

TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED

**2 X 660 MW ENNORE SEZ SUPER CRITICAL THERMAL
POWER**

VOLUME – II

**TECHNICAL SPECIFICATION FOR
LIGHTING PANELS**

SPECIFICATION NO: PE-TS-412-558-E005A, REV-0



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



**TECHNICAL SPECIFICATION FOR
LIGHTING PANELS**

SPECIFICATION NO. PE-TS-412-558-E005A

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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS



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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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1.0 SCOPE OF SUPPLY

- 1.1 Design, manufacture, assembly, inspection & testing at vendor's/ sub-vendor's works, proper packing and delivery to site of LIGHTING PANELS as mentioned in different sections of this specification, complete with all accessories for efficient and trouble-free operation.
- 1.2 Standard technical requirements of LIGHTING PANELS are indicated in Section-II. Project specific requirements/changes are listed in Section-I.
- 1.3 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.
- 1.4 Review of sub-vendor's documents by the vendor shall not relieve the vendor from the responsibility of design & supply.
- 1.5 The documents shall be in English language and MKS system of units.

2.0 BILL OF QUANTITIES:

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

3.0 SPECIFIC TECHNICAL REQUIREMENTS

- 3.1 Lighting panel (LP) for controlling lights with additional provision for manual control shall be provided:

AC Indoor / Outdoor lighting panel: a) With Energy saving system as per
BOQ Cum Price schedule.
b) Without Energy saving system as per
BOQ Cum Price schedule.

DC Indoor / Outdoor lighting panel: Without Energy saving system

Street lighting panel: With Timer & photocell

3.2 AC Normal Lighting Systems:

AC normal lighting panel as per details given below is envisaged:

Incomer type: TPN MCCB



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Incomer rating: 63A
Outgoing feeder type: SPN MCB
Outgoing feeder rating: 20A
Short circuit rating: 10kA
ELCB in Incomer: Yes

Street lighting panel as per details given below is envisaged:

Incomer type: TPN MCCB
Incomer rating: 63A
Outgoing feeder type: TPN MCB
Outgoing feeder rating: 20A
Short circuit rating: 10kA
ON/ OFF control With Timer & photo cell

Voltage drop at the fixture from the LDB bus shall not exceed 3%.

AC Normal Lighting Panel shall have 20% spare feeders.

3.3 AC Emergency Lighting Systems:

AC emergency lighting panel as per details given below is envisaged:

Incomer type: TPN MCCB
Incomer rating: 63A
Outgoing feeder type: SPN MCB
Outgoing feeder rating: 20A
Short circuit rating: 10kA
ELCB in Incomer: Yes

AC Emergency Lighting Panel shall have 20% spare feeders

3.4 DC Emergency Lighting Systems:

DCELPs as per details given below is envisaged:

Incomer type: DP Switchfuse unit
Incomer rating: 32A
Outgoing feeder type: DP MCB
Outgoing feeder rating: 20A



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3.5 Lighting Panel

- a) Lighting panels (LP) shall be Fibre reinforced plastic (FRP) type suitable for either wall/column mounting on brackets.
- b) Indoor Lighting Panels shall be dust and vermin-proof, IP-54. Outdoor panels shall be weather-proof with canopy, IPW-55 or better. The cubicle housing transformer shall be minimum IP-42.
- c) Lighting Panels shall be so constructed as to permit free access to the terminal connections and easy replacement of parts. Front access doors shall have padlocking arrangements.
- d) Lighting panels shall have provision of cable entry from top and bottom, as required, with removable gland plates. Necessary double compression type brass cable glands, tinned copper/Aluminium cable lugs are to be furnished.
- e) Two ground pads with M10 G.I. bolts and nuts shall be provided on each Lighting Panel for connection to 35 x 6 mm G.I. flat.
- f) Each Lighting Panel shall be complete with designation and caution notice plates fixed on front cover and a circuit directory plate fixed on inside of the front cover. Circuit directory plate shall contain details of the points to be controlled by each circuit including the location of the point controlled, rating of the protective units and loading of each circuit. The plates shall be of anodized aluminium with inscriptions indelibly etched on it.
- g) Bus bar shall be electrolytic grade hard drawn aluminium, colour coded for easy identification and designed for a maximum temperature of 85°C. Minimum size shall be 25 x 6 mm.
- h) Panel shall be fitted with phase barriers such that it is not readily possible for personnel to touch the phase busbars. Insulation barriers shall preferably be fitted around the circuit breakers such that only the surface and the toggle of the circuit breaker are available on the front.
- i) Incoming and outgoing circuits shall be terminated in suitable terminal blocks.
- j) In lighting and receptacle panel 3-phase and 1-phase MCB should not be mixed.
- k) All indicating lamps will be cluster LED type.

3.6 ENERGY SAVING SYSTEM (ESS)-Panels

The energy saving system panel shall consists of loss less reactance coils with voltage tapping, contactor to select the tap, Micro-processor based TIMER along with real time clock for activating the contactor at a pre-set time. The unit shall be programmable so that at a pre-set time contactor on the lower voltage tap can be selected and reduced voltage can be applied across the circuit. It shall also be possible to modify the setting at site, if required. The capacity of panels shall be 30 kVA. This system shall be incorporated in lighting panels as per BOQ-cum-price schedule.

3.7 Lighting Panel Equipment

- a) Each lighting panel (Without ESS) shall have an incoming triple pole MCCB with neutral link and a number of outgoing miniature circuit breakers (MCB).



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- b.1) Each lighting panel (With ESS) shall have an incoming triple pole MCCB with neutral link and a number of outgoing miniature circuit breakers (MCB) , load manager with CT to measure all electrical parameters viz. voltage, current, power, pf etc. and a separate digital Voltmeter with selector switch to measure input voltage, mains ON, output ON Lamps, and Energy Saving Mode ON/OFF indications, by pass switch, contactors & on delay timers with indication lamps.
- b.2) LP shall be arranged in two adjacent but separate compartments, one compartment for the reactor and the other for the incoming & outgoing feeders etc.
- b.3) Reactor shall be mounted on the base channel and it shall be possible to easily remove the reactor from the cubicle after opening the door.
- b.4) Independent gasket hinged door with operating handle shall be provided for access to reactor & its taps. Operating handle shall have built-in key locking arrangement.
- b.5) Suitable ventilation arrangement for the reactor compartment to dissipate the heat of the reactor shall be provided. The arrangement shall be in the form of louvers and the same shall be provided with galvanised wire mesh with dust catchers on the inside.
- b.6) Connections between reactor secondary terminals and the busbars shall be made by using PVC insulated flexible copper cables or busbars.
- b.7) Reactor shall form an integral part of LP.
- b.8) Reactor shall be dry type, natural air cooled and suitable for mounting inside the lighting distribution board. Reactor particulars shall be as specified in Data Sheet A. Reactor Winding shall be of copper material and maximum winding temperature at full load and under site conditions shall not exceed 130 °C.
- b.9) Reactor shall be suitable for cable connections on the primary side and flexible cable or busbar connection on the secondary side.
- b.10) Busbars shall be supported on non-hygroscopic and non-inflammable insulators material.
- c) Panel access door shall be interlocked with incoming switch unit such that the door can be opened only when the switch is in OFF position. Means shall be provided to defeat this interlock.
- d) Contactors shall be air-break electromagnetic type. Push buttons shall be push to actuate type.
- e) MCB shall be suitable for manual closing and opening and also automatic trip on overload and short circuit.
- f) Time switch in street lighting panels shall be photocell type with automatic voltage stabilizer and necessary electronic unit with provision for sensitivity adjustment depending on external light intensity. When the exterior illumination level shall fall below a preset value for a considerable period of time (adjustable 30 sec. to 180 secs.) the electronic unit shall generate signal for the output relay to pick-up and potential-free contact of the same shall be used for control of contactor for lighting system. Sustained normal illumination level being restored (adjustable 30 sec. to 180 sec.) the lights shall switch off.
- g) Voltmeter / Ammeter shall be of accuracy class 2.0 or better as per IS: 1248 Voltmeter / Ammeter selector switch shall be of reputed make.
- h) Each lighting panel shall be provided with adequate number of outgoing LCBs/MCBs for controlling fixtures. 5A, 3Pin sockets shall be fed from the lighting panel through separate circuits.



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3.8 Terminals

Multi way terminal blocks of approved type, complete with screws, nuts, washers and marking strips shall be furnished for connection of incoming/outgoing wires.

Each terminal shall be suitable for connection upto 2 nos. 10 Sq.mm stranded aluminium conductors without any damage to the conductor or looseness of connectors.

