

TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED

2 x 660MW Udangudi STPP Stage-I

VOLUME – II

**TECHNICAL SPECIFICATION FOR
DISTRIBUTION BOARDS & LIGHTING PANELS
SPECIFICATION NO: PE-TS-435-558-E005, REV-0**



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



TECHNICAL SPECIFICATION FOR
DISTRIBUTION BOARDS & LIGHTING
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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 DB/ WELDING DB & 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 DBs/ WELDING DBs & 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 lighting panel:	With Timer
AC Outdoor lighting panel:	With Timer or photocell
Street lighting panel:	With Timer & photocell

- 3.2 Lighting transformers shall be dry type, indoor type dust and vermin proof having single phase, 415 V/415 V, off load tap-changer with $\pm 2 \times 2.5\%$ on primary side. The vector-group shall be Dyn11. (The secondary side shall be solidly grounded through an additional neutral bushing exclusively used for grounding). The casing of the transformer shall be grounded at least at two (2) points. Rating of each transformer shall be decided to limit the fault level within 9kA. Insulation class of the lighting transformer shall be class -F and limited up to class B insulation.

3.3 AC Normal Lighting Systems:



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AC Normal lighting fixtures are fed through a number of conveniently located AC Lighting panel (ACLP) which are fed from Lighting Distribution Board (LDB).

LDBs consisting of dry type isolation transformer housed in LDB with proper separation from distribution panels as per details indicated below is envisaged:

Transformer rating: 50 / 100 kVA
Transformer voltage ratio: 415 / 415 Volt, taps of +5% to -5% in steps of 2.5%.
Transformer type: Encapsulated
Distribution Panel type: Single front fixed type
LDB Configuration: One incomer
Incomer type: TPN MCCB
Incomer rating: As per lighting transformer rating
Outgoing feeder type: TPN MCCB
Outgoing feeder rating: 63A

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

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

AC LDB shall be 3Ph, 4Wire, 50Hz effectively grounded System.

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

3.4 AC Emergency Lighting Systems:

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).



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ELDBs consisting of encapsulated, dry type isolation transformer housed in ELDB with proper separation from distribution panels as per details indicated below is envisaged:

Transformer rating: 50 / 100 kVA
Transformer voltage ratio: 415 / 415 Volt, taps of +5% to -5% in steps of 2.5%.
Transformer type: Encapsulated
Distribution Panel type: Single front fixed type
LDB Configuration: One incomer
Incomer type: TPN MCCB
Incomer rating: As per lighting transformer rating
Outgoing feeder type: TPN MCCB
Outgoing feeder rating: 63A

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

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

AC ELDB shall be 3Ph, 4Wire, 50Hz effectively grounded System.

3.5 DC Emergency Lighting Systems:

DC Emergency lighting fixtures fed through suitable numbers of conveniently located DC Emergency Lighting panel (DCELP) which are fed through DC emergency Lighting Distribution Board (DCELDB).

The DCELDB shall be fed from two sources i.e. AC emergency lighting distribution board (ELDB) & DCDB. The emergency lighting fixtures connected to this system shall remain normally 'ON' all the time from AC supply & on failure of AC supply they will automatically switch over to DC supply system. DCELDB shall be equipped with AC under voltage relay and contactor for emergency auto changeover scheme.

DCELDBs as per details given below is envisaged:

Distribution Panel type: Single front fixed type
DC Incomer type: DP Switchfuse unit with contactor
DC Incomer rating: 125A
AC Incomer type: TPN MCB with contactor
Converter: For Conversion of AC to DC
AC Incomer rating: 63A
Outgoing feeder type: DP Switchfuse unit



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Outgoing feeder rating: 32A

DCELPs as per details given below is envisaged:

Incomer type: DP MCB

Incomer rating: 32A

Outgoing feeder type: DP MCB

Outgoing feeder rating: 20A

3.6 Lighting Panel/Distribution Boards

a) Lighting Distribution Boards(LDB) shall be made of 2mm thick CRCA sheet.

