminaire shall be as per IS standards.
- Suitable heat sink with proper thermal management shall be designed & provided in the luminaire.
- The connecting wires used inside the system, shall be low smoke halogen free, fire retardant PTFE cable.
- Fuse protection shall be provided in input side specifically for LED luminaires.
- Care shall be taken in the design that there is no water stagnation anywhere. The entire housing shall be dust and water proof protection as per IS 12063.
- Driver Circuit: LED modules and drivers shall be compatible to each other. The LED module driver's ratings and makes shall be as recommended by corresponding LED manufacturer. LED Drivers may have following control & protections:
  - Suitable precision current control of LED.
  - Open Circuit Protection



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- Short Circuit Protection
- Over Temperature Protection
- Overload Protection

**o) Emergency Lighting Luminaires**

- The luminaire shall be automatic having in-built battery.
- Battery shall have integral charging unit.
- Charger shall be suitable for operation as per system design data.
- The battery enclosure shall be suitably painted and ventilated for the performance with sealed lead acid battery, as applicable.

**5.3 CONTROLGEAR BOX (NON-INTEGRAL TYPE)**

- a) Boxes shall have weatherproof construction and shall be provided with one piece neoprene gasket.
- b) Boxes shall be provided with HRC fuse mounted on a removable tray. Boxes shall be provided with all necessary components having a neat layout arrangement such that it is possible to test, inspect or replace any component without difficulty.
- c) Boxes shall be suitable for mounting on structures, walls and columns.
- d) Suitable number of terminals shall be provided for looping-in and looping-out of cable connections and also connections to the luminaire(s).
- e) Cable / conduit knock-outs shall be for each loop-in and loop-out connection and also connection to the luminaire(s).

**5.4 REFLECTORS**

- a) Reflectors shall be made of sheet steel or aluminium as applicable.
- b) The aluminium reflectors shall be made of high purity aluminium sheet. Sheet will be polished, electrochemically brightened and anodised.
- c) Wherever reflectors are separate from housing, they shall be securely attached to the luminaire by means of easily accessible fastening devices such that they are readily removable from the housing for maintenance.



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**5.5 LAMP HOLDERS**

- a) Holders shall be resistant to wear and shall be smooth in operation.
- b) Contacts shall be of durable quality.
- c) Holders shall hold the lamp under condition of shock and vibration.
- d) Lamp holders for fluorescent lamp shall be spring loaded, bi-pin, rotor type with low contact resistance.
- e) Live parts of the holder shall not be exposed when the lamp is inserted or removed in case of fluorescent luminaires.
- f) Lamp holders for HPMV & HPSV lamps shall be of porcelain material.
- g) Holders shall be screw type for HPSV & HPMV lamps. Holders for incandescent lamps shall be screw type, unless mentioned otherwise in Data sheet A.
- h) Lamp holders for incandescent lamps shall be of brass or porcelain.

**5.6 STARTER HOLDERS**

- a) Starter holders shall be designed and manufactured as per the applicable standard.

**5.7 BALLASTS**

- a) Fluorescent fixtures shall have electronic ballasts. Ballasts shall be totally enclosed type.
- b) Ballasts shall be easily removable type.
- c) Core shall be made of low loss, electrical grading stampings.
- d) End connections shall be made available in a terminal block, rigidly fixed to the ballast enclosure.
- e) Ballasts shall be free from humming.
- f) Ballast shall be provided separately for each lamp in a multi-lamp luminaire.
- g) Tappings shall be provided to set the voltage within range for HPMV & HPSV luminaires.

**5.8 STARTERS**

- a) Starters shall be made of aluminium material. Plastic or any other material if used shall be subject to purchaser's approval.
- b) Starters shall have bi-metal electrodes.



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- c) Starter shall be replaceable without the use of any tool and without disturbing any accessory or lamp.
- d) Starters shall have high mechanical strength.
- e) Starters shall be provided with radio interference suppressing capacitors.
- f) Starters shall have brass contacts.

**5.9 CAPACITORS**

- a) Capacitors shall have constant value of capacitance, suitable for operation at supply voltage.
- b) Capacitors shall be hermetically sealed, preferably in a metal enclosure to prevent seepage of impregnant and ingress of moisture.

**5.10 LAMPS**

- a) Lamps shall be suitable for use in any position.
- b) Lamps shall be capable of withstanding small vibrations without breakage to filaments / electrodes and lead-in wire.

**5.10.1 Type of Lamps**

- a) Fluorescent Lamp
  - i. Anode rings shall be provided to prevent blackening of the ends.
  - ii. Lamp caps shall be two pin type at each end.
- b) Incandescent (GLS) Lamps
  - i. Incandescent lamps shall be "clear" type.
- c) Mercury Vapour Lamps
  - i. Lamp caps shall be screw type.
- d) Sodium Vapour Lamps
  - i. Lamps shall be ovoid shaped with diffusing powder coating.
  - ii. Lamps shall be provided with external igniters and rapid restart facility.
  - iii. Lamp caps shall be screw type.



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**e) Halogen Lamps**

- i. Lamps shall be double ended linear type.
- ii. Lamps shall be of immediate start type.
- iii. Design of lamps shall ensure high performance and high efficiency.

**5.11 JUNCTION BOXES**

a) Junction boxes with terminals shall be supplied for branching and terminating lighting wires/cables whenever required, as specified.

**b) Construction Features**

- i. The junction boxes shall be fabricated out of material & thickness as specified in Datasheet-A and shall be of rectangular shape. The cover shall be hinged or bolted with captive nuts and bolts and shall be provided with neoprene gasket lining all over.
- ii. The junction boxes shall be provided with suitable knock outs/ gland plates for conduit/ cable connection. The conduit connection shall be properly sealed. The junction boxes meant for cable connection shall be complete with removable gland plates, glands and cable lugs, as required. The junction boxes shall be provided with two earthing terminals suitable for GI earthing wires.
- iii. The junction boxes shall be weather proof type conforming to IP-55..
- iv. The boxes and cover shall be hot dip galvanised. Junction boxes for corrosive areas like DM Plant, water treatment plant etc. shall have additional epoxy/acrylic coating of thickness not less than 50microns on outer surface.
- v. The junction boxes shall be suitable for mounting on wall, columns, etc. The brackets, bolts, nuts, screws and any other erection accessories required for erection shall be included.

**c) Terminals**

- i. Multiway terminal blocks of approved type and make complete with galvanised screws, nuts, washers and marking strips shall be furnished for terminating the lighting wires.
- ii. All the terminals blocks shall be of 650V grade one piece construction with insulating barriers. These terminals shall be made of copper alloy and shall be stud type. Each terminal provided on junction box shall be suitable for terminating two numbers of aluminium conductors of the size as specified without any damage to the conductors or looseness.