3.9 FRP LPs shall be of Siemens gray (RAL-7032).

3.10 Test for FRP

Flame spread as per ASTM E84

Low flammability as per ASTM E84

Anti-static, less surface resistivity as per ASTM D257

UV resistance as per ASTM D257

Resistance to heat and fire as per IEC 60695-2-12

Glass content test as per ASTM-D 5630

Oxygen Index Tests as per ASTM-D 2863

Flammability Test as per ASTM-D 635

4.0 DOCUMENTATION

4.1 Documents required after award of contract shall be as per Attachment-I (to be submitted by successful bidder).



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ATTACHMENT – I

DOCUMENTS REQUIRED AFTER AWARD OF LOI

SL. No.	DOCUMENT TITLE	DOCUMENT NO.	CATEGORY
1	TECHNICAL DATA SHEET FOR LP/ TRANSFORMER	PE-V0-412-558-E405	APPROVAL
2	SUB-VENDOR LIST FOR LP /TRANSFORMER	PE-V0-412-558-E088	APPROVAL
3	GA DRAWING OF TRANSFORMER	PE-V0-412-558-E004	APPROVAL
4	GA DRAWING & SLD OF LP-A(6) - INDOOR	PE-V0-412-558-E009	APPROVAL
5	GA DRAWING & SLD OF LP-A(6) - DECORATIVE	PE-V0-412-558-E010	APPROVAL
6	GA DRAWING & SLD OF LP-A(12) - INDOOR	PE-V0-412-558-E011	APPROVAL
7	GA DRAWING & SLD OF LP-A(12) - OUTDOOR	PE-V0-412-558-E012	APPROVAL
8	GA DRAWING & SLD OF LP-A(12) - DECORATIVE	PE-V0-412-558-E013	APPROVAL
9	GA DRAWING & SLD OF LP-A(18) - INDOOR	PE-V0-412-558-E014	APPROVAL
10	GA DRAWING & SLD OF LP-A(18) - OUTDOOR	PE-V0-412-558-E015	APPROVAL
11	GA DRAWING & SLD OF LP-D(6) - INDOOR	PE-V0-412-558-E016	APPROVAL
12	GA DRAWING & SLD OF LP-D(6) - OUTDOOR	PE-V0-412-558-E017	APPROVAL
13	GA DRAWING & SLD OF LP-S(6)	PE-V0-412-558-E018	APPROVAL
14	GA DRAWING & SLD OF LP-A(6) – INDOOR WITH ESS	PE-V0-412-558-E019	APPROVAL
15	GA DRAWING & SLD OF LP-A(6) - DECORATIVE WITH ESS	PE-V0-412-558-E020	APPROVAL
16	GA DRAWING & SLD OF LP-A(12) - INDOOR WITH ESS	PE-V0-412-558-E021	APPROVAL
17	GA DRAWING & SLD OF LP-A(12) - OUTDOOR WITH ESS	PE-V0-412-558-E022	APPROVAL
18	GA DRAWING & SLD OF LP-A(12) - DECORATIVE WITH ESS	PE-V0-412-558-E023	APPROVAL
19	GA DRAWING & SLD OF LP-A(18) - INDOOR WITH ESS	PE-V0-412-558-E024	APPROVAL
20	GA DRAWING & SLD OF LP-A(18) - OUTDOOR WITH ESS	PE-V0-412-558-E025	APPROVAL
21	MANUFACTURING QUALITY PLAN FOR LPs	PE-V0-412-558-E902	APPROVAL
22	MANUFACTURING QUALITY PLAN FOR LIGHTING TRANSFORMERS	PE-V0-412-558-E910	APPROVAL
23	TYPE TEST REPORT OF LP	PE-V0-412-558-E409	INFORMATION
24	TYPE TEST REPORT OF TRANSFORMERS	PE-V0-412-558-E410	INFORMATION

Note:

1. The above list of drawings and documents is indicative.



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DATA SHEET -A

S. No.	Description	Unit	Value
1.0	SYSTEM DESIGN DATA		
1.1	Design ambient	°C	50
1.2	AC Supply		
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.
1.3	DC Supply		
a)	Rated voltage	V	220
b)	Voltage variation (permissible)	%	+10% to -15%
c)	System fault level & duration	kA, sec.	25kA for 1 sec.
2.0	APPLICABLE STANDARDS		
	IS 60947	Low voltage switchgear and controlgear	
	IS 11171	Dry type transformers	
	IS 13703	Low voltage fuses for voltages not exceeding 1000V AC or 1500 V	
	IS 10118	Code of practice for selection, installation and maintenance of switchgear and controlgear	
	IS 60898	Electrical Accessories - circuit breakers for over protection for household and similar installations	
	IS 1901	Visual indicator lamps	
	IS 60079	Explosive atmospheres	
	IS 5572	Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installation	
	IS:2551	Danger notice plates	



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3.1	Loss less reactance coil for ESS		
a)	Rating	kVA	10x3
b)	Type of cooling		Air natural
c)	Voltage ratio	V	415/415
d)	Rated frequency	Hz	50
e)	No. of phases		3 x 1 ph
f)	Vector group		Star
g)	Off circuit taps		
	Tap range, steps	%	5%,-10%,-12.5%
	Voltage of each tap	V	395,394,364 V
h)	Impedance at rated current, frequency at 75 °C	%	As per IS
i)	Rated current		
	Primary	A	As per manufacturer's data
	Secondary	A	As per manufacturer's data
j)	Transformer type		☒ Cast resin / ☒ Encapsulated / ☐ Non-Encapsulated
k)	Transformer winding insulation		Class-F and limited upto class B insulation
l)	Transformer winding insulation temperature rise limit		80 degree C above 50 degree C. ambient (class B insulation can withstand 130°C)
n)	Type of ventilation arrangement provided for transformer enclosure		As per manufacturer's data
o)	Winding conductor material		Copper
p)	Iron loss at 50 Hz and 100% rated voltage	kW	As per manufacturer's data
q)	Copper loss at rated load at 75 °C	kW	As per manufacturer's data
r)	Regulation at full load at 75 °C and 0.8 p.f. lagging		As per manufacturer's data



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s)	Weight	kg	As per manufacturer's data
4.0	LIGHTING PANELS		
4.1	Operational Front		Single Front
4.2	Type of execution of modules (functional unit)		☒ Fixed ☐ Draw out
4.3	Application		☐ Indoor ☐ Outdoor ☒ Both
4.4	Type of sheet		FRP
4.5	FRP thickness (minimum)		3.0
4.6	Degree of Protection		
a)	Indoor panel		IP-54
b)	Outdoor panel		IPW-55, Weatherproof
c)	Canopy in outdoor panel		☒ Yes ☐ No
d)	Transformer cubicle		IP-42
4.7	Bus bar material		Electrolytic grade hard drawn Aluminium
4.8	Earth bus bar required		☒ Yes ☐ No
4.9	Earth bus bar material		☒ GI Strip ☐ Aluminium ☐ Copper
4.10	Gland Plate	mm	3.0
4.11	Earthing studs required		☒ Yes ☐ No
4.12	Hinged door with locking facility		☒ Yes ☐ No
4.13	AC Lighting Panel		
a)	Incomer rating	A	63A for LP and SLP
b)	Type of Incomer		☐ SFU ☒ MCCB
c)	Earth Leakage Circuit Breaker (ELCB) in incomer required		☒ Yes ☐ No
d)	Type of Outgoing Feeders (non-flameproof panel)		☒ SPN MCB ☐ TPN MCB
e)	Type of Outgoing Feeders (Flameproof panel)		☐ DP MCB ☐ TPN MCB



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f)	Type of Outgoing Feeders (Street Light panel)		☐ SPN MCB ☒ TPN MCB
g)	ESS required for AC indoor/Outdoor panel		☒ Yes , as per BOQ cum price schedule ☐ No
h)	ESS required for DC panel		☐ Yes ☒ No
i)	ESS required for street panel		☐ Yes ☒ No
j)	Timer required Street Light panel		☒ Yes ☐ No
k)	Photocell required for Street Light panel		☒ Yes ☐ No
l)	Outgoing feeders rating	A	20
4.14	DC Lighting Panel		
a)	Incomer rating	A	32
b)	Type of Incomer		☒ DP SFU ☐ DP MCCB
c)	Type of Outgoing Feeders (non-flameproof panel)		☒ DP MCB
d)	Type of Outgoing Feeders (Flameproof panel)		☐ DP MCB
e)	Outgoing feeders rating	A	20
5.0	COMPONENTS OF LIGHTING SYSTEM EQUIPMENT		
5.1	Moulded Case Circuit Breaker (MCCB)		
a)	Rated voltage	V	415
b)	Number of poles		Three
c)	Rated short circuit duty	kA	50
d)	Rated breaking capacity (rms)	kA	50KA
e)	Rated making current (peak)	kA	105KA



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f)	Release with short circuit		YES
g)	Release with overload		YES
h)	Release with under voltage		NO
i)	Auxiliary contacts		
	Numbers	NO+NC	2NO+2NC
	Rating	A	As per manufacturer data
5.2	Switch-Fuse Unit		
a)	Utilisation category for main contacts		AC23
b)	Breaking Capacity: With conditions: a) Voltage b) Power Factor		3 times rated current 110% of rated voltage 0.3
5.3	Miniature Circuit Breaker		
a)	SPN MCB rating (min)	A	Refer Sl. No. 3 & 4
b)	DP MCB rating (min)	A	Refer Sl. No. 3 & 4
c)	TPN MCB rating (min)	A	Refer Sl. No. 3 & 4
d)	Short time rating	kA	10
e)	Magnetic short circuit protection required		☒ Yes ☐ No
f)	Thermal overload protection required		☒ Yes ☐ No
5.4	Current Transformer		
a)	Type		Cast resin
b)	Secondary current rating	A	☒ 1 ☐ 5
c)	Burden	VA	10
d)	Accuracy class		1.0
e)	Instrument Safety Factor		<5



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5.5	Indicating Meters		
5.5.1	Voltmeter		
a)	Type		Digital
b)	Shape		Square
c)	Size		96mm x 96mm
d)	Accuracy		2.0
e)	AC voltage coil rating	V	0-500
f)	DC voltage coil rating	V	0-250
5.5.2	Energy meter (if applicable)		
a)	Type		[] Analog [√] Digital
b)	Accuracy		1.0
c)	Current coil rating	A	1
d)	Voltage coil rating	V	0-500
5.6	Power Contactors		
a)	Coil voltage (nominal)		
	AC contactors	V	240
	DC contactors	V	220
b)	Current rating of contacts		
	Power	A	As per manufacturer data
	Control	A	As per manufacturer data
5.7	Timer		
5.7.1	Time switch		
a)	Type		Digital synchronous
b)	Range	hr	0-24
c)	Coil voltage rating	V	240
5.7.2	On delay timer		
a)	No. of contacts		
	ON time delay	NO+NC	As per scheme requirement