The Lighting panels shall be rated for 415 V, 3 phase, 4 wire, AC with neutral bus and suitable for either wall/column mounting. Indoor panels shall have degree of protection of IP 54 and outdoor type shall have degree of protection of IP 55 and shall have a sloping canopy. Panels shall be constructed from CRCA sheet. Sheet thickness shall be 2.0 mm.

b) Indoor Lighting Distribution Boards & 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 Distribution Boards and 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 Distribution Boards shall have provision of cable entry from bottom and, 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 Distribution Board for connection to 50 x 6 mm GS flat and Lighting Panel for connection to 25 x 6 mm GS flat.

f) Each Lighting Distribution Board shall be complete with designation and caution notice plates fixed on front cover and a directory plate fixed on inside of the front cover. This directory Plate shall contain details of the Lighting Panels being fed from the Distribution Board including their designation, location, loading etc. 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 bars shall be made of high conductivity copper/aluminium alloy. They shall be supported on insulators of material such as fiber reinforced polyester or epoxy cast resin. Bus bar shall be electrolytic grade hard drawn aluminium, colour coded for easy identification and designed for a maximum temperature of 90°C. Minimum size shall be 25 x 6 mm.

h) Board / 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.



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- 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.

3.7 Lighting distribution Board/Panel Equipment

- a) Each board shall consist of 1 x 100% dry type transformer housed in the different cubicles voltmeter with selector switch, C.T. operated ammeter and incoming TPN MCCB. Outgoing feeder from the Lighting Distribution Board shall have TPN MCCB.
- b) Each lighting panel shall have an incoming TPN MCB with neutral link and a number of outgoing miniature circuit breakers (MCB).
- c) Board/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 fitted with arc shields. 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 1.0 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 MCBs for controlling fixtures. 5A, 3Pin sockets shall be fed from the lighting panel through separate circuits.

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 Painting

Painting shall be carried out by approved process. After preparation of the under surface the equipment shall be painted with epoxy based paint by powder coating. The final thickness of paint film on sheet steel shall not be less than 85 microns. Final shade shall be RAL-7035.

All equipment shall be given touch-up paint as required after installation.



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3.10 FITTINGS AND ACCESSORIES OF LIGHTING TRANSFORMER

Each transformer shall be equipped with fittings and accessories as listed below:

1. 150 mm dia. winding temperature indicator with maximum reading pointer and electrically separate sets of contacts for trip and alarm.
2. Handling and lifting lugs both for enclosure and core-coil assembly.
3. Jacking pad for core-coil assembly.
4. Inspection cover for fixed portion of cable box.
5. Door handle operated safety limit switch with 1NO + 1NC contact.
6. Ground bus.
7. IP-55 junction box.
8. Rating and terminal marking plates.

Note: All indication, alarm, trip contacts provided shall be rated for 0.5A at 220 V D.C. and 5A at 240 V A.C.

3.11 Welding distribution board

Transformer rating of WDB shall be 100KVA. Other construction detail shall be same as AC LDB.

- 3.12** Miniature circuit breakers (MCB) shall have thermal elements for overload protection and an instantaneous magnetic trip to protect against severe faults. All MCBs provided shall be suitable for breaking capacity of 10 kA (minimum) at 240 V AC.

- 3.13** Contactors shall be of the air break type fitted with arc shields. Time switch shall be suitable for automatic switching ON and OFF of street lighting / flood lighting circuits. Time switch has 00 - 24 hours clock base. Time switch shall indicate actual time and shall permit accurate time setting. Time switch shall be provided with Ni-Cd gel battery.