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d) The junction boxes shall be of following types:

| Type  | Description                                                                                                                                                                                       |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| JB-F  | Provided with four (4) way stud type terminals for terminating upto 2 nos. 10 mm <sup>2</sup> stranded aluminium conductors on each terminal, suitable for outdoor installations.                 |
| JB-FE | Same as above but with an additional epoxy coating of 50 micron thickness.                                                                                                                        |
| JB-S  | Provided with four (4) way stud type terminals, each terminal suitable for terminating upto two nos. of 3.5Cx50 mm <sup>2</sup> stranded aluminium conductors & with one no.6A HRC fuse and link. |

## **5.12 RECEPTACLES**

- a) Receptacle unit shall consist of socket outlet with associated switch and plug. The socket outlet and switch shall be flush mounted on a box which shall be suitable for mounting on wall or steel structures.
- b) Receptacle boxes shall be fabricated from material with thickness mentioned in Data Sheet A.
- c) Steel boxes shall be hot dip galvanised/ painted as specified in Datasheet-A and as per the requirements of applicable standard corresponding to the sheet thickness.
- d) The boxes shall have conduit knock-outs and shall be suitable for cable entry of the size to be specified by purchaser during detailed engineering.
- e) The boxes shall be provided with neoprene rubber gaskets to make them moisture and dust proof.
- f) Suitable loop-in and loop-out terminals shall be provided inside the box. Terminals for incoming and outgoing shall be suitable for the size of conductor of cables.
- g) The receptacle units shall be of the following types:
  - I. Type RA: It shall have the following:
    - i. 20A, 240V, 1-phase, 2 pole, 3-pin (third pin scrapping earth) porcelain, metal clad socket with a metallic cover tied to it.
    - ii. Rotary, heavy duty 20A switch conforming to applicable standard.
    - iii. Shrouded, die-cast aluminium plug.
    - iv. It shall be combined interlocked weather proof industrial unit.



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v. Mechanical interlock shall be provided as follows :

- Switch can be put ON only when plug is fully engaged.
- Plug can be withdrawn only when switch is in OFF position.
- Cover can be opened only when switch is in OFF position.

vi. The arrangement should ensure that water does not enter the plug when socket is ON.

vii. Loop-in loop-out terminals shall be provided inside the box suitable for 10 mm<sup>2</sup> Al conductor.

II. Type RB: It shall have the following:

- i. Combination of 5A & 15A, 240V, 1-phase, 2 pole, 3-pin, third pin grounded socket with integral piano key type 15A switch, flush mounted on decorative bakelite (6 mm thick)/ perspex (3 mm thick) sheet as cover of the boxes.
- ii. Loop-in loop-out terminals similar to type RA shall be provided. These will be located in office areas.

III. Type RC: It shall have the following:

- i. 63A, 415V, 3-phase-neutral earth, metal clad socket with cover
- ii. Rotary, heavy duty 63A switch conforming to applicable standard.
- iii. Shrouded, die-cast aluminium plug
- iv. It shall be combined, interlocked weather proof industrial unit.
- v. Mechanical interlock shall be same as that are applicable for RA type receptacles
- vi. The receptacle boxes shall be suitable for entry and exit of 3.5CX70 mm<sup>2</sup> Al conductor PVC cable and loop-in loop-out terminals for the same shall be provided such that not more than one core is terminated at one terminal. Removable, undrilled cable gland plate shall be provided. Tinned copper lugs and double compression cable glands shall also be supplied by the bidder.

IV. Type RD: It shall have the following:

- i. 125A, 415V, 3-phase-neutral earth, metal clad socket with cover.
- ii. Rotary, heavy duty 125A switch conforming to applicable standard.
- iii. Shrouded, die-cast aluminium plug



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- iv. It shall be combined, interlocked weather proof industrial unit.
  - v. Mechanical interlock shall be same as that are applicable for RC type receptacles
  - vi. The receptacle boxes shall be suitable for entry and exit of 3.5CX95 mm<sup>2</sup> Al conductor PVC cable and loop-in loop-out terminals for the same shall be provided such that not more than one core is terminated at one terminal. Removable, undrilled cable gland plate shall be provided. Tinned copper lugs and double compression cable glands shall also be supplied by the bidder.
- V. Type RE: It shall have the following:
- i. 5A, 240V, 1-phase, 2 pole, 3-pin, third pin grounded socket with integral piano key type 5A switch, flush mounted on decorative bakelite (6 mm thick)/ perspex (3 mm thick) sheet as cover of the boxes.
  - ii. Loop-in loop-out terminals similar to type RA shall be provided. These will be located in office areas.

**5.13 CEILING FAN & REGULATORS**

- a) The bidder shall supply the following ceiling fans complete with suspension rod, canopy and accessories and regulators:
  - i. 1200 mm sweep
  - ii. 1400 mm sweep
- b) The fan motor shall be totally enclosed. The motor winding shall be of copper wire provided with double or reinforced class-E insulation.
- c) The fan shall have three (3) well balanced blades. Precaution shall be taken in the manufacture of fan as well as regulators to ensure reasonable degree of silence at all speeds.
- d) The regulator shall be electronic type with stepped/smooth (stepless) control of approved make.

**5.14 LIGHTING CONTROL SWITCH-BOXES**

- a) The switch-boxes shall be of bent steel construction, fabricated of 1.6 mm thick MS steel with 6 mm thick decorative bakelite or 3 mm thick perspex sheet cover. The boxes shall be hot dip galvanised.
- b) The switch-boxes shall be suitable for surface mounting as well as flush mounting in brick walls. They shall be flush mounted in the walls in the office areas where false ceiling is provided.



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- c) Switch-boxes shall have conduit knock-out on two sides. Adequate provision shall be made for ventilation of these boxes. Conduit knock-out sizes shall be as per conduit layout drgs.
- d) Switches shall be of piano-key type having quick-make, quick-break mechanism, provided with position marking, suitable for mounting on insulating plate. The switches shall be suitable for 1-phase, 240V, 50 Hz supply. They shall conform to relevant standards. The switches shall be supplied loose and shall be fixed at site according to requirement.
- e) All components housed in the switch-boxes shall be wired to an outgoing junction box by 1.5 mm<sup>2</sup> Cu wire. The junction box shall have adequate nos. of terminals.
- f) The size of switch-boxes shall be adequately chosen to accommodate the no. of switches and fan regulator boxes specified below. Fan regulators shall be supplied separately.
- i. Type SWB1 - Switch board with 1 no. 5A switch, JB type SW1.
- ii. Type SWB2 - 3 nos. 5A switches and 1 no. fan regulator, JB type SW2.
- iii. Type SWB2a - 4 nos. 5A switches, JB type SW2.
- iv. Type SWB3 - 7 nos. 5A switches, 3 nos. fan regulator, JB type SW3.
- v. Type SWB3a - 8 nos. 5A switches, JB type SW3.

JB details for lighting control switch boxes are as below:

JB-SW1 Provided with four (4) way stud type terminals, each terminal suitable for terminating upto two nos. of 10 mm<sup>2</sup> stranded aluminium conductor.

JB-SW2 Similar to the JB-SW1 but provided with ten (10) way terminals.

JB-SW3 Similar to the JB-SW1 but provided with eighteen (18) way terminals.

**5.15 CABLE GLANDS**

- a) Whether specifically mentioned or not, cable glands of suitable sizes shall be supplied along with each equipment for power and control cables.
- b) Rubber components used in the gland shall be of neoprene.
- c) Name / trade name of manufacturer, type no. and applicable range of outer diameter of cable shall be engraved / indelibly printed on the cable gland.

**5.16 CABLE LUGS**

- a) All equipment shall be supplied with the power and control cable lugs of suitable size, whether specifically mentioned or not.



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- b) Name / trade name and size of lug shall be engraved/ indelibly printed on each cable lug.

**5.17 FLEXIBLE METALLIC CONDUITS AND FITTINGS**

- a) Flexible metallic conduits shall generally conform to the requirements of IS:3480.
- b) Flexible conduits shall be made of strip steel, which shall be of cold rolled mild steel. The strip shall be of uniform width and thickness throughout.
- c) The strip for making flexible conduit shall be wound tightly and so overlapped in subsequent helicals that no openings are seen in normal position.
- d) The surface of the strip shall be thoroughly cleaned before application of protective coating. Pre-treatment, before galvanization, shall conform to IS:6005.
- e) The strip shall be electro-galvanized to a minimum thickness of 25 microns as per IS 3480.
- f) Flexible conduits shall be lead coated for application in high temperature zones if specifically mentioned in Data Sheet A.
- g) The conduit shall have uniform diameter throughout its length. The internal surface of all conduits shall be free from burrs and sharp edges and suitable for pulling insulated cables and wires without damage.