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	OFF time delay	NO+NC	As per scheme requirement
	Instantaneous	NO+NC	As per scheme requirement
b)	Coil voltage rating		
	AC timer	V	240
	DC timer	V	220
c)	Time delay range		
	AC timer	min	0-15
	DC timer	Sec	NA
5.8	Selector switch (voltage selector switch\auto manual control switch\ energy saving mode by pass control switch)		
a)	Type of selector switch		☒ Stay put ☐ Wing knob
b)	Lockable		☐ Yes ☒ No
5.9	Push Button		
a)	Voltage grade	V	500
b)	Potential free contacts		2NO+2NC
5.10	Indicating Lamps		
a)	Lens Colour		
	ON condition		Red
	OFF condition		Green
b)	Circuit voltage	V	240V
5.11	Cable Glands		By vendor for all incoming and outgoing cables
a)	Type		☒ Double compression ☐ Single compression
b)	Material		Brass
c)	Nickel Plating provided		☒ Yes ☐ No
d)	Flameproof glands with flameproof equipment		☒ Yes ☐ No



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5.12	Cable Lugs		By vendor for all incoming and outgoing cables
a)	Type		Crimping type/ ring type
b)	Material		Tinned copper
5.13	Load Manager		Class 0.5,digital,240V AC
6.0	Colour		
6.1	Colour shade		
a)	FRP LPs		Siemens gray (RAL-7032)



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REV. 0

DATE: 18.04.2018

SHEET OF

ANNEXURE-1

SUB-VENDOR LIST

2X660 MW ENNORE SEZ SUPER CRITICAL THERMAL POWER

SUB-VENDOR LIST

S. NO.	ITEM	VENDOR
1	AC CONTACTORS	SIEMENS
	AC CONTACTORS	GE-POWER
	AC CONTACTORS	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.
	AC CONTACTORS	L&T
	AC CONTACTORS	BCH
2	AC MCCB	C&S ELECTRIC LTD.
	AC MCCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	AC MCCB	SIEMENS
	AC MCCB	GE-POWER
	AC MCCB	L&T
3	AMMETER	CROMPTON GREAVES
	AMMETER	AUTOMATIC ELECTRIC LTD.
	AMMETER	RISHABH INST.PVT LTD
4	AUXILIARY RELAYS	ABB
	AUXILIARY RELAYS	ALSTOM LTD
	AUXILIARY RELAYS	JYOTI LTD.
	AUXILIARY RELAYS	OEN INDIA LTD
	AUXILIARY RELAYS	SIEMENS
5	CABLE GLANDS	ALLIED TRADERS & EXPORTERS
	CABLE GLANDS	ARUP ENGG & FOUNDARY WORKS
	CABLE GLANDS	BALIGA LIGHTING EQPT PVT LTD
	CABLE GLANDS	COMMET BRASS PRODUCTS
	CABLE GLANDS	DOWELLS
	CABLE GLANDS	ELECTROMAC INDUSTRIES
6	CABLE GLANDS	INCAB
	CABLE LUGS	DOWELLS
	CABLE LUGS	UNIVERSAL MACHINES LTD.
7	CONTROL SWITCHES/ SELECTOR SWITCH	KAYCEE
	CONTROL SWITCHES/ SELECTOR SWITCH	GE-POWER
	CONTROL SWITCHES/ SELECTOR SWITCH	ALSTOM LTD
	CONTROL SWITCHES/ SELECTOR SWITCH	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	CONTROL SWITCHES/ SELECTOR SWITCH	Shrenik & Co.
8	CONTROL SWITCHES/ SELECTOR SWITCH	RECOM PVT. LTD.
	D.C. MCCB	CROMPTON GREAVES
	D.C. MCCB	L&T
	D.C. MCCB	GE-POWER
9	D.C. MCCB	SIEMENS
	DC CONTACTORS	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	DC CONTACTORS	BHEL (BHOPAL)
	DC CONTACTORS	ELECTROMAC INDUSTRIES
	DC CONTACTORS	L&T
	DC CONTACTORS	SIEMENS
10	DC CONTACTORS	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.
	DC CONTACTORS	GE-POWER
	DC SWITCH	GE-POWER
11	DC SWITCH	KAYCEE
	DC SWITCH	SIEMENS
	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
12	EARTH LEAKAGE CB	INDO ASIAN
	EARTH LEAKAGE CB	MDS SWITCHGEAR LTD
	EARTH LEAKAGE CB	S&S POWER SWITCHGEAR LTD,
	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
	GI WIRE & FLAT	Brahampuri Steels Limited

2X660 MW FNNORE SEZ SUPER CRITICAL THERMAL POWER

SUB-VENDOR LIST

13	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
14	GI WIRE & FLAT	PARCO Engineers Pvt. Ltd.
	GI WIRE & FLAT	UNITECH FABRICATORS and ENGINEERS PVT LTD
	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.
15	HRC FUSES	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	HRC FUSES	ALSTOM LTD
	HRC FUSES	ESSEN DEINKI
	HUME PIPE	REPUTED MAKE
	16	IND.POWER & WLDG SOCKETS
IND.POWER & WLDG SOCKETS		CYCLO ELECTRIC DEVICE & SERV.CO.
IND.POWER & WLDG SOCKETS		BCH
IND.POWER & WLDG SOCKETS		BEST & CROMPTON
IND.POWER & WLDG SOCKETS		AJMERA INDUSTRIES & ENGG. WORKS
17	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.
18	JUNCTION BOXES (FLAME PROOF)	SUDHIR SWITCHGEAR
19	JUNCTION BOXES (NON FLAME PROOF)	JASPER ENGNIREES 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
20	JUNCTION BOXES (NON FLAME PROOF)	S.B. ELECTRICAL ENGINEERING CORPORATION
	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
21	LIGHTING SWITCH , SOCKET & S/F UNIT	INDO ASIAN
	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
22	LT- CURRENT TRANSFORMER	PRAYOG ELECTRICALS PVT. LTD.
	LT- CURRENT TRANSFORMER	C&S ELECTRIC LTD.
	LT- POTENTIAL TRANSFORMER	SIEMENS
	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

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SUB-VENDOR LIST

	LT- POTENTIAL TRANSFORMER	PRAYOG ELECTRICALS PVT. LTD.
23	MCB	MDS SWITCHGEAR LTD
	MCB	INDO ASIAN
	MCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	MCB	S&S POWER SWITCHGEAR LTD,
26	PHOTOELECTRIC SWITCH	REPUTED MAKE
27	PVC WIRES	BIS APPROVED MAKE
28	TERMINAL BLOCKS	WAGO-CONTROLS
	TERMINAL BLOCKS	CONNECT WELL
	TERMINAL BLOCKS	ELMEX CONTROLS PVT. LTD.
	TERMINAL BLOCKS	ESSEN DEINKI
	TERMINAL BLOCKS	TECHNOPLAST
29	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.
30	VOLTMETER	AUTOMATIC ELECTRIC LTD.
	VOLTMETER	RISHABH INST.PVT LTD
31	LIGHTING TRANSFORMER	AUTOMATIC ELECTRIC LTD.
	LIGHTING TRANSFORMER	INDCOIL
	LIGHTING TRANSFORMER	POWER PACK ENTERPRISES
	LIGHTING TRANSFORMER	VIJAY ELECTRICALS LTD.
	LIGHTING TRANSFORMER	GILBERT & MAXWELL
	LIGHTING TRANSFORMER	KAPPA ELECTRICALS
32	LIGHTING TRANSFORMER	Ames Impex Electricals Pvt. Ltd
	GALVANISING	JENCO INDUSTRIAL CORPORATION
	GALVANISING	NATIONAL GALVANISING COMPANY
	GALVANISING	SIGMA GALVANISING PVT.LTD
	GALVANISING	B.P. PROJECTS PVT LTD
	GALVANISING	STANDARD GALVANISERS
	GALVANISING	STEEL PRODUCTS
	GALVANISING	UNITECH FABRICATORS & ENGINEERS PVT. LTD.
	GALVANISING	M/s Shivam Engineers & Fabricators
	GALVANISING	M/s B.G. Shirke Construction Technology Pvt. Ltd.
33	ENERGY SAVING SYSTEM	AUTOMATIC ELECTRIC LTD /REPUTED
	FRP	REPUTED

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



**TECHNICAL SPECIFICATION FOR
LIGHTING PANELS**

SPECIFICATION NO. PE-TS-412-558-E005A

VOLUME II

SECTION - II

2 x 660 MW ENNORE SEZ

REV. 0

DATE: 18.04.2018

SHEET 1 OF 7

DATA SHEET –C

S. No.	Description	Unit	Value
1.0	SYSTEM DESIGN DATA		
1.1	Design ambient	⁰ C	
1.2	AC Supply		
a)	Rated voltage	V	
b)	Rated frequency	Hz	
c)	Voltage variation (permissible)	%	
d)	Frequency variation (permissible)	%	
e)	Combined voltage & frequency variation (sum of absolutes permissible)	%	
f)	System fault level & duration	kA, sec.	
1.3	DC Supply		
a)	Rated voltage	V	
b)	Voltage variation (permissible)	%	
c)	System fault level & duration	kA, sec.	
2.0	APPLICABLE STANDARDS IS 60947 Low voltage switchgear and controlgear IS 11171 Dry type transformers IS 13703 Low voltage fuses for voltages not exceeding 1000V AC or 1500 V IS 10118 Code of practice for selection, installation and maintenance of switchgear and controlgear IS 60898 Electrical Accessories - circuit breakers for over protection for household and similar installations IS 1901 Visual indicator lamps IS 60079 Explosive atmospheres IS 5572 Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installation IS:2551 Danger notice plates		