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4.0 DOCUMENTATION

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

ATTACHMENT – I

DOCUMENTS REQUIRED AFTER AWARD OF LOI

SL. No.	DOCUMENT TITLE	DOCUMENT NO.	CATEGORY
1	TECHNICAL DATA SHEET FOR LDB/ LP/ TRANSFORMER	PE-V0-435-558-E405	APPROVAL
2	SUB-VENDOR LIST FOR LDB /LP /TRANSFORMER	PE-V0-435-558-E088	APPROVAL
3	GA DRAWING & SLD OF LDB-H(12)	PE-V0-435-558-E003	APPROVAL
4	GA DRAWING OF 100 KVA TRANSFORMER	PE-V0-435-558-E004	APPROVAL
5	GA DRAWING & SLD OF WDB-H(12)	PE-V0-435-558-E005	APPROVAL
6	GA DRAWING & SLD OF LDB-F(8)	PE-V0-435-558-E006	APPROVAL
7	GA DRAWING & SLD OF DC LDB-D(12)	PE-V0-435-558-E007	APPROVAL
8	GA DRAWING & SLD OF LP-A(6) - INDOOR	PE-V0-435-558-E009	APPROVAL
9	GA DRAWING & SLD OF LP-A(6) - DECORATIVE	PE-V0-435-558-E010	APPROVAL
10	GA DRAWING & SLD OF LP-A(12) - INDOOR	PE-V0-435-558-E011	APPROVAL
11	GA DRAWING & SLD OF LP-A(12) - OUTDOOR	PE-V0-435-558-E012	APPROVAL
12	GA DRAWING & SLD OF LP-A(12) - DECORATIVE	PE-V0-435-558-E013	APPROVAL
13	GA DRAWING & SLD OF LP-A(18) - INDOOR	PE-V0-435-558-E014	APPROVAL
14	GA DRAWING & SLD OF LP-A(18) - OUTDOOR	PE-V0-435-558-E015	APPROVAL
15	GA DRAWING & SLD OF LP-D(6) - INDOOR	PE-V0-435-558-E016	APPROVAL
16	GA DRAWING & SLD OF LP-D(6) - OUTDOOR	PE-V0-435-558-E017	APPROVAL
17	GA DRAWING & SLD OF LP-S(6)	PE-V0-435-558-E018	APPROVAL
18	GA DRAWING OF 50 KVA TRANSFORMER	PE-V0-435-558-E019	APPROVAL
19	MANUFACTURING QUALITY PLAN FOR LDBs & LPs	PE-V0-435-558-E902	APPROVAL
20	MANUFACTURING QUALITY PLAN FOR LIGHTING TRANSFORMERS	PE-V0-435-558-E910	APPROVAL
21	TYPE TEST REPORT OF LDBs & LP	PE-V0-435-558-E409	INFORMATION
22	TYPE TEST REPORT OF TRANSFORMERS	PE-V0-435-558-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	⁰ 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)	%	+3% 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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3.0	LIGHTING/ WELDING DISTRIBUTION BOARDS		
3.1	Operational Front		Single Front
3.2	Type of execution of modules (functional unit)		☒ Fixed ☐ Draw out
3.3	Type of sheet		CRCA
3.4	Sheet thickness (minimum)		
a)	Non-load bearing covers	mm	1.6 mm
b)	Non-load bearing partitions	mm	1.6 mm
c)	Load bearing members	mm	2.0 mm
d)	Frames	mm	2.0 mm
e)	Door	mm	1.6 mm
f)	Withdrawable unit (if applicable)	mm	2.0 mm
3.5	Cable alley width (minimum)	mm	300
3.6	Bus bar material		High conductivity Copper/Aluminium Alloy
3.7	Earth bus bar material		☒ GI Strip ☐ Aluminium ☐ Copper
3.8	Degree of Protection		
a)	Main Panel		IP-54 for indoor & IPW-55 with canopy for outdoor
b)	Transformer cubicle		IP-42
3.9	Gland plate thickness	mm	3.0
3.10	AC LDB/ WDB		
a)	No. of Incomers		☒ One ☐ Two
b)	Bus coupler required		☐ Yes ☒ No
c)	Incomer and Bus coupler rating	A	As per transformer rating
d)	Type of Incomer and Bus coupler		☐ SFU ☒ MCCB
e)	Type of Outgoing Feeders		☐ SFU ☒ MCCB
f)	Outgoing feeders rating	A	63
g)	Cable entry		☒ Bottom ☐ Top



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3.11	Lighting Transformer		
a)	Rating	kVA	100 / 50
b)	Type of cooling		Air natural
c)	Voltage ratio	V	415/415
d)	Rated frequency	Hz	50
e)	No. of phases		3
f)	Vector group		Dyn11
g)	Off circuit taps		
	Tap range, steps	%	+5% to -5% in steps of 2.5%
	Voltage of each tap	V	As per manufacturer's data
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°C above 50°C design ambient of (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
s)	Weight	kg	As per manufacturer's data