**5.18 PVC CONDUITS**

- a) PVC conduits shall generally conform to the requirements of IS: 9537(Part I & Part III).

**6.0 SURFACE TREATMENT**

- 6.1 All metal parts and the surfaces (exterior & interior) of equipment, unless stated otherwise in case of reflectors, shall be degreased by dipping in hot alkaline solution and rubbed with wire brush to remove oil & scale from them & then rinsed in water. Alternatively, they may be shot / sand blasted.
- 6.2 Parts shall be pickled by dipping in hydrochloric acid tank to remove the rust from the surfaces formed during storage of sheets & then rinsed to remove traces of the acid. The cleaning and pretreatment of all metal parts shall be as per applicable standard.
- 6.3 The surfaces to be painted shall then be prepared by phosphatizing to protect them from further rusting & to create a good bond with the paint. The pretreatment shall conform to the applicable standard.
- 6.4 All parts shall then be subjected to a coat of red oxide primer paint.
- 6.5 All inside and outside surfaces of panel shall be spray painted with synthetic enamel of the shade as per Data Sheet A.



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6.6 Electrostatic or powder painting shall be acceptable subject to purchaser's approval.

6.7 Wherever possible, finished parts shall be coated with peelable compound by spraying method to protect the finished product from scratches, grease, dirty and oily spots during handling and transportation.

**7.0 PACKING**

7.1 Vendor shall furnish packing procedure along with packing drawing at contract stage for applicable items for purchaser approval.

7.2 Containers adequate for storing 70% of P.O. quantity material at site are to be supplied. Vendor shall furnish suitable justification to purchaser during detailed engineering for the number and size of containers being supplied.

7.3 Specification for the sea worthy packing, if enclosed, for the export jobs shall form part of the specification.

**8.0 GUARANTEED PERFORMANCE REQUIREMENTS**

8.1 The vendor shall guarantee satisfactory performance of the equipment supplied under all conditions and requirement as laid down by this specification.

8.2 Vendor shall ensure satisfactory performance for lighting system designed by them at site.

**9.0 INSPECTION & TESTING**

9.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-558-E006) without any deviations. The equipment which are not covered in the Quality Plan shall be tested as per the QP to be submitted by bidder. In case bidder has reference QP agreed with ultimate customer, same can be submitted for specific project after award of contract for BHEL/ ultimate customer's approval. There shall be no commercial implication to BHEL on account of any changes in QP during contract stage.

9.2 All the components and completely assembled equipment shall be tested as per the latest edition of standards. Charges for these tests shall be deemed to be included in equipment price.

9.3 All the specified type and routine tests shall be carried out to verify the rating and performance of the equipment. Where valid type test certificates in evidence of equipment performance claimed are available & approved by purchaser, the requirements for conducting type tests may be waived. The general arrangement of object under test shall be to purchaser's approval.

9.4 All manufacturing processes viz. machining, sheet forming, electroplating, wire routing, cleating & crimping, assembly, surface preparation shall conform to good manufacturing practices.



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9.5 Inspection for dimensional & visual checks especially of the following, with respect to contract drawings, documents & standards shall be conducted:

- a) General sturdiness & rigidity of equipment
- b) Surface finishing
- c) Gasketting
- d) Inter-changeability
- e) Constructional features viz. location, accessibility & marking of components, segregation, accessibility to live parts (shrouding) etc.
- f) Completeness of scope

9.6 Equipment shall be liable for rejection if tolerances on the values of dimensions, power consumption, impedances, temperature rise etc. exceed the specified values by purchaser and / or standards.

**10.0 SPARES**

10.1 Mandatory spares (if applicable) are indicated in BOQ-cum-price schedule.

10.2 Erection & commissioning spares are included in the bidder's scope of supply. BE&C spares are indicated in BOQ-cum-price schedule.

10.3 A list of recommended O&M spares quantities for a duration of 3 years A shall be filled up in the applicable schedule / format and submitted by bidder along with offer. However, the acceptance of the same shall not be binding on purchaser.

**11.0 TOOLS AND TACKLE**

11.1 Tools & tackle which are essential to facilitate assembly, adjustments, erection, maintenance & dismantling of equipment shall be provided as part of equipment supplied.

11.2 The above tools shall be supplied along with the initial consignment of equipment so as to be available prior to erection but may not be used for erection purposes.

11.3 Vendor shall also submit a list of recommended tools and tackle. Acceptance of these tools and tackle shall not be a binding on the purchaser.

11.4 Schedule of tools & tackle shall be filled up by bidder.

**12.0 DOCUMENTATION**

**12.1 Documents to be submitted by the vendor immediately after award of contract**

- a) Bar chart of activities of manufacture, testing, inspection and despatch.

**12.2 Documents to be submitted during detailed engineering of contract**

12.2.1 Engineering documents (refer clause 4.3) to be generated by the vendor, if applicable.



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- a) Lighting calculations for indoor areas.
- b) Lighting calculations for outdoor areas.
- c) SLD of power distribution upto LPs.
- d) Power load on each LP & LDB
- e) Layout drawings for indoor areas
- f) Layout drawings for outdoor areas.
- g) Conduit layout drawings.
- h) Wiring and load distribution details for outdoor areas.
- i) Master Bill of Material.
- j) Packing Procedure & drawing.
- k) Calculation for selection of no. & size of container.

**12.2.2 Other documents :**

- a) Final Quality Plans
- b) Technical data sheet
- c) Polar curves, zonal flux diagram and CoU charts of luminaires.
- d) Complete design calculations for arriving at number of luminaires.
- e) Fixing / mounting details of luminaires and other items.
- f) General arrangement drawings of following:
  - i. Luminaires
  - ii. Receptacles
  - iii. 24 V Supply module
- g) Field Quality Plan as per General Technical Conditions.
- h) Control Scheme for fluorescent, HPMV and HPSV luminaires.
- i) Schematic drawings for LDBs / LPs.
- j) Type test certificates.
- k) Catalogues / leaflets

**12.3 Operation and Maintenance (O&M) manual :**

The document shall comprise of installation, operating and maintenance instructions for various items / components. The O&M manual shall include the following :

- a) Write ups / instructions / procedures for
  - i. Storage at site.
  - ii. Unpacking.
  - iii. Handling at site.



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- iv. Erection.
- v. Pre-commissioning / commissioning tests.
- vi. Operating procedures.
- vii. Maintenance procedures.
- viii. Precautions to be taken during operation and maintenance work.
- ix. Trouble shooting charts covering problems, cause and solution.
- b) Approved Technical Data Sheets.
- c) Technical leaflet of various items / components.
- d) Copies of the type, acceptance and routine test certificates in bound volume.
- e) Details of all components liable to be replaced during the life of the equipment.
- f) List of maintenance tools required.
- g) List of testing equipment required.

**12.4 AS BUILT DRAWINGS**

- a) Preparation of as-built drawings shall be in the scope of vendor.
- b) The as-built drawings shall be prepared on the basis of marked up copies received from the erection contractor.
- c) Entire work of as-built drawings shall be to the satisfaction of purchaser.