TECHNICAL SPECIFICATION FOR
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SECTION - II

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SHEET 2 OF 7

3.1	Lighting Transformer		
a)	Rating	kVA	
b)	Type of cooling		
c)	Voltage ratio	V	
d)	Rated frequency	Hz	
e)	No. of phases		
f)	Vector group		
g)	Off circuit taps		
	Tap range, steps	%	
	Voltage of each tap	V	
h)	Impedance at rated current, frequency at 75 °C	%	
i)	Rated current		
	Primary	A	
	Secondary	A	
j)	Transformer type		
k)	Transformer winding insulation		
l)	Transformer winding insulation temperature rise limit		
n)	Type of ventilation arrangement provided for transformer enclosure		
o)	Winding conductor material		
p)	Iron loss at 50 Hz and 100% rated voltage	kW	
q)	Copper loss at rated load at 75 °C	kW	
r)	Regulation at full load at 75 °C and 0.8 p.f. lagging		
s)	Weight	kg	



TECHNICAL SPECIFICATION FOR
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SHEET 3 OF 7

4.0	Lighting Panel		
4.1	Operational Front		
4.2	Type of execution of modules (functional unit)		
4.3	Application		
4.4	Type of sheet steel		
4.5	FRP thickness (minimum)		
4.6	Degree of Protection		
a)	Indoor panel		
b)	Outdoor panel		
c)	Canopy in outdoor panel		
d)	Transformer cubicle		
4.7	Bus bar material		
4.8	Earth bus bar required		
4.9	Earth bus bar material		
4.10	Gland Plate	mm	
4.11	Earthing studs required		
4.12	Hinged door with locking facility		
4.13	AC Lighting Panel		
a)	Incomer rating	A	
b)	Type of Incomer		
c)	Earth Leakage Circuit Breaker (ELCB) in incomer required		
d)	Type of Outgoing Feeders (non-flameproof panel)		
e)	Type of Outgoing Feeders (Flameproof panel)		
f)	Type of Outgoing Feeders (Street Light panel)		
g)	ESS required for AC indoor/Outdoor panel		
h)	ESS required for DC panel		



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i)	ESS required for street panel		
j)	Timer required Street Light panel		
k)	Photocell required for Street Light panel		
l)	Outgoing feeders rating	A	
4.12	DC Lighting Panel		
a)	Incomer rating	A	
b)	Type of Incomer		
c)	Type of Outgoing Feeders (non-flameproof panel)		
d)	Type of Outgoing Feeders (Flameproof panel)		
e)	Outgoing feeders rating	A	
5.0	COMPONENTS OF LIGHTING SYSTEM EQUIPMENT		
5.1	Moulded Case Circuit Breaker (MCCB)		
a)	Rated voltage	V	
b)	Number of poles		
c)	Rated short circuit duty	kA	
d)	Rated breaking capacity (rms)	kA	
e)	Rated making current (peak)	kA	
f)	Release with short circuit		
g)	Release with overload		
h)	Release with under voltage		
i)	Auxiliary contacts		
	Numbers	NO+NC	
	Rating	A	
5.2	Switch-Fuse Unit		
a)	Utilisation category for main contacts		



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5.3	Miniature Circuit Breaker		
a)	SPN MCB rating (min)	A	
b)	DP MCB rating (min)	A	
c)	TPN MCB rating (min)	A	
d)	Short time rating	kA	
e)	Magnetic short circuit protection required		
f)	Thermal overload protection required		
5.4	Current Transformer		
a)	Type		
b)	Secondary current rating	A	
c)	Burden	VA	
d)	Accuracy class		
e)	Instrument Safety Factor		
5.5	Indicating Meters		
5.5.1	Voltmeter		
a)	Type		
b)	Shape		
c)	Size		
d)	Accuracy		
e)	AC voltage coil rating	V	
f)	DC voltage coil rating	V	
5.5.2	Energy meter (if applicable)		
a)	Type		
b)	Accuracy		
c)	Current coil rating	A	
d)	Voltage coil rating	V	
5.6	Power Contactors		



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a)	Coil voltage (nominal)		
	AC contactors	V	
	DC contactors	V	
b)	Current rating of contacts		
	Power	A	
	Control	A	
5.7	Timer		
5.7.1	Time switch		
a)	Type		
b)	Range	hr	
c)	Coil voltage rating	V	
5.7.2	On delay timer		
a)	No. of contacts		
	ON time delay	NO+NC	
	OFF time delay	NO+NC	
	Instantaneous	NO+NC	
b)	Coil voltage rating		
	AC timer	V	
	DC timer	V	
c)	Time delay range		
	AC timer	min	
	DC timer	Sec	
5.8	Selector switch (voltage selector switch\auto manual control switch\ energy saving mode by pass control switch)		
a)	Type of selector switch		
b)	Lockable		
5.9	Push Button		
a)	Voltage grade	V	



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SECTION - II

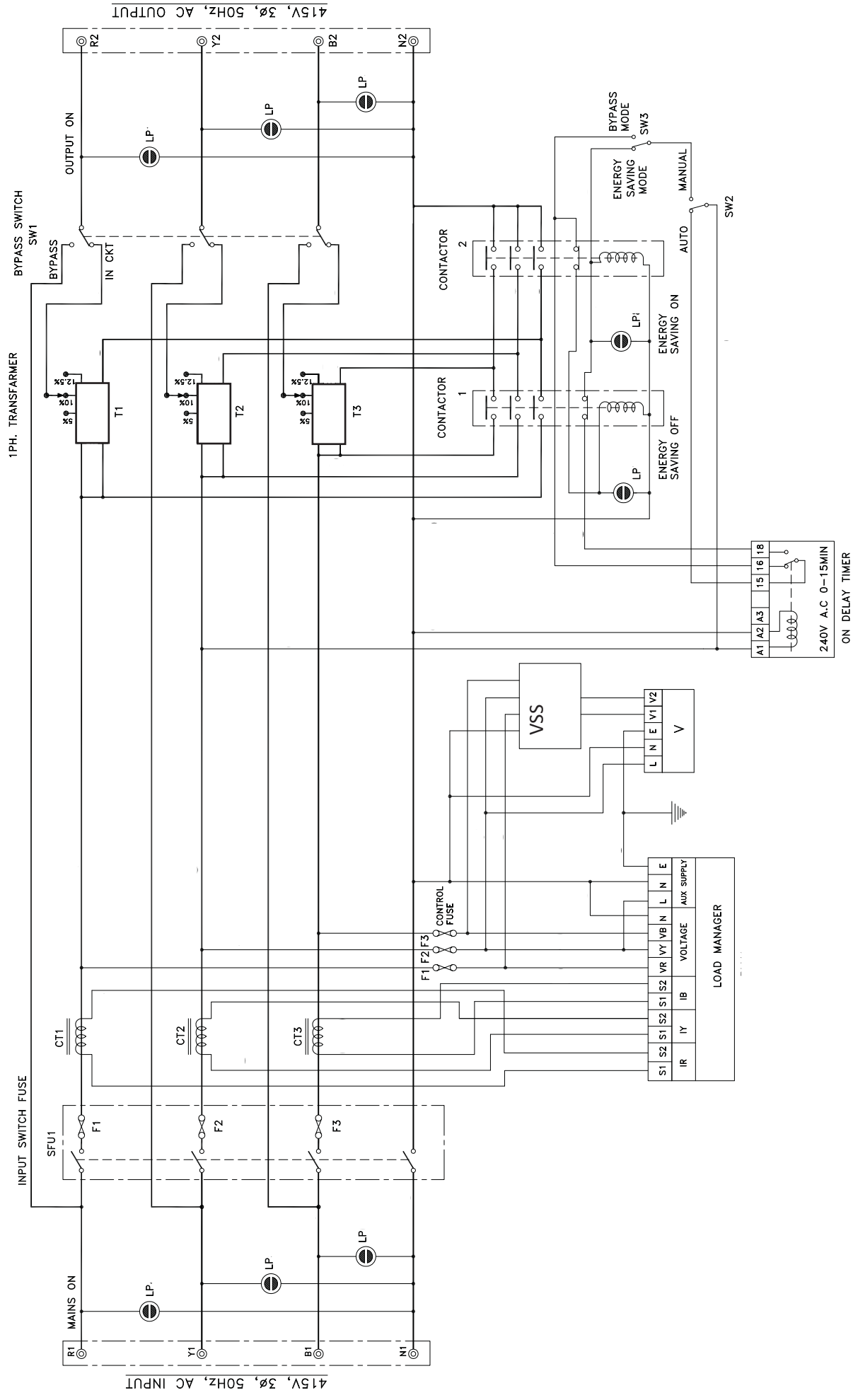
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b)	Potential free contacts		
5.10	Indicating Lamps		
a)	Lens Colour		
	ON condition		
	OFF condition		
b)	Circuit voltage	V	
5.11	Cable Glands		
a)	Type		
b)	Material		
c)	Nickel Plating provided		
d)	Flameproof glands with flameproof equipment		
5.12	Cable Lugs		
a)	Type		
b)	Material		
5.13	Load Manager		
6.0	Colour		
6.1	Colour shade		
a)	FRP LPs		



TYPICAL SINGLE LINE DIAGRAM FOR ENERGY SAVING SYSTEM

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SECTION – II

STANDARD TECHNICAL REQUIREMENTS

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1.0 INTENT OF SPECIFICATION

- 1.1 The requirements given in specification shall be fully complied with.
- 1.2 The “design” shall broadly cover the selection of components, materials, sizes etc. for the equipment of supply in vendor’s scope. 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.