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3.12	DC LDB		
a)	No. of Incomers		☐ One ☒ Two
b)	DC incomer Type		DP Switch fuse unit with contactor
c)	DC incomer rating	A	125
d)	AC incomer type		TPN MCB with contactor
e)	AC incomer rating	A	63
f)	Bus coupler required		☐ Yes ☒ No
g)	Incomer and Bus coupler rating	A	125
h)	Type of Incomer and Bus coupler		☒ DP SFU ☐ DP MCCB
i)	Type of Outgoing Feeders		☒ DP SFU ☐ MCCB ☐ DP MCB
j)	Outgoing Feeders rating	A	32
k)	Changeover required in DC LDB		☒ Yes (Converter for Conversion of AC to DC) ☐ No
l)	Provision of Manual override		☒ Yes ☐ No
m)	Cable Entry		☒ Bottom ☐ Top
4.0	LIGHTING PANELS		
4.1	Application		☐ Indoor ☐ Outdoor ☒ Both
4.2	Type of sheet		CRCA
4.3	Sheet thickness (minimum)		2.0 mm
3.4	Degree of Protection		
a)	Indoor panel		IP-54
b)	Outdoor panel		IPW-55, Weatherproof
c)	Canopy in outdoor panel		☒ Yes ☐ No
4.5	Bus bar material		High conductivity Copper/Aluminium Alloy
4.6	Earth bus bar required		☒ Yes ☐ No
4.7	Earth bus bar material (if applicable)		Aluminium
4.8	Gland Plate	mm	2.0
4.9	Earthing studs required		☒ Yes ☐ No



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4.10	Hinged door with locking facility		☒ Yes ☐ No
4.11	AC Lighting Panel		
a)	Incomer rating	A	63A for LP and SLP
b)	Type of Incomer		☐ SFU ☒ TPN MCB
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
f)	Type of Outgoing Feeders (Street Light panel)		☐ SPN MCB ☒ TPN MCB
g)	Timer required Street Light panel/ High mast feeder pillar		☒ Yes ☐ No
h)	Photocell required for Street Light panel/ High mast feeder pillar		☒ Yes ☐ No
i)	Outgoing feeders rating	A	20
4.12	DC Lighting Panel		
a)	Incomer rating	A	32
b)	Type of Incomer		☐ DP SFU ☒ DP MCB
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



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2 x 660MW UDANGUDI STPP

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c)	Rated short circuit duty	kA	50
d)	Rated breaking capacity (rms)	kA	50KA
e)	Rated making current (peak)	kA	105KA
f)	Release with short circuit		YES
g)	Release with overload		YES
h)	Release with under voltage		YES
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		



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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
5.5	Voltage Transformer		
a)	Type		Cast resin
b)	Secondary terminal voltage (phase-phase)	V	110 V
c)	Burden	VA	10
d)	Accuracy class		1.0
e)	Winding configuration		Star/ Star
f)	System grounding		[√] Effective [] Non-effective
5.6	Indicating Meters		
5.6.1	Ammeter		
a)	Type		Analog
b)	Shape		Square
c)	Size		96mm x 96mm
d)	Accuracy		1.0
e)	Current coil rating	A	1
f)	Angle of deflection	deg	90
5.6.2	Voltmeter		
a)	Type		Analog
b)	Shape		Square
c)	Size		96mm x 96mm
d)	Accuracy		1.0
e)	AC voltage coil rating	V	0-500
f)	DC voltage coil rating	V	0-250
g)	Angle of deflection	deg	90



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5.6.3	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
5.7	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
5.8	Under voltage relay		
a)	Type		☒ Electromagnetic ☐ Static
b)	Coil voltage rating	V	110
c)	Means for in-built testing provided		As per manufacturer data
5.9	Timer		
5.9.1	Time switch		
a)	Type		Digital synchronous (with Ni-Cd gel battery)
b)	Range	hr	0-24
c)	Coil voltage rating	V	240
5.9.2	Timer for AC-DC changeover		
a)	No. of contacts		
	ON time delay	NO+NC	As per scheme requirement
	OFF time delay	NO+NC	As per scheme requirement
	Instantaneous	NO+NC	As per scheme requirement
b)	Coil voltage rating		