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**ANNEXURE-I**

**LUMINAIRE DETAILS**

**LUMINAIRE CODING SCHEME**

**1.0 Code Structure**

A A NN (no. x W) — Number of lamps x Wattage of each lamp  
| |  
| | Classified Serial Number (Numeric)  
| | Luminaire type (Alpha)  
| | Lamp type (Alpha)

**2.0 Lamp types**

- a) F - Fluorescent
- b) M - Mercury Vapour
- c) S - Sodium Vapour
- d) T - Tungsten
- e) H - Halogen

**3.0 Luminaire types**

- a) C - Channel Mounted (Fluorescent)
- b) B - Bay Mounted
- c) W - Well Glass
- d) S - Street Lighting
- e) F - Flood Lighting
- f) H - Bulk Head
- g) P - Post Top Lantern
- h) E - Emergency Lighting
- i) X - Others

**4.0 Serial Numbers**

- a) 01 - 20 General Purpose (Industrial)
- b) 21 - 40 Decorative
- c) 41 - 50 Vapour Proof
- d) 51 - 60 Dust Proof
- e) 61 - 70 Drip Proof
- f) 81 - 90 Corrosion Proof
- g) 91 - 99 Flame Proof

**NOTES :**

- 1. Flood lighting luminaires to have non-integral control gearbox.
- 2. All other luminaires shall have integral control gearbox, unless specifically mentioned otherwise in enclosed sheets.
- 3. For more details of each luminaire, refer specification.



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**1.0 Fluorescent Lamp Luminaires**

- |      |      |        |                                                                                                                 |
|------|------|--------|-----------------------------------------------------------------------------------------------------------------|
| 1.1  | FC01 | 1 x 28 | Fluorescent, industrial box type base without any cover.                                                        |
| 1.2  | FC02 | 2 x 28 | Fluorescent, industrial box type base without any cover.                                                        |
| 1.3  | FC03 | 1 x 28 | Fluorescent, industrial box type base and stove enamelled side reflectors.                                      |
| 1.4  | FC04 | 2 x 28 | Fluorescent, industrial box type base and stove enamelled side reflectors.                                      |
| 1.5  | FC05 | 1 x 28 | Fluorescent, industrial box type base and vitreous enamelled side reflectors.                                   |
| 1.6  | FC06 | 2 x 28 | Fluorescent, industrial box type base and vitreous enamelled/ anodized glossy side reflectors.                  |
| 1.7  | FC07 | 1 x 18 | Fluorescent, industrial box type base and vitreous enamelled side reflectors operating on 220V DC input supply. |
| 1.8  | FC21 | 1 x 28 | Fluorescent, decorative with 3 side perspex acrylic diffuser.                                                   |
| 1.9  | FC22 | 2 x 28 | Fluorescent, decorative with 3 side perspex acrylic diffuser.                                                   |
| 1.10 | FC23 | 1 x 28 | Fluorescent, decorative, recessed type with perspex acrylic diffuser.                                           |
| 1.11 | FC24 | 2 x 28 | Fluorescent, decorative, recessed type with perspex acrylic diffuser.                                           |
| 1.12 | FC25 | 1 x 28 | Fluorescent, decorative, recessed type with mirror optic reflector.                                             |
| 1.13 | FC26 | 2 x 28 | Fluorescent, decorative, recessed type with mirror optic reflector.                                             |
| 1.14 | FC27 | 2 x 28 | Fluorescent, decorative with opal polystyrene louvers.                                                          |
| 1.15 | FC28 | 2 x 28 | Fluorescent, decorative, recessed type with opal polystyrene louvers.                                           |
| 1.16 | FC29 | 2 x 28 | Fluorescent, decorative with vertical metallic louvers.                                                         |
| 1.17 | FC30 | 4 x 14 | Fluorescent, decorative, recessed type, 600 x 600 size with perspex acrylic diffuser.                           |
| 1.18 | FC31 | 4 x 20 | Fluorescent, decorative, recessed type, 600 x 600 size with opal polystyrene louvers.                           |



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|------|------|--------|-----------------------------------------------------------------------------------------------------------|
| 1.19 | FC32 | 2 x 28 | Fluorescent, decorative, surface mounted with mirror optic reflector.                                     |
| 1.20 | FC33 | 1 x 18 | Fluorescent, decorative, recessed type with mirror optic reflector operating on 220V DC input supply.     |
| 1.21 | FC34 | 1 x 18 | Fluorescent, dust proof, totally enclosed type with sheet steel housing operating on 220V DC input supply |
| 1.22 | FC41 | 2 x 28 | Fluorescent, vapour proof with end boxes and controlgear box of cast Al.                                  |
| 1.23 | FC51 | 2 x 28 | Fluorescent, dust proof, totally enclosed type with sheet steel housing.                                  |
| 1.24 | FC61 | 1 x 28 | Fluorescent, street light with sheet aluminium canopy and ribbed acrylic cover.                           |
| 1.25 | FC62 | 2 x 28 | Fluorescent, street light with sheet aluminium canopy and ribbed acrylic cover.                           |
| 1.26 | FC81 | 2 x 28 | Fluorescent, corrosion proof, totally enclosed type with sheet aluminium/ polycarbonate housing.          |

**2.0 High Pressure Mercury Vapour (HPMV) Lamp Luminaire**

- |      |      |          |                                                        |
|------|------|----------|--------------------------------------------------------|
| 2.1  | MB01 | 1 x 250  | Mercury, high bay, industrial type.                    |
| 2.2  | MB02 | 1 x 400  | Mercury, high bay, industrial type.                    |
| 2.3  | MB03 | 1 x 1000 | Mercury, high bay, industrial type.                    |
| 2.4  | MB04 | 1 x 250  | Mercury, high bay, totally enclosed industrial type.   |
| 2.5  | MB05 | 1 x 400  | Mercury, high bay, totally enclosed industrial type.   |
| 2.6  | MB06 | 1 x 250  | Mercury, high bay with non-integral controlgear box.   |
| 2.7  | MB07 | 1 x 400  | Mercury, high bay with non-integral controlgear box.   |
| 2.8  | MB11 | 1 x 250  | Mercury, medium bay, industrial type.                  |
| 2.9  | MB12 | 1 x 400  | Mercury, medium bay, industrial type.                  |
| 2.10 | MB13 | 1 x 250  | Mercury, medium bay, totally enclosed industrial type. |
| 2.11 | MB14 | 1 x 400  | Mercury, medium bay, totally enclosed industrial type. |



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| 2.12 | MB17 | 1 x 80  | Mercury, low bay, industrial type.                                                                                                                   |
| 2.13 | MB18 | 1 x 125 | Mercury, low bay, industrial type.                                                                                                                   |
| 2.14 | MB19 | 1 x 80  | Mercury, low bay, totally enclosed industrial type.                                                                                                  |
| 2.15 | MB20 | 1 x 125 | Mercury, low bay, totally enclosed industrial type.                                                                                                  |
| 2.16 | MW41 | 1 x 80  | Mercury, well glass, vapour proof with vitreous enamelled reflector.                                                                                 |
| 2.17 | MW42 | 1 x 125 | Mercury, well glass, vapour proof with vitreous enamelled reflector.                                                                                 |
| 2.18 | MW51 | 1 x 80  | Mercury, well glass, dust proof with vitreous enamelled reflector.                                                                                   |
| 2.19 | MW52 | 1 x 125 | Mercury, well glass, dust proof with vitreous enamelled reflector.                                                                                   |
| 2.20 | MW91 | 1 x 80  | Mercury, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing.                                             |
| 2.21 | MW92 | 1 x 125 | Mercury, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing.                                             |
| 2.22 | MW93 | 1 x 80  | Mercury, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing                                              |
| 2.23 | MW94 | 1 x 125 | Mercury, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing.                                             |
| 2.24 | MW95 | 1 x 80  | Mercury, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast aluminium alloy LM6 housing for Div.-2 areas. |
| 2.25 | MW96 | 1 x 125 | Mercury, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast aluminium alloy LM6 housing for Div. 2 areas. |
| 2.26 | MW98 | 1 x 125 | Mercury, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast aluminium alloy LM6 housing                   |
| 2.27 | MS61 | 1 x 125 | Mercury, street light with one piece cast aluminium body.                                                                                            |
| 2.28 | MS62 | 1 x 250 | Mercury, street light with two piece cast aluminium body.                                                                                            |
| 2.29 | MS63 | 1 x 400 | Mercury, street light with two piece cast aluminium body.                                                                                            |



**TECHNICAL SPECIFICATION FOR  
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MISCELLANEOUS ITEMS**

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2.30 MF61 1 x 250 Mercury, flood light, general purpose.