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 DESIGN REQUIREMENTS

3.1 LIGHTING DISTRIBUTION BOARD (LDB) / WELDING DISTRIBUTION BOARD (WDB)

3.1.1 General Requirements of LDBs/ WDBs

- a) LDB/WDB shall be totally enclosed, modular in construction, indoor type and suitable for electrical system data as specified in Data Sheet-A. The LDB/ WDB shall be free standing type suitable for installation on cable trenches / floor.
- b) LDB/ WDB shall consist of dust and vermin proof cubicles without the use of louvers (except the transformer compartment, where applicable).
- c) Good quality synthetic rubber / neoprene gaskets shall be put around the door, cover edges and cut-out edges for push button, lamps etc. for protection against dust. The door when closed, shall compress the gasket uniformly.

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- d) Cut-out edges for instruments, relays etc. shall have sufficient overlap surface to minimize the dust entry. The arrangement for the front mounting of switch handles shall render the LDB/ WDB reasonably dust free such that the normal operations are not affected.
- e) The LDB/ WDB shall be designed to prevent contact with live parts both within the modules and in the cable alley.
- f) The bidder shall be responsible to check and coordinate the MCB characteristic with back up fuses etc. provided.
- g) All equipment shall be constructed of non-hygroscopic and non-inflammable materials.
- h) All components mounted in the LDB/ WDB shall be accessible and shall not impede access to wiring or terminals. All faults except busbar fault which may occur within any individual unit shall be confined within that unit only and shall not cause shutdown of any section of the board other than the affected unit itself. Maintenance and inspection shall be possible in any individual unit without affecting other units.
- i) Incoming unit shall comprise of either switch-fuse/ composite switch-fuse unit or MCCB as per Data Sheet A. Outgoing units shall be either switch-fuse/ composite switch-fuse unit or MCCB as per data Sheet A.
- j) Interlock between compartment door and modules shall be provided such that the door cannot be opened without switching off the power supply to the module.
- k) Defeat interlock shall be provided for the units comprising of switch or moulded case circuit breaker as a means of isolation device, such that it is possible to open the door with device ON. It shall not be possible to close the door till the interlock has been reinstated.
- l) Each LDB/ WDB shall be fitted with base frame made of angle or channel.
- m) All fixing nuts and bolts together with grounding bolts shall be provided.
- n) Lifting lugs shall be provided for each shipping section of LDB/ WDB. Removal of such lugs or hooks shall leave no opening in the LDB/ WDB.

3.1.2 LDB/ WDB with transformers (Additional Features)

- a) The LDB/ WDB shall be arranged in two adjacent but separate compartments, one compartment for the lighting transformer and the other for the incoming & outgoing feeders etc.
- b) The transformer shall be mounted on the base channel and it shall be possible to easily remove the transformer from the cubicle after opening the door. Necessary portable ramp made of mild steel shall be supplied along with each LDB/ WDB.

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- c) Independent gasket hinged door with operating handle shall be provided for access to transformer & its taps. Operating handle shall have built-in key locking arrangement.
- d) Suitable ventilation arrangement for the transformer compartment to dissipate the heat of the transformer shall be provided. The arrangement shall be in the form of louvers and the same shall be provided with galvanised wire mesh with dust catchers on the inside.
- e) Connections between transformer secondary terminals and the busbars shall be made by using PVC insulated flexible copper cables or busbars.
- f) Warning plate shall be provided on transformer enclosure. The inscription of warning plate shall be as given below:
 - DO NOT OPEN DOORS WHEN ENERGISED
 - KEEP TAPS AT SAME POSITION FOR ALL PHASES
- g) Transformer enclosure shall be provided with a danger plate.

3.1.3 Lighting Transformer/ Welding Transformer

- a) Transformer, where specified, shall form an integral part of LDB/ WDB.
- b) Lighting transformer shall be dry type, natural air cooled and suitable for mounting inside the lighting distribution board. Transformer particulars shall be as specified in Data Sheet A.
- c) Rating of transformer shall be as per BOQ.
- d) Winding shall be of copper material and maximum winding temperature at full load and under site conditions shall not exceed 130 °C.
- e) Transformer shall be suitable for cable connections on the primary side and flexible cable or busbar connection on the secondary side.
- f) The secondary neutral of the transformer shall be brought out for getting a grounded 4 wire supply system.
- g) The transformer neutral shall be brought outside the LDB/ WDB for earthing. The neutral bus bar shall be insulated from the LDB/ WDB enclosure.
- h) Transformers shall be provided with the rollers, pulling holes, lifting lugs, jacking positions etc.

3.1.4 Busbars, Connections and Joints

- a) Busbars shall be supported on non-hygroscopic and non-inflammable insulators of material such as glass reinforced moulded plastic material, epoxy cast resin

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etc. Separate supports shall be provided for each phase of the busbars. Insulation level of neutral busbar shall be same as that of phase busbars.

- b) Busbars shall be contained in a separate vermin-proof compartment within the LDB/ WDB and shall have bolted sheet steel covers for providing suitable access.
- c) Busbar clearances in the air shall be as per applicable standard for 415V, 3 phase system.
- d) Temperature for busbars, droppers and connections shall not exceed 85 deg.C for an ambient of 50 deg.C while carrying maximum continuous current.
- e) The busbar, busbar connections and supports shall have sufficient strength to withstand thermal and electromechanical stresses produced by the specified short circuit level of the system.
- f) Busbars (including neutral busbar) shall be capable of carrying the short-time current specified in Data Sheet A. The duration of short-time current shall be 1 sec unless mentioned otherwise in Data Sheet A. For the specified current and duration, there shall be no damage to the equipment.
- g) The neutral bus shall be rated same as phase bus.
- h) Main busbars and connections shall be prominently marked and displaced for standard sequence counting from rear to front, top to bottom, or left to right as viewed from the switching device operating mechanism side.
- i) Busbars and connections shall be provided with colour coded PVC sleeves. All live parts shall be properly shrouded with insulating material.
- j) Earth busbar shall be provided separately.
- k) Busbar Joints
 - Busbar and tap off joints shall be bolted type.
 - Busbars shall be thoroughly cleaned before jointing. Suitable contact grease shall be applied to remove oxide film just before jointing.
 - For copper busbars, the connecting portion shall be tinned or silver plated.

3.1.5 Wiring and Terminals

- a) All internal wiring for connections to remote equipment shall be brought to terminal boards. Spare contacts of devices shall also be wired upto terminal board as per schemes. Wires shall not be jointed or teed-off except at terminal points.
- b) Wiring shall be made by 1100 volt grade three / seven strand PVC insulated copper wire having a cross-sectional area of not less than 1.5 sq.mm. All

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connections from CT leads upto instruments, terminals shall be made by copper wires of minimum 2.5 sq.mm size.

c) All wiring shall be made with the Colour Codes specified below :

i) 3 phase AC Connections

Phase 1 (R)	Red
Phase 2 (Y)	Yellow
Phase 3 (B)	Blue
Neutral	Black

ii) 1 phase AC Connections

Phase	Red / Yellow / Blue (as per associated circuit)
Neutral	Black

iii) DC Connections

Positive	White
Negative	Grey

iv) Earth Connection Green

d) Where wiring passes from one compartment to another, the aperture shall be 'Bushed' to prevent damage to wires against sheet metal edges. Bushes may comprise of good quality rubber / PVC grommets.

e) Every wire end shall be fitted with numbered ferrules of white or yellow colour having glossy finish with identification number engraved in black. Ferrules shall be made of moisture and oil resisting insulating material. Ferrules shall be of interlocked type or tight fitting type. Ferrules shall be so fitted that they will not get detached, when the wire is removed from the terminal.

f) System of marking of wiring shall be as per applicable standard.

g) All wires used internally shall have crimped on tinned copper lugs for terminations.

h) Terminal boards shall be stud type with insulating barriers of adequate height.

i) Terminal boards shall have separate terminals for incoming and outgoing wires with not more than two wires connected to any one terminal.

j) Terminal boards shall be mounted vertically or in the horizontal rows and properly spaced to have clean wiring arrangement, adequate access for putting ferrules, making terminations etc. It shall be possible to read the ferrule numbers when the wiring is complete. Where terminals may be live when the equipment is isolated from the main supply, these shall be clearly marked near the terminal boards.

3.1.6 Cable Terminations

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- a) All cables, either incoming or outgoing to the LDB/ WDB, shall be terminated in a cable chamber. For each panel, there shall be a cable chamber on the side. The door of cable chamber should open or be locked with the help of a tool. Unless stated otherwise in Data Sheet A, all cables shall enter from the bottom.
- b) Removable undrilled gland plates of sheet steel shall be provided in the cable chamber for entry of cables. Minimum thickness of gland plate shall be as per Data Sheet-A. The gland plate shall be of adequate size for connecting requisite number of cable glands for power and control cables.
- c) Heavy duty bolt-on termination tinned copper lugs of compression type shall be used for power cable termination. The tinned copper cable lugs for all incoming and outgoing power cables shall be supplied by the vendor.
- d) For supporting and clamping of cable cores at regular interval in cable alleys, suitable slotted angle upto the respective terminal blocks shall be provided.