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	AC timer	V	240
	DC timer	V	220
c)	Time delay range		
	AC timer	sec	0-5
	DC timer	Sec	0-180
5.10	Selector switch		
a)	Type of selector switch		☒ Stay put ☐ Wing knob
b)	Lockable		☒ Yes ☐ No
5.11	Push Button		
a)	Voltage grade	V	500
b)	Potential free contacts		2NO+2NC
5.12	Indicating Lamps		
a)	Lens Colour		
	ON condition		Red
	OFF condition		Green
b)	Circuit voltage	V	240V
5.13	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
5.14	Cable Lugs		By vendor for all incoming and outgoing cables
a)	Type		Crimping type/ ring type
b)	Material		Tinned copper
6.0	PAINTING		



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6.1	Paint shade		
a)	LDBs		RAL 7035
b)	LPs		RAL 7035
6.2	Paint Finish		
a)	Interior		[] Matt [✓] Semi-glossy
b)	Exterior		[✓] Semi-glossy [] Full-glossy
6.3	Paint Thickness	Microns	85 micron



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ANNEXURE-1

SUB-VENDOR LIST

2 x 660MW UDANGUDI STPP SUPER CRITICAL THERMAL POWER

SUB-VENDOR LIST

S. No.	ITEM DESCRIPTION	VENDOR NAME
1	AC CONTACTORS	SIEMENS
	AC CONTACTORS	GE-POWER
	AC CONTACTORS	TELEMECHANIQUE/ SCHNEIDER ELECTRIC INDIA PVT. LTD.
	AC CONTACTORS	L&T
2	AC CONTACTORS	BCH
	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	AC MCCB	CROMPTON GREAVES
	AUXILIARY RELAYS	ABB
	AUXILIARY RELAYS	ALSTOM LTD
	AUXILIARY RELAYS	JYOTI LTD.
	AUXILIARY RELAYS	OEN INDIA LTD
4	AUXILIARY RELAYS	SIEMENS
	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
5	CABLE GLANDS	INCAB
	CABLE LUGS	DOWELLS
6	CABLE LUGS	UNIVERSAL MACHINES LTD.
	D.C. MCCB	CROMPTON GREAVES
	D.C. MCCB	L&T
	D.C. MCCB	GE-POWER
7	D.C. MCCB	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
	EARTH LEAKAGE CB	INDO ASIAN
	EARTH LEAKAGE CB	MDS SWITCHGEAR LTD
8	EARTH LEAKAGE CB	S&S POWER SWITCHGEAR LTD.
	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.
9	DC CONTACTORS	GE-POWER
	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	M/s Shrenik & Co.
10	CONTROL SWITCHES/ SELECTOR SWITCH	RECOM PVT. LTD.
	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.
11	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
12	LT- POTENTIAL TRANSFORMER	PRAYOG ELECTRICALS PVT. LTD.
	DC SWITCH	GE-POWER
	DC SWITCH	KAYCEE
	DC SWITCH	SIEMENS
	FUSE BASE	INDO ASIAN
	FUSE BASE	GE-POWER