2.31 MF62 1 x 400 Mercury, flood light, heavy duty type.

2.32 MF63 2 x 400 Mercury, flood light, heavy duty type.

2.33 MP21 1 x 80 Mercury, post top lantern

2.34 MP22 1 x 125 Mercury, post top lantern

**3.0 High Pressure Sodium Vapour (HPSV) Lamp Luminaire**

3.1 SB01 1 x 150 Sodium, high bay, industrial type.

3.2 SB02 1 x 250 Sodium, high bay, industrial type.

3.3 SB03 1 x 400 Sodium, high bay, industrial type.

3.4 SB04 1 x 150 Sodium, high bay, totally enclosed industrial type.

3.5 SB05 1 x 250 Sodium, high bay, totally enclosed industrial type.

3.6 SB06 1 x 400 Sodium, high bay, totally enclosed industrial type.

3.7 SB07 1 x 150 Sodium, high bay with non-integral controlgear box.

3.8 SB08 1 x 250 Sodium, high bay with non-integral controlgear box.

3.9 SB09 1 x 400 Sodium, high bay with non-integral controlgear box.

3.10 SB11 1 x 150 Sodium, medium bay, industrial type.

3.11 SB12 1 x 250 Sodium, medium bay, industrial type.

3.12 SB13 1 x 150 Sodium, medium bay, totally enclosed industrial type.

3.13 SB14 1 x 250 Sodium, medium bay, totally enclosed industrial type.

3.14 SB17 1 x 70 Sodium, low bay, industrial type.

3.15 SB18 1 x 150 Sodium, low bay, industrial type.

3.16 SB19 1 x 70 Sodium, low bay, totally enclosed industrial type.

3.17 SB20 1 x 150 Sodium, low bay, totally enclosed industrial type.

3.18 SW41 1 x 70 Sodium, well glass, vapour proof with vitreous enamelled/  
powder coated type reflector.



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|      |      |         |                                                                                                                                                     |
|------|------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.19 | SW42 | 1 x 150 | Sodium, well glass, vapour proof with vitreous enamelled/ powder coated type reflector.                                                             |
| 3.20 | SW51 | 1 x 70  | Sodium, well glass, dust proof with vitreous enamelled reflector.                                                                                   |
| 3.21 | SW52 | 1 x 150 | Sodium, well glass, dust proof with vitreous enamelled reflector.                                                                                   |
| 3.22 | SW91 | 1 x 70  | Sodium, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing.                                             |
| 3.23 | SW92 | 1 x 150 | Sodium, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing.                                             |
| 3.24 | SW93 | 1 x 70  | Sodium, well glass, flame proof with vitreous enamelled reflector and cast aluminium alloy LM6 housing.                                             |
| 3.26 | SW95 | 1 x 70  | Sodium, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast aluminium alloy LM6 housing for Div. 2 areas. |
| 3.27 | SW96 | 1 x 150 | Sodium, well glass, flame proof increased safety luminaire with vitreous enamelled reflector and cast aluminium alloy LM6 housing for Div. 2 areas. |
| 3.28 | SS61 | 1 x 70  | Sodium, street light with one piece cast aluminium body.                                                                                            |
| 3.29 | SS62 | 1 x 150 | Sodium, street light with one piece cast aluminium body.                                                                                            |
| 3.30 | SS63 | 1 x 250 | Sodium, street light with two piece cast aluminium body.                                                                                            |
| 3.31 | SS64 | 1 x 400 | Sodium, street light with two piece cast aluminium body.                                                                                            |
| 3.32 | SF61 | 1 x 250 | Sodium, flood light, general purpose.                                                                                                               |
| 3.33 | SF62 | 1 x 400 | Sodium, flood light, general purpose.                                                                                                               |
| 3.34 | SF63 | 1 x 250 | Sodium, flood light, heavy duty type.                                                                                                               |
| 3.35 | SF64 | 1 x 400 | Sodium, flood light, heavy duty type.                                                                                                               |
| 3.36 | SF65 | 2 x 250 | Sodium, flood light, heavy duty type.                                                                                                               |
| 3.37 | SF66 | 2 x 400 | Sodium, flood light, heavy duty type.                                                                                                               |
| 3.38 | SP21 | 1 x 70  | Sodium, post top lantern.                                                                                                                           |



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**4.0 Tungsten Lamp Luminaires**

- |      |      |         |                                                                                    |
|------|------|---------|------------------------------------------------------------------------------------|
| 4.1  | TW41 | 1 x 100 | Tungsten, well glass, vapour proof with vitreous enamelled reflector.              |
| 4.2  | TW42 | 1 x 200 | Tungsten, well glass, vapour proof with vitreous enamelled reflector.              |
| 4.3  | TW51 | 1 x 100 | Tungsten, well glass, dust proof with vitreous enamelled reflector.                |
| 4.4  | TW52 | 1 x 200 | Tungsten, well glass, dust proof with vitreous enamelled reflector.                |
| 4.5  | TW91 | 1 x 100 | Tungsten, well glass, flame proof with vitreous enamelled reflector.               |
| 4.6  | TW92 | 1 x 200 | Tungsten, well glass, flame proof with vitreous enamelled reflector.               |
| 4.7  | TW95 | 1 x 100 | Tungsten, well glass, increased safety (Div. 2) with vitreous enamelled reflector. |
| 4.8  | TW96 | 1 x 200 | Tungsten, well glass, increased safety (Div. 2) with vitreous enamelled reflector. |
| 4.9  | TB21 | 1 x 60  | Tungsten, bulk head, weather proof.                                                |
| 4.10 | TB22 | 1 x 100 | Tungsten, bulk head, weather proof.                                                |
| 4.11 | TB91 | 1 x 100 | Tungsten, bulk head, flame proof.                                                  |
| 4.12 | TB92 | 1 x 200 | Tungsten, bulk head, flame proof.                                                  |
| 4.13 | TP21 | 1 x 200 | Tungsten, post top lantern.                                                        |
| 4.14 | TE02 | 1 x 20  | Tungsten, portable emergency unit with rechargeable battery.                       |
| 4.15 | TE02 | 1 x 40  | Tungsten, portable emergency unit with rechargeable battery.                       |
| 4.16 | TX01 | 1 x 60  | Tungsten, dispersive vitreous enamelled reflector.                                 |
| 4.17 | TX02 | 1 x 100 | Tungsten, dispersive vitreous enamelled reflector.                                 |
| 4.18 | TX03 | 1 x 75  | Decorative recessed mounting luminaire suitable for comptalux lamp.                |
| 4.19 | TX04 | 1 x 100 | Decorative recessed mounting luminaire suitable for comptalux lamp.                |



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4.20 TX05 2 x 100 Double obstruction aviation light of cast Al. alloy with red glass.