3.1.7 Earthing

- a) An earth busbar of adequate size of shall be provided at the bottom for the entire length of the LDB/ WDB. Material of earth busbar shall be GI unless mentioned otherwise in Data Sheet A.
- b) Every metal part other than those forming parts of an electrical circuit shall be connected to the earth bus by means of high conductivity copper wire of size not less than 2.5 sq. mm. cross-sectional area.
- c) Doors shall have a flexible copper wire for earth connection to fixed unit.
- d) Each LDB/ WDB shall be fitted with two earthing studs located in accessible position on sides for connection of internal earth busbar to the external earthing connection.
- e) Earth busbar shall be brought outside LDB/ WDB for making external connections.

3.1.8 Types of LDB/ WDB

- a) The LDB/ WDB shall be of following type:
 - LDB/ WDB-H (n) - AC LDB/ WDB with 100 kVA transformer
 - LDB/ WDB-F (n) - AC LDB/ WDB with 50 kVA transformer
 - LDB/ WDB-N (n) - AC LDB/ WDB with no transformer
 - LDB-D (n) - DC LDB

NOTE: (n) indicates number of outgoing feeders.

- b) AC LDB/ WDB (LDB/ WDB-H, LDB/ WDB-F, LDB/ WDB-N)

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Each LDB/ WDB shall comprise of the following and comply with Data Sheet A :

- i. One lighting/welding transformer (LDB/WDB-H & LDB/WDB-F).
- ii. Incomer(s) of TP / TPN switch-fuse unit or MCCB / MCCB with neutral link as per Data Sheet A. It shall be provided on the primary side of transformer for LDB/WDB type LDB/WDB-H & LDB/WDB-F.
- iii. Set of busbars with 3 phase and neutral.
- iv. TPN switchfuse units or MCBs for each outgoing circuit.
- v. Three indicating lamps with fuses for indicating bus supply ON.
- vi. CT operated ammeter with selector switch.
- vii. VT operated voltmeter with selector switch.
- viii. Power & control terminals, earth-stud, earth busbar, designation labels, internal wiring, power cable lugs, glands etc. shall be provided to complete the LDB/ WDB in all respects.

c) DC LDB (LDB-D)

Each LDB shall comprise of following and comply with enclosed Data Sheet A :

- i. Incomer & Outgoing feeders shall be as per Datasheet-A.
- ii. Two pole DC contactor on the incoming circuit for changeover to DC in case of AC normal supply failure.
- iii. One under voltage relay of suitable range, if required.
- iv. One ON delay timer.
- v. One test push button.
- vi. Set of busbars for positive and negative.
- vii. Two indicating lamps with fuses for indicating bus supply ON.
- viii. Power & control terminals, earth-stud, earth busbar, designation labels, internal wiring, power cable lugs, glands etc. shall be provided to complete the LDB in all respects.

3.2 LIGHTING PANELS (LPs)

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3.2.1 General Requirements of Lighting Panels

- a) LPs shall be totally enclosed, suitable for electrical system data as specified in Data Sheet A. The LP shall be suitable for mounting on wall / column / structure.
- b) Panels shall be suitable for indoor / outdoor application as per Data Sheet A.
- c) All components of the LP shall be fully mounted inside the panel. LPs shall have only one operational front. Door shall be provided to give full access to all the components. Door shall have padlocking arrangement.
- d) LPs shall consist of dust and vermin proof cubicles without the use of louvers.
- e) Good quality synthetic rubber / neoprene gaskets shall be put around the door. The door when closed, shall compress the gasket uniformly.
- f) The LPs shall be designed to prevent contact with live parts when the front door is open.
- g) All busbars (phase, neutral, positive, negative as applicable) within a panel shall be of the same size.
- h) All control wiring inside the panels shall be carried out with 1100 V grade, PVC insulated flexible copper wire of 2.5 sq. mm size.
- i) The rated continuous current of the equipment and components shall be as given in Datasheet-A. These ratings shall be obtained with the components mounted in their housing as in service without exceeding the permissible temperature rise.
- j) Each LP shall be fitted with M.S. mounting brackets.
- k) Panel shall be suitable for top / bottom cable / conduit entries. However, outdoor LPs shall have bottom cable / conduit entry. Removable undrilled gland plate of sheet steel shall be provided for entry of cables. Minimum thickness of gland plate shall be as per Data Sheet-A. The gland plate shall be of adequate size having knock-outs for requisite number cable connections. Gland plate shall be provided with gasket.
- l) The lighting panel shall be complete with copper busbars, and shall incorporate incomer and outgoing circuits as per Data Sheet-A. Number of outgoing circuits shall be as per BOQ.
- m) Each lighting panel shall be fitted with two GI earth studs located in accessible position on the outside of the panel on opposite sides.
- n) All metal parts of the panel except current carrying parts shall be bonded together electrically to the earthing stud.

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- o) Each panel shall be fitted with phase barriers of fireproof insulating material in such a manner that it is not readily possible for personnel to touch the phase busbars. Insulating sheet shall be fitted around the MCBs such that only the surface and toggle of the MCBs are available on the front.
- p) The supply of cable lugs for power and control cable connections forms part of the supply of equipment.
- q) Each panel shall be provided with a circuit directory plate with inscriptions neatly typed and laminated, fitted on the inside of door.

3.2.2 Type of Lighting Panels

- a) LP-A (n) - AC Lighting Panel
- b) LP-D (n) - DC Lighting Panel
- c) LP-F (n) - Fancy Lighting Panel (Decorative)
- d) LP-S (n) - Street Lighting Panel

NOTE: (n) indicates number of outgoing circuits.

3.2.3 AC Lighting Panel (LP-A)

- a) LPs shall be provided with incomer and requisite number of outgoing circuits as per Data Sheet-A. Number of outgoing circuits shall be as per BOQ.
- b) Separate neutral shall be available at terminal block for each outgoing circuit.
- c) Construction of AC Normal and AC Emergency panels shall be same.

3.2.4 DC Lighting Panels (LP-D)

- a) LPs shall be provided with incomer and requisite number of outgoing circuits as per Data Sheet-A. Number of outgoing circuits shall be as per BOQ.

3.2.5 Decorative Type Lighting Panels (LP-A)

- a) Decorative lighting panels shall be designed for use in areas like administrative building, service building, canteen, residential premises etc.
- b) Thickness of sheet steel shall be as per manufacturer's practice.
- c) LPs shall be of tone colour with elegant finish.
- d) LPs shall be provided with incomer and requisite number of outgoing circuits as per Data Sheet-A. Number of outgoing circuits shall be as per BOQ.
- e) LPs shall be suitable for either surface or flush mounting. Flush mounted panels shall have the collared door suitable for matching with the wall.

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- f) Lighting Panels may be provided with transparent acrylic cover for operation of MCBs.
- g) LPs shall be provided with knockouts on the top, bottom and sides.

3.2.6 Street Lighting Panel (LP-S)

- a) Street Lighting Panels shall be provided for feeding power supply to luminaires of street light poles, flood lighting poles, lighting masts, watch towers etc.
- b) Each Street Lighting Panel shall comprise of the following :
 - i. One TPN door interlocked switch-fuse unit incomer. Interlock defeat feature shall also be provided.
 - ii. Three pole AC Contactor
 - iii. 0 - 24 hrs timer and/or photo-electric switch for automatic switching of contactor
 - iv. Three phase & neutral busbars
 - v. Single pole or three pole MCBs for each outgoing circuit as per Data Sheet A
 - vi. Two lamps for bus supply ON & OFF indications
 - vii. Complete wiring arrangement as per control scheme.
 - viii. Auto-Manual selector switch
 - ix. ON push button
 - x. OFF push button
- c) Switching ON and switching OFF shall be through both 0 - 24 hrs timer and light sensor in automatic mode.
- d) One number light sensor in weather proof enclosure having IP:55 degree of protection shall be supplied loose along with each SLP.
- e) Internal power wiring shall be done with PVC insulated Cu wire of suitable size. All control wiring inside the panel shall be carried out with 1100 V grade, PVC insulated flexible copper wires.
- f) Two nos. outgoing circuit in each panel shall be tapped before contactor for watch tower supply.

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4.0 COMPONENTS OF LDB/WDB AND LIGHTING PANEL

4.1 MOULDED CASE CIRCUIT BREAKERS

- a) Moulded case circuit breakers (MCCBs) shall be provided when called for in Data Sheet A for use in lieu of switch fuse. MCCB shall meet the requirements stipulated in Data Sheet A.
- b) MCCBs in AC circuits shall be of single throw, air break, heavy duty type triple pole construction arranged for simultaneous three pole manual closing and opening and for automatic tripping at short circuit and overload. Neutral link shall be provided for LDB/ WDB without transformers.
- c) Operating mechanism shall be quick make, quick break and trip free type.
- d) The ON, OFF & TRIP positions of the MCCB shall be clearly indicated so as to be visible to the operator when mounted as in service. Operating handle shall be provided on front of the LDB/ WDB.
- e) MCCBs shall be capable of withstanding the thermal stresses caused by overloads and short circuits. The maximum tripping time under short circuit shall not exceed 20 milli-seconds.
- f) MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit ratings.
- g) Under voltage releases and other releases shall be provided as specified in data Sheet-A.