S. No.	ITEM DESCRIPTION	VENDOR NAME
13	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
14	FUSE BASE	ESSEN DEINKI
	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.
15	HRC FUSES	ALSTOM LTD
	HRC FUSES	ESSEN DEINKI
	GALVANISING	Jenco Industrial Corporation
	GALVANISING	National Galvanizing 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	Shivam Engineers & Fabricators
	GALVANISING	B.G. Shirke Construction Technology Pvt. Ltd
	GALVANISING	Galbro Ispat Galvanizers Pvt. Ltd.
	GALVANISING	Eros Metals
	GALVANISING	Industrial Perforation (India) Pvt. Ltd.
	GALVANISING	Indmark Formtech Pvt. Ltd.
	GALVANISING	Namdhari Industrial Traders Pvt. Ltd.
	GALVANISING	Neha Galvaniser
	GALVANISING	Patny Systems (P) Ltd.
	GALVANISING	Parmar Metal Company
	GALVANISING	Passive Infra Projects Pvt. Ltd
	GALVANISING	Rukmani Electrical & Fabricators Pvt. Ltd.
	GALVANISING	DMP Projects Pvt.Ltd.
	GALVANISING	Vinfab Engineers India Private Limited
16	GALVANISING	Saral Projects & Processors
	GALVANISING	Jamna Metal Company
	GALVANISING	Brahampuri Steels Limited
	GALVANISING	Indiana Gratings PVT. LTD
	GI WIRE & FLAT	INDUSTRIAL PERFORATION (I) PVT.LTD.
	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.
17	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
	IND.POWER & WLDG SOCKETS	CROMPTON GREAVES
18	IND.POWER & WLDG SOCKETS	CYCLO ELECTRIC DEVICE & SERV.CO.
	IND.POWER & WLDG SOCKETS	BCH
	IND.POWER & WLDG SOCKETS	BEST & CROMPTON
	IND.POWER & WLDG SOCKETS	AJMERIA INDUSTRIES & ENGG. WORKS
	INDICATING LAMPS	BCH
19	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.
19	JUNCTION BOXES (NON FLAME PROOF)	JASPER ENGINREES PVT. LTD.
	JUNCTION BOXES (NON FLAME PROOF)	Electro Controls & Devices
	JUNCTION BOXES (NON FLAME PROOF)	M/s Shrenik & Co.
	JUNCTION BOXES (NON FLAME PROOF)	M/s PHOENIX MECANO LTD.,
	JUNCTION BOXES (NON FLAME PROOF)	Adroit Control Engineers Pvt.Ltd.
	JUNCTION BOXES (NON FLAME PROOF)	M/s PHOENIX MECANO LTD.,
	JUNCTION BOXES (NON FLAME PROOF)	MIKA ENGINEERS
	JUNCTION BOXES (NON FLAME PROOF)	M/s PHOENIX MECANO LTD.,
	JUNCTION BOXES (NON FLAME PROOF)	BAJAJ ELECTRICALS

S. No.	ITEM DESCRIPTION	VENDOR NAME
	JUNCTION BOXES (NON FLAME PROOF)	AJMERA INDUSTRIES & ENGG. WORKS
	JUNCTION BOXES (NON FLAME PROOF)	S.B. ELECTRICAL ENGINEERING CORPORATION
	JUNCTION BOXES (NON FLAME PROOF)	RITTAL INDIA PVT. LTD.
20	JUNCTION BOXES (FLAME PROOF)	SUDHIR SWITCHGEAR
	LIGHTING SWITCH , SOCKET & S/F UNIT	ELEXPRO ELECTRICALS PVT/ LTD.
	LIGHTING SWITCH , SOCKET & S/F UNIT	ANCHOR
21	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
	LIGHTING TRANSFORMER	AUTOMATIC ELECTRIC LTD.
	LIGHTING TRANSFORMER	INDCOIL
22	LIGHTING TRANSFORMER	POWER PACK ENTERPRISES
	LIGHTING TRANSFORMER	VIJAY ELECTRICALS LTD.
	LIGHTING TRANSFORMER	GILBERT & MAXWELL
	LIGHTING TRANSFORMER	KAPPA ELECTRICALS
	LIGHTING TRANSFORMER	Ames Impex Electricals Pvt. Ltd
	MCB	MDS SWITCHGEAR LTD
23	MCB	INDO ASIAN
	MCB	SCHNEIDER ELECTRIC INDIA PVT. LTD.
	MCB	S&S POWER SWITCHGEAR LTD,
	TERMINAL BLOCKS	WAGO-CONTROLS
	TERMINAL BLOCKS	CONNECT WELL
24	TERMINAL BLOCKS	ELMEX CONTROLS PVT. LTD.
	TERMINAL BLOCKS	ESSEN DEINKI
	TERMINAL BLOCKS	TECHNOPLAST
	TERMINAL BLOCKS	M/s PHOENIX MECANO LTD.,
	TERMINAL BLOCKS	ESSEN DEINKI
	TIMERS - PNEUMATIC	BCH
25	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.
26	TIMERS - ELECTRONIC	ESSEN DEINKI
27	AMMETER	AUTOMATIC ELECTRIC LTD.
	AMMETER	RISHABH INST.PVT LTD
28	VOLTMETER	AUTOMATIC ELECTRIC LTD.
	VOLTMETER	RISHABH INST.PVT LTD
29	PVC WIRES	BIS APPROVED MAKE
30	HUME PIPE	REPUTED MAKE
31	PHOTOELECTRIC SWITCH	REPUTED MAKE