**5.0 Halogen**

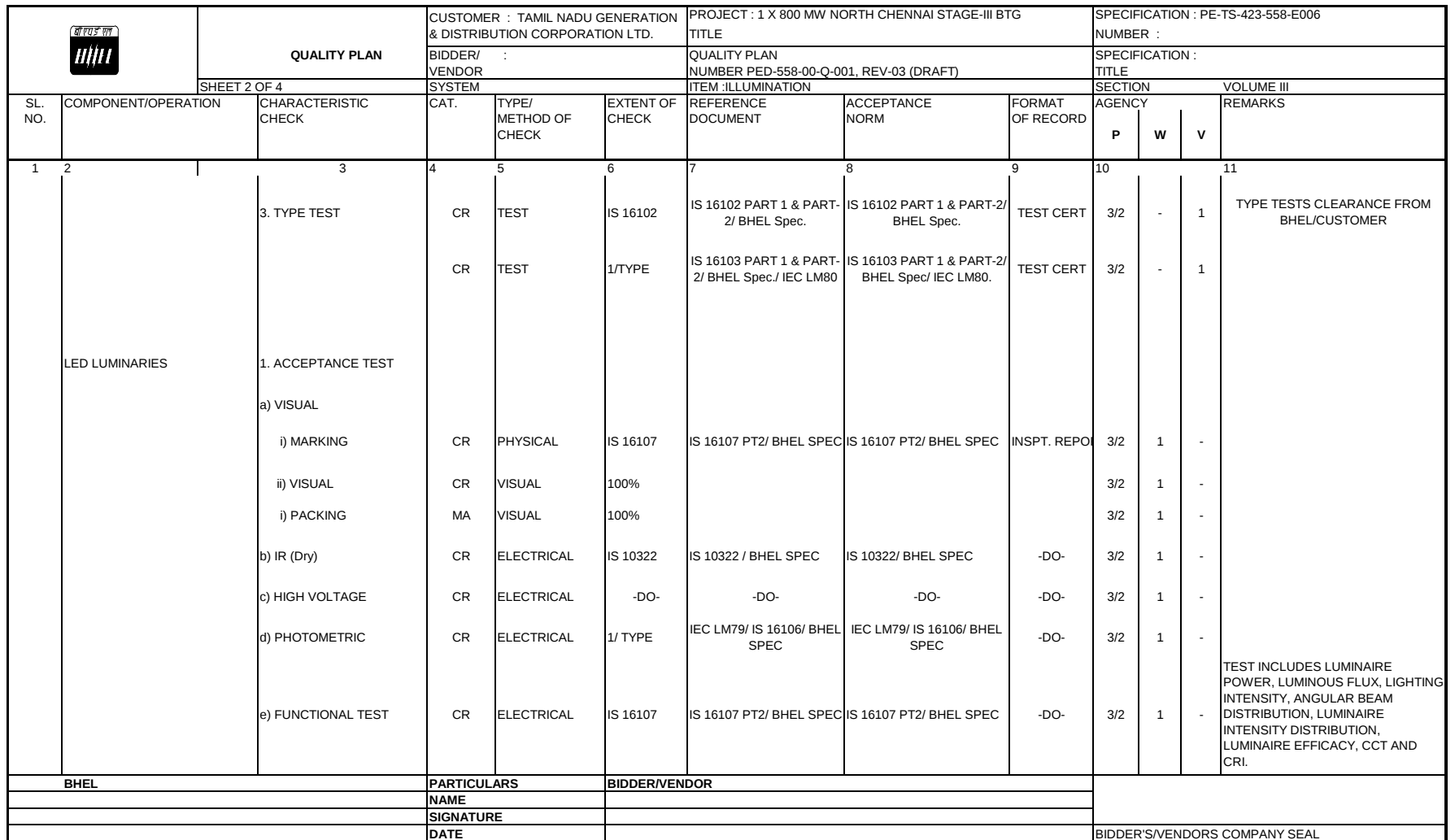
5.1 HF61 1 x 300 Halogen, flood light, drip proof.

5.2 HF62 1 x 500 Halogen, flood light, drip proof.

5.3 HF63 1 x 750 Halogen, flood light, drip proof.

5.4 HF64 1 x 1000 Halogen, flood light, drip proof.

|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              |             |                                                                  |                 |                               |                                                  |                  |                               |                                    |   |                                                                                                            |
|-----------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------------------------------------|-----------------|-------------------------------|--------------------------------------------------|------------------|-------------------------------|------------------------------------|---|------------------------------------------------------------------------------------------------------------|
|  |                                                 | QUALITY PLAN                                                                                                                                                                                                                                                                                                                                                                                 |             | CUSTOMER : TAMIL NADU GENERATION & DISTRIBUTION CORPORATION LTD. |                 |                               | PROJECT : 1 X 800 MW NORTH CHENNAI STAGE-III BTG |                  |                               | SPECIFICATION : PE-TS-423-558-E006 |   |                                                                                                            |
| BIDDER/ VENDOR :                                                                  |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              |             | QUALITY PLAN NUMBER PED-558-00-Q-001, REV-03 (DRAFT)             |                 |                               | SPECIFICATION : TITLE                            |                  |                               |                                    |   |                                                                                                            |
| SHEET 1 OF 4                                                                      |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              |             | SYSTEM                                                           |                 |                               | ITEM :ILLUMINATION                               |                  |                               | SECTION VOLUME III                 |   |                                                                                                            |
| SL. NO.                                                                           | COMPONENT/OPERATION                             | CHARACTERISTIC CHECK                                                                                                                                                                                                                                                                                                                                                                         | CAT.        | TYPE/ METHOD OF CHECK                                            | EXTENT OF CHECK | REFERENCE DOCUMENT            | ACCEPTANCE NORM                                  | FORMAT OF RECORD | AGENCY                        |                                    |   | REMARKS                                                                                                    |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              |             |                                                                  |                 |                               |                                                  |                  | P                             | W                                  | V |                                                                                                            |
| 1                                                                                 | 2                                               | 3                                                                                                                                                                                                                                                                                                                                                                                            | 4           | 5                                                                | 6               | 7                             | 8                                                | 9                | 10                            |                                    |   | 11                                                                                                         |
| 1.0                                                                               | LUMINAIRES & LAMPS<br><br>SELF BALAST LED LAMPS | 1. ACCEPTANCE TEST<br><br>a) VISUAL<br><br>i) DIMENSION<br><br>ii) INTERCHANGEABILITY<br><br>iii) SHOCK RESISTANCE<br><br>b) MARKING<br><br>c) IR (Dry)<br><br>d) HIGH VOLTAGE<br><br>e) Mechanical Strength<br><br>f) Temp Rise<br><br>g) PHOTOMETRIC<br><br>h) FUNCTIONAL TEST<br><br>2. ROUTINE TEST<br><br>a) VISUAL<br><br>b) IR (Dry)<br><br>c) HIGH VOLTAGE<br><br>d) FUNCTIONAL TEST |             |                                                                  |                 |                               |                                                  |                  |                               |                                    |   |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | MA          | MEASUREMENT                                                      | IS 16102        | IS 16102 PT2/ BHEL SPEC       | IS 16102 PT2/ BHEL SPEC                          | TEST CERT        | 3/2                           | 1                                  | - | Functional Test includes Luminous Flux, Wattage, Centre Beam Intensity, Beam Angle, Colour Rendering Index |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | TEST                                                             | -DO-            | IS 9206/ BHEL SPEC            | IS 9206/ BHEL SPEC                               | -DO-             | 3/2                           | 1                                  | - |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | TEST                                                             | -DO-            | IS 9206/ BHEL SPEC            | IS 9206/ BHEL SPEC                               | -DO-             | 3/2                           | 1                                  | - |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | TEST                                                             | -DO-            | IS 16102 PT1/ BHEL SPEC       | IS 16102 PT1/ BHEL SPEC                          | -DO-             | 3/2                           | 1                                  | - |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | ELECTRICAL                                                       | -DO-            | -DO-                          | -DO-                                             | -DO-             | 3/2                           | 1                                  | - |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | ELECTRICAL                                                       | -DO-            | -DO-                          | -DO-                                             | -DO-             | 3/2                           | 1                                  | - |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | TEST                                                             | -DO-            | -DO-                          | -DO-                                             | -DO-             | 3/2                           | 1                                  | - |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | TEST                                                             | -DO-            | IS 8913/ BHEL SPEC            | IS 8913/ BHEL SPEC                               | -DO-             | 3/2                           | 1                                  | - |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | ELECTRICAL                                                       | 1/ LOT          | IEC LM79/ IS 16106/ BHEL SPEC | IEC LM79/ IS 16106/ BHEL SPEC                    | -DO-             | 3/2                           | 1                                  | - |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | ELECTRICAL                                                       | IS 16102        | IS 16102 PT2/ BHEL SPEC       | IS 16102 PT2/ BHEL SPEC                          | TEST CERT        | 3/2                           | 1                                  | - |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | MA          | VISUAL                                                           | 100%            | IS 16102 PT1/ BHEL SPEC       | IS 16102 PT1/ BHEL SPEC                          | TEST CERT        | 3/2                           | -                                  | 1 |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | ELECTRICAL                                                       | -DO-            | -DO-                          | -DO-                                             | -DO-             | 3/2                           | -                                  | 1 |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | ELECTRICAL                                                       | -DO-            | -DO-                          | -DO-                                             | -DO-             | 3/2                           | -                                  | 1 |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | CR          | ELECTRICAL                                                       | 10%             | -DO-                          | -DO-                                             | -DO-             | 3/2                           | -                                  | 1 |                                                                                                            |
| BHEL                                                                              |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | PARTICULARS |                                                                  |                 | BIDDER/VENDOR                 |                                                  |                  |                               |                                    |   |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | NAME        |                                                                  |                 |                               |                                                  |                  |                               |                                    |   |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | SIGNATURE   |                                                                  |                 |                               |                                                  |                  |                               |                                    |   |                                                                                                            |
|                                                                                   |                                                 |                                                                                                                                                                                                                                                                                                                                                                                              | DATE        |                                                                  |                 |                               |                                                  |                  | BIDDER'S/VENDORS COMPANY SEAL |                                    |   |                                                                                                            |