4.2 SWITCH-FUSE UNITS

- a) These units shall preferably comprise of switches having integral fuses, called composite units. Alternatively, combination units of separate switch and fuse may also be acceptable.
- b) These units shall be provided for general purpose i.e. incoming or outgoing units.
- c) The units shall be of the air break air insulated type and designed to ensure safety to operating personnel.
- d) Composite units shall have integral fuses i.e. fuse carrier with fuse link (fuse link forming the moving contact). The design shall ensure that the moving contact is not live when switch is open i.e. in OFF position, so as to facilitate removal of fuse.
- e) The switch shall be capable making and carrying the system prospective fault current, but limited in magnitude and duration by the cut off characteristics of the largest HRC fuse link that may be fitted to that unit.

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- f) The fixed contact shall be so shrouded that maintenance of the unit can be carried out in safety with the busbars live.
- g) Where one isolating switch is used as the incoming device, the incoming side fixed contacts shall be shrouded to ensure that maintenance can be carried out with the remote fuse and switch closed.
- h) Composite switch-fuse or the combination of switch and fuse shall meet the requirements of its components as follows:

Isolating Switch

- i. Switches shall be air-break, quick make, and quick break heavy duty type conforming to applicable standard.
- ii. All switches shall have visible ON / OFF position indication and shall be padlockable in any (ON / OFF) position.
- iii. Switches shall be door interlocked such that it shall not be possible to gain access to inside the unit unless the isolating switch is in OFF position.
- iv. The switches shall be suitable for independent manual operation.
- v. The switch contacts shall be of silver alloy or silver plated copper and springs of non-corrosive material.
- vi. Inter-phase barriers shall be provided to prevent possibilities of phase to phase fault in the switch. The switch shall also be shrouded from all sides to prevent access to live parts on the switch after opening the unit door. The barriers and shrouding shall extend upto the height of switch to fully enclose both side terminals of the device. The arrangement shall permit easy maintenance.

High Rupturing Capacity (HRC) Fuses

- i. The fuse serving as the short-circuit protective device in isolating fuse-switch units shall be of HRC cartridge, current limiting and plug-in non-deteriorating type.
- ii. The fuse carriers shall be easily withdrawable for replacement of fuse. Insulated fuse pullers shall be provided where fuses are not mounted in insulating carriers to remove and replace fuses in live conditions.
- iii. Fuses shall preferably be fitted with a device to indicate operation (i.e. when the fuse has blown).
- iv. Live terminals of fuse bases shall be shrouded to prevent contact with personnel where fuse links are not mounted in carriers and are directly plugged into the fuse base. Inter-phase barriers extending throughout the

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length of the fuse base shall be provided to prevent inter-phase short circuit. They shall be shrouded from all sides to prevent accidental contact.

v. Fuse carriers and bases shall be of good quality moulded insulating material. Porcelain fuse bases and carriers will not be accepted.

vi. The rating and characteristics of fuse links shall be chosen appropriately for short circuit protection of circuits downstream.

4.3 MINIATURE CIRCUIT BREAKERS

a) The use of miniature circuit breakers (MCBs) combining thermal overload and magnetic short circuit protection shall be application for the outgoing circuits of Lighting Panels.

b) MCBs shall have suitable rating as specified in Data Sheet A.

c) MCBs shall be suitable for housing in the lighting panel and for connection of copper link bus bar at the incoming and copper lugs at the outgoing ends.

d) The terminals of MCB and ON/OFF positions shall be clearly and indelibly marked.

4.4 CURRENT TRANSFORMERS

a) CTs shall be air insulated having insulation class E or better, cast resin type and shall be capable to withstand the thermal and mechanical stresses resulting from maximum short circuit.

b) The short time current duration for CTs shall be one second.

c) CT primary current shall not be less than the full load thermal rating of the associated circuit. CT secondary current shall be as specified in Data Sheet A. Polarity shall be marked in a suitable manner. The ratings shall be adequate to cater for the burden of connected instruments.

d) CTs shall be of bar primary / wound primary / ring type capable of carrying the rated primary current.

4.5 VOLTAGE TRANSFORMER

a) Voltage transformers (VT) shall be dry, cast resin type comprising of single phase or three phase units. They shall have their primary windings protected by current limiting fuses with interrupting capacity corresponding to that of the lighting board / panel.

b) VT secondary windings shall be earthed in LDB/ WDB / LP through link, which can be removed for insulation testing.

c) Three phase voltage transformers shall be as per Data Sheet A.

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Single phase VTs shall have voltage rating of (Nominal System Voltage / $\sqrt{3}$) V / (110 / $\sqrt{3}$) V so that secondary voltage shall be 110 volts phase to phase when the secondary winding is star connected.

- d) VTs shall have an output rating adequate to cater to the burden connected to them.

4.6 INDICATING METERS

- a) Meters shall be panel mounted, flush type and suitable for rear terminal connection.
- b) Meters and instruments shall be enclosed in dust proof, moisture resistant black finished cases and shall be suitable for tropical use. Instruments shall be suitable for operation from the secondary windings of CTs and VTs.
- c) All instruments shall be calibrated to enable direct reading of primary quantities. Instruments shall be adjusted and calibrated at manufacturer's works and shall have means of calibration, checking and zero adjustment at site.
- d) All the divisions and the quantity to be measured shall be clearly marked. Instruments shall conform to applicable standard having black numerals and lettering on white anti-parallax dial with knife edge pointer. Indicating instruments shall be of moving iron type for AC and moving coil type for DC circuits.
- e) Instruments having metallic cases shall be fitted with earthing terminals.

4.7 CONTACTORS

- a) Contactors shall be of the air break type, electromagnetic type fitted with arc shields.
- b) The operating coil shall be suitable for satisfactory operation in the range of 85% - 110% of nominal voltage specified under the Data Sheet A. The coil shall be tropicalized having insulation not less than class 'E'.
- c) Electrically independent auxiliary contacts not less than 2NO + 2NC for interlocking and indication shall be fitted to individual power contactor.
- d) All springs shall be made out of a corrosion proof material.

4.8 RELAYS

- a) Relays shall be provided on the various circuits as per schemes. Relays shall be flush mounted on front of the board. Relay case shall be painted with dull black or egg shell black enamel and with back connected terminals. Metal cases and frames of relay shall be earthed.
- b) All relays shall be of withdrawable type with built-in testing facilities, with provision for inspection, maintenance and replacement. Where built-in test facility is not

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provided for a particular relay, separate suitable test block shall be provided on the board for this purpose.

- c) Relay performance shall not alter due to mechanical shock or vibration or external magnetic field which may be present at the place of mounting.
- d) Each relay shall not have less than two independent pairs of contacts.

4.9 TIMERS

4.9.1 Time Switch

- a) Time switch shall be suitable for automatic switching ON and OFF of street lighting / flood lighting circuits.
- b) Time switch have 00 - 24 hrs clock base.
- c) Time switch shall indicate actual time and shall permit accurate time setting.
- d) Time switch shall be rugged, independent of normal fluctuations of voltage / frequency and free from maintenance.
- e) Contact rating, clock accuracy, rated voltage rating and frequency rating of timer shall be suitable to its application.
- f) Time switch shall be provided with Ni-Cd battery.
- g) Time switch shall be suitable for mounting inside the panel.

4.9.2 On/Off Delay Timer

- a) On delay timer shall be required for continuation of DC supply for a limited duration when the AC Emergency supply has been restored and DG set is under stabilisation.
- b) Timer shall be fully static and suitable for operation on normal frequency and system voltage.
- c) Timer shall have high setting accuracy, high repeat accuracy, low reset time and low power consumption.
- d) Timer shall have the time setting range as mentioned in Data Sheet A.
- e) Timer shall be suitable for mounting inside the panel.

4.10 SELECTOR SWITCHES

- a) The rating and other features of the switches shall be suitable for the application. The number of positions and the number of contacts required for each switch shall be as indicated in the schemes

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- b) Selector switches shall be stay put type, provided with properly designated escutcheon plates clearly marked to show operating position.
- c) Terminals carrying potential above 120 Volts shall be shrouded to prevent accidental contact with personnel.
- d) Ammeter selector switches shall have make before break contacts.
- e) The switches shall be suitable for semi-flush mounting with the front plate and operating handle projecting out. All connection to the switches shall be from the back.
- f) The arrangement for front mounting of these devices shall be such as to make them reasonably dust free so as not to interfere with normal operation.

4.11 PUSH BUTTONS

- a) Push button shall be heavy duty, flush mounted suitable for the application.
- b) Push button shall be provided with integral escutcheon plates marked with its function identified as per schemes.
- c) Colour shall be appropriate to the function.
- d) Minimum number of contacts shall be 2 NO + 2 NC or as per the requirements of control scheme.

4.12 INDICATION LAMPS

- a) Indication lamps shall be complete with lens covers and holders.
- b) Each lamp shall be fitted with a durable resistance integrally wired in series with the lamp. Alternatively, lamps with built in transformers are acceptable.
- c) The lamp cover (lens) shall be translucent of appropriate colour.
- d) Bulbs and covers shall be interchangeable, easily replaceable from the front without the need for any special means.
- e) Terminals having potential above 120V shall be shrouded to prevent contact with personnel.
- f) Terminals shall be suitable for ring type copper cable lugs of size depending upon the circuit rating.

4.13 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.

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- 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.

4.14 CABLE LUGS

- a) All equipment shall be supplied with the power and control cable lugs of suitable size, whether specifically mentioned or not.
- b) Name / trade name and size of lug shall be engraved/ indelibly printed on each cable lug.

4.15 TERMINALS

- a) Terminals shall be stud type of copper material.
- b) Terminals shall be provided with transparent cover(s).
- c) Separate terminals shall be available for each termination of loop-in and loop-out power connections.