Note:

1. The above list of Sub vendors is indicative.



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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		



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3.0	LIGHTING/ WELDING DISTRIBUTION BOARDS		
3.1	Operational Front		
3.2	Type of execution of modules (functional unit)		
3.3	Type of sheet steel		
3.4	Sheet metal thickness (minimum)		
a)	Non-load bearing covers	mm	
b)	Non-load bearing partitions	mm	
c)	Load bearing members	mm	
d)	Frames	mm	
e)	Door	mm	
f)	Withdrawable unit (if applicable)	mm	
3.5	Cable alley width (minimum)	mm	
3.6	Bus bar material		
3.7	Earth bus bar material		
3.8	Degree of Protection		
a)	Main Panel		
b)	Transformer cubicle		
3.9	Gland plate thickness	mm	
3.10	AC LDB/ WDB		
a)	No. of Incomers		
b)	Bus coupler required		
c)	Incomer and Bus coupler rating	A	
d)	Type of Incomer and Bus coupler		
e)	Type of Outgoing Feeders		
f)	Outgoing feeders rating	A	
g)	Cable entry		



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3.11	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	



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3.12	DC LDB		
a)	No. of Incomers		
b)	DC incomer Type		
c)	DC incomer rating	A	
d)	AC incomer type		
e)	AC incomer rating	A	
f)	Bus coupler required		
g)	Incomer and Bus coupler rating	A	
h)	Type of Incomer and Bus coupler		
i)	Type of Outgoing Feeders		
j)	Outgoing Feeders rating	A	
k)	Changeover required in DC LDB		
l)	Provision of Manual override		
m)	Cable Entry		
4.0			
4.1	Application		
4.2	Type of sheet steel		
4.3	Sheet metal thickness (minimum)		
3.4	Degree of Protection		
a)	Indoor panel		
b)	Outdoor panel		
c)	Canopy in outdoor panel		
4.5	Bus bar material		
4.6	Earth bus bar required		
4.7	Earth bus bar material (if applicable)		
4.8	Gland Plate	mm	
4.9	Earthing studs required		
4.10	Hinged door with locking facility		



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4.11	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 indoor panel		
h)	ESS required for outdoor panel		
i)	Timer required Street Light panel/ High mast feeder pillar		
j)	Photocell required for Street Light panel/ High mast feeder pillar		
k)	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	



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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		
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	Voltage Transformer		
a)	Type		
b)	Secondary terminal voltage (phase-phase)	V	
c)	Burden	VA	



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d)	Accuracy class		
e)	Winding configuration		
f)	System grounding		
5.6	Indicating Meters		
5.6.1	Ammeter		
a)	Type		
b)	Shape		
c)	Size		
d)	Accuracy		
e)	Current coil rating	A	
f)	Angle of deflection	deg	
5.6.2	Voltmeter		
a)	Type		
b)	Shape		
c)	Size		
d)	Accuracy		
e)	AC voltage coil rating	V	
f)	DC voltage coil rating	V	
g)	Angle of deflection	deg	
5.6.3	Energy meter (if applicable)		
a)	Type		
b)	Accuracy		
c)	Current coil rating	A	
d)	Voltage coil rating	V	
5.7	Power Contactors		
a)	Coil voltage (nominal)		
	AC contactors	V	
	DC contactors	V	



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b)	Current rating of contacts		
	Power	A	
	Control	A	
5.8	Under voltage relay		
a)	Type		
b)	Coil voltage rating	V	
c)	Means for in-built testing provided		
5.9	Timer		
5.9.1	Time switch		
a)	Type		
b)	Range	hr	
c)	Coil voltage rating	V	
5.9.2	Timer for AC-DC changeover		
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	sec	
	DC timer	Sec	
5.10	Selector switch		
a)	Type of selector switch		
b)	Lockable		
5.11	Push Button		



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a)	Voltage grade	V	
b)	Potential free contacts		
5.12	Indicating Lamps		
a)	Lens Colour		
	ON condition		
	OFF condition		
b)	Circuit voltage	V	
5.13	Cable Glands		
a)	Type		
b)	Material		
c)	Nickel Plating provided		
d)	Flameproof glands with flameproof equipment		
5.14	Cable Lugs		
a)	Type		
b)	Material		
6.0	PAINTING		
6.1	Paint shade		
a)	LDBs		
b)	LPs		
6.2	Paint Finish		
a)	Interior		
b)	Exterior		
6.3	Paint Thickness	Microns	

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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 120 °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 90 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	Grey
Negative	White

iv) Earth Connection Yellow-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.

k) 20% spare terminals to be provided.