|                                                                                   |                                 |                      |             |                                                                  |                       |                                                |                                                         |                               |        |                                    |   |            |                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------|---------------------------------|----------------------|-------------|------------------------------------------------------------------|-----------------------|------------------------------------------------|---------------------------------------------------------|-------------------------------|--------|------------------------------------|---|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                                 | QUALITY PLAN         |             | CUSTOMER : TAMIL NADU GENERATION & DISTRIBUTION CORPORATION LTD. |                       |                                                | PROJECT : 1 X 800 MW NORTH CHENNAI STAGE-III BTG        |                               |        | SPECIFICATION : PE-TS-423-558-E006 |   |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 |                      |             | BIDDER/ VENDOR                                                   |                       |                                                | QUALITY PLAN<br>NUMBER PED-558-00-Q-001, REV-03 (DRAFT) |                               |        | NUMBER :                           |   |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 | SHEET 3 OF 4         |             | SYSTEM                                                           |                       |                                                | ITEM :ILLUMINATION                                      |                               |        | SECTION                            |   | VOLUME III |                                                                                                                                                                                                                                           |
| SL. NO.                                                                           | COMPONENT/OPERATION             | CHARACTERISTIC CHECK | CAT.        | TYPE/<br>METHOD OF CHECK                                         | EXTENT OF CHECK       | REFERENCE DOCUMENT                             | ACCEPTANCE NORM                                         | FORMAT OF RECORD              | AGENCY | P                                  | W | V          | REMARKS                                                                                                                                                                                                                                   |
| 1                                                                                 | 2                               | 3                    | 4           | 5                                                                | 6                     | 7                                              | 8                                                       | 9                             | 10     |                                    |   | 11         |                                                                                                                                                                                                                                           |
|                                                                                   | CONVENTIONAL LUMINAIRES & LAMPS | 3. TYPE TEST         |             |                                                                  |                       |                                                |                                                         |                               |        |                                    |   |            | TYPE TESTS CLEARANCE FROM BHEL/CUSTOMER                                                                                                                                                                                                   |
|                                                                                   |                                 | a) LED MODULE        | MA          | TEST                                                             | 1/ TYPE               | IS 16103 PART 1 & PART-2/ BHEL Spec./ IEC LM80 | IS 16103 PART 1 & PART-2/ BHEL Spec/ IEC LM80.          | TEST CERT                     | 3/2    | -                                  | 1 |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 | b) PHOTOMETRIC       | CR          | ELECTRICAL                                                       | 1/ TYPE               | IEC LM79/ IS 16106/ BHEL SPEC                  | IEC LM79/ IS 16106/ BHEL SPEC                           | -DO-                          | 3/2    | -                                  | 1 |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 | c) LED LUMINAIRE     | MA          | TEST                                                             | IS 16107              | IS 16107 PART 2/ BHEL Spec.                    | IS 16107 PART 2/ BHEL Spec.                             | TEST CERT                     | 3/2    | -                                  | 1 |            | TEST INCLUDES MARKING, LUMINAIRE POWER, LUMINOUS FLUX, LIGHTING INTENSITY, ANGULAR BEAM DISTRIBUTION, LUMINAIRE EFFICACY, CCT, CRI, LIFE, LUMAN MAINENANCE. IP PROTECTION, SURGE PROTECTION, TOTAL HARMONIC DISTORTION AND ENDURANCE TEST |
|                                                                                   |                                 | d) CONTROL GEAR      | MA          | TEST                                                             | 1/TYPE                | IS 15885 PART 2 SEC 13/ BHEL Spec.             | IS 15885 PART 2 SEC 13/ BHEL Spec.                      | TEST CERT                     | 3/2    | -                                  | 1 |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 | 1. ACCEPTANCE TEST   |             |                                                                  |                       |                                                |                                                         |                               |        |                                    |   |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 | a) VISUAL            | MA          | VISUAL                                                           | IS 10322 (PART5 SEC1) | IS 10322 / BHEL SPEC                           | IS 10322 /BHEL SPEC                                     | TEST CERT                     | 3/2    | 1                                  | - |            | AFTER SUCCESSFUL COMPLETION OF 1a, 1b & 1c FURTHER TESTING OF 1d) TO BE DINE BY PAPER INSERTION METHOD.                                                                                                                                   |
|                                                                                   |                                 | b) IR (Dry)          | CR          | ELECTRICAL                                                       | IS 10322              | -DO-                                           | -DO-                                                    | -DO-                          | 3/2    | 1                                  | - |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 | c) HIGH VOLTAGE      | CR          | ELECTRICAL                                                       | -DO-                  | -DO-                                           | -DO-                                                    | -DO-                          | 3/2    | 1                                  | - |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 | d) DUST PROOF        | CR          | ELECTRICAL                                                       | -DO-                  | -DO-                                           | -DO-                                                    | -DO-                          | 3/2    | 1                                  | - |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 | e) PHOTOMETRIC       | CR          | ELECTRICAL                                                       | *                     | -DO-                                           | -DO-                                                    | -DO-                          | 3/2    | 1                                  | - |            | *: ONE NO. LUMINAIRE OF EACH TYPE TO BE WITNESSED BY BHEL. MAIN VENDOR TO WITNESS AS PER IS-10322.                                                                                                                                        |
|                                                                                   |                                 | 2. ROUTINE TEST      |             |                                                                  |                       |                                                |                                                         |                               |        |                                    |   |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 | a) VISUAL            | MA          | VISUAL                                                           | 100%                  | IS 10322 / BHEL SPEC                           | IS 10322 /BHEL SPEC                                     | TEST CERT                     | 3/2    | -                                  | 1 |            | TYPE TESTS CLEARANCE FROM BHEL/CUSTOMER                                                                                                                                                                                                   |
|                                                                                   |                                 | b) IR (Dry)          | CR          | ELECTRICAL                                                       | -DO-                  | -DO-                                           | -DO-                                                    | -DO-                          | 3/2    | -                                  | 1 |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 | c) HIGH VOLTAGE      | CR          | ELECTRICAL                                                       | -DO-                  | -DO-                                           | -DO-                                                    | -DO-                          | 3/2    | -                                  | 1 |            |                                                                                                                                                                                                                                           |
| BHEL                                                                              |                                 |                      | PARTICULARS |                                                                  | BIDDER/VENDOR         |                                                |                                                         |                               |        |                                    |   |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 |                      | NAME        |                                                                  |                       |                                                |                                                         |                               |        |                                    |   |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 |                      | SIGNATURE   |                                                                  |                       |                                                |                                                         |                               |        |                                    |   |            |                                                                                                                                                                                                                                           |
|                                                                                   |                                 |                      | DATE        |                                                                  |                       |                                                |                                                         | BIDDER'S/VENDORS COMPANY SEAL |        |                                    |   |            |                                                                                                                                                                                                                                           |