5.0 LABELING

- 5.1 Labels to identify all the Main assemblies, Sub-assemblies and components of the LDB/ WDB and LPs shall be provided.
- 5.2 Name and rating plate / marking shall be provided as required by relevant standard applicable to each component / assembly to be identified.
- 5.3 Labels shall be of two colour, three layer plastic material with matt or semi matt finish or of the anodised aluminium sheet.
- 5.4 All labels other than "Danger" or "Warning" labels shall have black lettering on a white background. Danger labels shall be as per applicable standard and shall not be affixed on to removable parts.
- 5.5 All labels shall be securely fixed on to the equipment by means of self tapping screws or other approved means.
- 5.6 Stick-on type labels of good quality and permanent mounting shall be acceptable for internally mounted components only.
- 5.7 A list of all such items to be labeled and text and type of labels to be provided is given below:

a) BOARD DESIGNATION (MAIN EQUIPMENT LABEL)

i. Inscription :

Designation & LDB/ WDB number for LDB/ WDB.

Designation and LP number for LPs.

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ii. **Location :**

Top centre in the front of the LDB/ WDB.

Top centre in the front of the LP.

iii. **Material :**

3 Layer plastic material, fixation by self tapping, non-rusting screws, black inscription on white back ground.

b) OUTGOING - FEEDER DESIGNATION

i. **Inscription :** Module number, LP number / purpose.

ii. **Material :**

Black engraving on white anodised aluminium plate of thickness 1.6 mm or more. Plate to be secured with screws.

c) COMPONENT DESIGNATION

i. **Inscription :** Letter symbol / Legend as assigned in schemes.

ii. **Location :** Near or on the component

iii. **Material :** Stick-on type

5.8 CIRCUIT DIAGRAM / DIRECTORY PLATE

- a) A diagram is to be prepared for fixing to the inside cover of every lighting panel giving details of the points controlled by each circuit.
- b) The circuit list shall be typed or printed stating the location of the equipment served, rating of the protective unit and the circuit loadings.
- c) The list shall be mounted on the inside of the cover door and shall be protected by an acrylic sheet cover to be easily removable to permit circuit modifications.

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.

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- 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 and minimum thickness as per Data Sheet A.
- 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 Packing procedure shall conform to the following :
- The equipment shall be properly packed before dispatch. The packing shall prevent damage to the contents while handling and lengthy period of outdoor storage.
 - The equipment shall be wrapped in weather proof packing using polythene sheets/ air bubble sheets/ thermocol sheets and then secured in wooden packing cases. Wood for wooden packing cases/ crates shall be chemically treated to prevent deterioration due to fungi and attack by termites, borers, and any other kind of infection.
 - The equipment shall be secured by fixing base plate/ frame with the help of bolt and nuts etc. to bottom frame of the wooden packing cases/ crates. Suitable cushioning material like rubberised coir (min. 50 mm thick & 100 mm wide) shall be provided on the bottom support. Gap between the panel and casing shall be filled with rubberised coir with distance between consecutive supports less than 500mm.
- 7.2 Specification for the sea worthy packing, if enclosed, for the export jobs shall form part of the specification.

8.0 INSPECTION & TESTING

- 8.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-558-E005) without any deviations. At contract stage, the successful bidder shall submit the same QP for BHEL/ ultimate customer's approval. 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.
- 8.2 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.

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8.3

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.

8.4

Functional testing shall be carried out for Lighting/Welding Distribution Boards/ Lighting Panels.

8.5

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

8.6

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.

8.7

Safety interlocking verification shall be done.

8.8

Each lighting transformer shall be routine tested and one transformer of each rating shall be type tested in accordance with relevant standard in case type test certificates of similar transformers are not available / not acceptable to the purchaser.

8.9

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.

9.0

TOOLS AND TACKLE

9.1

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

9.2

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.

9.3

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.

9.4

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

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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. Bidder to furnish list of E&C spares in the relevant schedules of the Bid Form and Price Schedules.

		QUALITY PLAN		CUSTOMER : COMPANY PVT.LTD.		PROJECT TITLE : 2X660 MW ENNORE SEZ			SPECIFICATION NO.: - PE-TS-412-558-E005A				
				BIDDER/ VENDOR :		QUALITY PLAN NO. PE-QP-999-558-E005, REV-0			SPECIFICATION TITLE:- TECH. SPECIFICATION FOR LIGHTING PANELS				
SHEET 1 OF 2		SYSTEM		ITEM :ILLUMINATION					SECTION II			VOLUME II	
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	LIGHTING PANELS	1.DIMENSIONS 2.PAINT SHADE/ THICKNESS 3.VERIFICATION OF GA & BOM 4.FUNCTIONAL TESTS (INCLUDING WIRING CONTINUITY) 5.HV/IR/HV 6.DEGREE OF PROTECTION (INCLUDING EXPLOSION PROOF IF ANY) 7.TEMPERATURE RISE TEST (FOR COMPLETE ASSEMBLED LDB/LP)	MA MA CR MA MA MA	MEASUREMENT VISUAL/ MEASUREMENT VISUAL ELECT. ELECT TESTS ELECT	10% 10% 100% 100% 100% 1/SIZE & RATING 1/RATING	APPROVED DRG. APPROVED DRG. APPROVED DRG. APPROVED DRG./ BHEL SPEC. HV -2.5KV AC FOR 1 MINUTE IR - >50 M OHM BHEL SPEC/ RELEVANT IS BHEL SPEC/ RELEVANT IS	APPROVED DRG. APPROVED DRG. APPROVED DRG. APPROVED DRG./ BHEL SPEC. HV -2.5KV AC FOR 1 MINUTE IR - >50 M OHM BHEL SPEC/ RELEVANT IS BHEL SPEC/ RELEVANT IS	INSPT. REPORT INSPT. REPORT INSPT. REPORT INSPT. REPORT INSPT. REPORT TEST REPORT TEST REPORT	3/2 3/2 3/2 3/2 3/2 3/2	2,1 2,1 2,1 2,1 2,1 - -	- - - - - 2,1 2,1	COMPONENTS TO BE OF APPROVED MAKE	
BHEL		LEGEND :	LEGEND :		PARTICULARS			BIDDER/VENDOR					
		P-perform	1 - BHEL		NAME								
		W-witness	2 - BHEL's Vendor		SIGNATURE								
		V-verify	3 - Manufacturer		DATE								
											BIDDER'S/VENDORS COMPANY SEAL		

		QUALITY PLAN SHEET 2 OF 2		CUSTOMER : NTPC-SAIL POWER COMPANY PVT.LTD.		PROJECT TITLE : 2X660 MW ENNORE SEZ			SPECIFICATION NO.: - PE-TS-412-558-E005A				
				BIDDER/ VENDOR :		QUALITY PLAN NO. PE-QP-999-558-E005, REV-0			SPECIFICATION TITLE:- TECH. SPECIFICATION FOR LIGHTING PANELS				
				SYSTEM		ITEM :ILLUMINATION			SECTION II VOLUME II				
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	
2.0	LOSS LESS REACTANCE COIL	1. ROUTINE TEST a) TYPE / RATING b) WINDING RESISTANCE c) VOLTAGE RATIO /VECTOR d) Z VOLT/ Z SCKT e) LOAD LOSS/ CURRENT f) NO LOAD LOSS & NO LOAD CURRENT g) SOURCE WITHSTAND h) INDUCED O/V 2. TYPE TEST	CR CR CR CR CR CR CR CR MA	VISUAL TEST TEST TEST TEST TEST TEST TEST TEST	100% 100% 100% 100% 100% 100% 100% 100% 1/RATING	IS 11171 / BHEL SPEC IS 11171 / BHEL SPEC IS 11171 / BHEL SPEC IS 11171 / BHEL SPEC IS 11171 / BHEL SPEC IS 11171 / BHEL SPEC IS 11171 / BHEL SPEC IS 11171 / BHEL SPEC IS 11171 / BHEL SPEC	IS 11171 / BHEL SPEC. IS 11171 / BHEL SPEC. IS 11171 / BHEL SPEC. IS 11171 / BHEL SPEC. IS 11171 / BHEL SPEC. IS 11171 / BHEL SPEC. IS 11171 / BHEL SPEC. IS 11171 / BHEL SPEC. IS 11171 / BHEL SPEC.	INSPT. REPORT INSPT. REPORT INSPT. REPORT INSPT. REPORT INSPT. REPORT INSPT. REPORT INSPT. REPORT INSPT. REPORT INSPT. REPORT TEST CERTIFICATE	3 3 3 3 3 3 3 3 3 3	- - - - - - - - -	2,1 2,1 2,1 2,1 2,1 2,1 2,1 2,1 2,1 2,1	TYPE TESTS CERTIFICATE CLEARANCE FROM BHEL/CUSTOMER	
BHEL		LEGEND :		LEGEND :		PARTICULARS		BIDDER/VENDOR					
		P-perform		1 - BHEL		NAME							
		W-witness		2 - BHEL's Vendor		SIGNATURE							
		V-verify		3 - Manufacturer		DATE							
											BIDDER'S/VENDORS COMPANY SEAL		

DOCUMENTS SUBMISSION SCHEDULE FOR LIGHTING PANELS

SL. No.	DOCUMENT TITLE	SUBMISSION SCHEDULE
1	OGA of LP, Loss less reactance coil	Within two weeks from the date of LOI.
2	Data sheets, Sub vendor list, Manufacturing quality plan	Within two weeks from the date of LOI.
3	Resubmission of BHEL/ customer commented document	Within one week from receipt of comments.