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- l) Terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities.

3.1.6 Cable Terminations

- 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

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➤ 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)

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.

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3.2 LIGHTING PANELS (LPs)

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 MCB 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.

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- 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 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.

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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
- 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.

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- 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.
- 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.

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- 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.
- 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.

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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 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 :
 - a) The equipment shall be properly packed before dispatch. The packing shall prevent damage to the contents while handling and lengthy period of outdoor storage.
 - b) 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.
 - c) 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.

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- 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.
- 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:
- General sturdiness & rigidity of equipment.
 - Surface finishing.
 - Gasketting.
 - Inter-changeability.
 - Constructional features viz. location, accessibility & marking of components, segregation, accessibility to live parts (shrouding) etc.
 - 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.

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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.

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 : 2 x 660MW UDANGUDI STPP			SPECIFICATION NO.: - PE-TS-435-558-E005			
				BIDDER/ VENDOR :		QUALITY PLAN NO. PE-QP-999-558-E005, REV-0			SPECIFICATION TITLE:- TECH. SPECIFICATION FOR DISTRIBUTION BOARDS & 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 AND LIGHTING DISTRIBUTION BOARDS	1.DIMENSIONS	MA	MEASUREMENT	10%	APPROVED DRG.	APPROVED DRG.	INSPT. REPORT	3/2	2,1	-	COMPONENTS TO BE OF APPROVED MAKE
		2.PAINT SHADE/ THICKNESS	MA	VISUAL/ MEASUREMENT	10%	APPROVED DRG.	APPROVED DRG.	INSPT. REPORT	3/2	2,1	-	
		3.VERIFICATION OF GA & BOM	CR	VISUAL	100%	APPROVED DRG.	APPROVED DRG.	INSPT. REPORT	3/2	2,1	-	
		4.FUNCTIONAL TESTS (INCLUDING WIRING CONTINUITY)	MA	ELECT.	100%	APPROVED DRG./ BHEL SPEC.	APPROVED DRG./ BHEL SPEC.	INSPT. REPORT	3/2	2,1	-	
		5.HV/IR/HV	MA	ELECT	100%	HV -2.5KV AC FOR 1 MINUTE IR - >50 M OHM	HV -2.5KV AC FOR 1 MINUTE IR - >50 M OHM	INSPT. REPORT	3/2	2,1	-	
		6.DEGREE OF PROTECTION (INCLUDING EXPLOSION PROOF IF ANY)	MA	TESTS	1/SIZE & RATING	BHEL SPEC/ RELEVANT IS	BHEL SPEC/ RELEVANT IS	TEST REPORT	3/2	-	2,1	
		7.TEMPERATURE RISE TEST (FOR COMPLETE ASSEMBLED LDB/LP)	MA	ELECT	1/RATING	BHEL SPEC/ RELEVANT IS	BHEL SPEC/ RELEVANT IS	TEST REPORT	3/2	-	2,1	
BHEL		PARTICULARS		BIDDER/VENDOR								
		NAME										
		SIGNATURE										
		DATE										
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : NTPC-SAIL POWER COMPANY PVT.LTD.		PROJECT TITLE : 2 x 660MW UDANGUDI STPP			SPECIFICATION NO.: - PE-TS-435-558-E005			
				BIDDER/ VENDOR :		QUALITY PLAN NO. PE-QP-999-558-E005, REV-0			SPECIFICATION TITLE:- TECH. SPECIFICATION FOR DISTRIBUTION BOARDS			
		SHEET 2 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
2.0	LIGHTING TRANSFORMER	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			PARTICULARS		BIDDER/VENDOR			BIDDER'S/VENDORS COMPANY SEAL				
			NAME									
			SIGNATURE									
			DATE									