|  |                              | <b>QUALITY PLAN</b>                                                                                                                                                                                                                                                                                                                                                                                                    |      | CUSTOMER : TAMIL NADU GENERATION & DISTRIBUTION CORPORATION LTD. |                 | PROJECT : 1 X 800 MW NORTH CHENNAI STAGE-III BTG<br>TITLE |                     | SPECIFICATION : PE-TS-423-558-E006<br>NUMBER : |        |            |     |                                   |
|-----------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------------------------------------------------------|-----------------|-----------------------------------------------------------|---------------------|------------------------------------------------|--------|------------|-----|-----------------------------------|
|                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                        |      | BIDDER/ :<br>VENDOR                                              |                 | QUALITY PLAN<br>NUMBER PED-558-00-Q-001, REV-03 (DRAFT)   |                     | SPECIFICATION :<br>TITLE                       |        |            |     |                                   |
|                                                                                   |                              | SHEET 4 OF 4                                                                                                                                                                                                                                                                                                                                                                                                           |      | SYSTEM                                                           |                 | ITEM : ILLUMINATION                                       |                     | SECTION                                        |        | VOLUME III |     |                                   |
| SL. NO.                                                                           | COMPONENT/OPERATION          | CHARACTERISTIC CHECK                                                                                                                                                                                                                                                                                                                                                                                                   | CAT. | TYPE/METHOD OF CHECK                                             | EXTENT OF CHECK | REFERENCE DOCUMENT                                        | ACCEPTANCE NORM     | FORMAT OF RECORD                               | AGENCY |            |     | REMARKS                           |
| 1                                                                                 | 2                            | 3                                                                                                                                                                                                                                                                                                                                                                                                                      | 4    | 5                                                                | 6               | 7                                                         | 8                   | 9                                              | 10     | 11         | 12  |                                   |
| 2.0                                                                               | JUNCTION BOXES & RECEPTACLES | 1.DIMENSIONS                                                                                                                                                                                                                                                                                                                                                                                                           | MA   | MEASUREMENT                                                      | 100%            | BHEL DRG.                                                 | BHEL DRG.           | INSP. REPOR                                    | 3      | -          | 2   | COMPONENTS TO BE OF APPROVED MAKE |
|                                                                                   |                              | 2.PAINT SHADE/ THICKNESS                                                                                                                                                                                                                                                                                                                                                                                               | MA   | VISUAL/MEAS.                                                     | SAMPLE          | BHEL SPEC/DRG                                             | BHEL SPEC/DRG       | -DO-                                           | 3      | -          | 2   |                                   |
|                                                                                   |                              | 3.HV/IR/HV                                                                                                                                                                                                                                                                                                                                                                                                             | MA   | ELECT.TESTS                                                      | 100%            | 2KV AC FOR 1 MINUTE                                       | 2KV AC FOR 1 MINUTE | -DO-                                           | 3      | -          | 2   |                                   |
|                                                                                   |                              | 4.DEGREE OF PROTECTION                                                                                                                                                                                                                                                                                                                                                                                                 | MA   | TEST                                                             | 1/SIZE          | IS:2147                                                   | IS:2147             | TEST CERT.                                     | 3      | -          | 2,1 |                                   |
|                                                                                   |                              | 5.SPECIAL TESTS IF ANY,EXPLOSION PROOF ETC.                                                                                                                                                                                                                                                                                                                                                                            | MA   | TEST                                                             | 1/SIZE          | IS:2148                                                   | IS:2148             | TEST CERT.                                     | 3      | -          | 2,1 |                                   |
|                                                                                   |                              | 6. OPERATION CHECK                                                                                                                                                                                                                                                                                                                                                                                                     | MA   | TEST                                                             | SAMPLE          | BHEL DRG                                                  | BHEL DRG            | INSP. REPOR                                    | 3      | -          | 2   |                                   |
|                                                                                   |                              | 7. MECHANICAL INTERLOCK                                                                                                                                                                                                                                                                                                                                                                                                | MA   | TEST                                                             | SAMPLE          | BHEL DRG                                                  | BHEL DRG            | INSP. REPOR                                    | 3      | -          | 2   |                                   |
|                                                                                   |                              | 1. IN CASE TYPE TEST CERTIFICATE FOR DEGREE OF PROTECTION/EXPLOSION PROOFNESS FROM INDEPENDENT LAB. IS NOT AVAILABLE, THE ITEM SHALL BE TESTED AT AN INDEPENDENT LAB.<br>2. ITEMS LIKE CEILING FANS, EMERGENCY LIGHTING UNIT, FLEXIBLE CONDUIT, EARTHING WIRE & FLATS, 24V SUPPLY MODULE, LADDERS, HUME PIPE, SWITCHBOXES, EXIT SIGNS, STRUCTURAL STEEL ETC. WILL BE CLEARED BASED ON COC (CERTIFICATE OF COMPLIANCE). |      |                                                                  |                 |                                                           |                     |                                                |        |            |     |                                   |
| BHEL                                                                              |                              | PARTICULARS                                                                                                                                                                                                                                                                                                                                                                                                            |      | BIDDER/VENDOR                                                    |                 |                                                           |                     |                                                |        |            |     |                                   |
|                                                                                   |                              | NAME                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                                                                  |                 |                                                           |                     |                                                |        |            |     |                                   |
|                                                                                   |                              | SIGNATURE                                                                                                                                                                                                                                                                                                                                                                                                              |      |                                                                  |                 |                                                           |                     |                                                |        |            |     |                                   |
|                                                                                   |                              | DATE                                                                                                                                                                                                                                                                                                                                                                                                                   |      |                                                                  |                 | BIDDER'S/VENDORS COMPANY SEAL                             |                     |                                                |        |            |     |                                   |