

3X660 MW NORTH KARANPURA SC TPS,
NTPC

***TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR***

BHEL DOCUMENT NO. : EPD-TS-CPBG-14015, REV-0



**BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPORCELAINS DIVISION
BANGALORE – 560012**



**3X660 MW NORTH KARANPURA SC TPS,
NTPC
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LOW VOLTAGE SWITCHGEAR**

SPECIFICATION NO. : EPD-TS-
CPBG-14015

VOLUME II-B

SECTION -

REVISION
0

DATE: 01/07/2015

SHEET 1 OF 2

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**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT
THERE ARE NO TECHNICAL DEVIATIONS.**

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')



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INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. In line with clause no. 7.1 of Section-C of the specification, two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a) Un-priced copy of Annexure-A, B,C, D, E, F, G, H,I duly stamped and signed by the bidder.
 - b) Complete dimension of all the boards including no. of panels, dimensions of each type of panels, module size of each type of feeders and minimum clearances required on all sides for each type of panels.
 - c) No. of Vertical consider by vendor for each boards are to be compulsory given along with offer.
 - d) A copy of the sheet "Instructions to Bidders for Preparing Technical Offer" duly stamped and signed by the bidder.
 - e) A copy of sheet "List Of Contents" duly stamped and signed by the bidder.
 - f) Technical deviation/ clarification, if any
 - g) No. Of Breaker panels, No. of MCC panels, Weight & Dimensions of all boards.
2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.
3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
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 Item description/ quantities, notes etc. from those given in various annexures to Section-C of specification shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).
6. Bidders to quote for all items/sub items even if those are not in their manufacturing range.
7. No raw material/Component/Sub Assembly/Assembly/Equipment shall be sourced from China directly or indirectly for manufacture or supply.
8. In case of any ambiguity in specification between various sections and end customer specification vendor should clearly brought out in technical deviations failing in which BHEL will have choice to prefer which ever it suits at later stage for which vendor should accept.
9. Vendor should bring out clearly in deviation sheet if any.

BIDDER'S STAMP & SIGNATURE

VOLUME - IIB

SECTION – 'A'

SCOPE OF ENQUIRY

- 1.0 This specification covers the design, manufacture, relay parameterization and site support, one suitable Ethernet switch per board, inspection and testing at manufacturer's works, proper packing and delivery to site of **LOW VOLTAGE SWITCHGEAR** as mentioned in different sections of this specification for 3X 660 MW NORTH KARANPURA SC TPS, NTPC.
- 2.0 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to vendor's guarantee.
- 3.0 The general terms and conditions, instruction to tenderer and other attachment referred to elsewhere are hereby made part of the tender specification.
- 4.0 The tendered shall be responsible for and governed by all requirements stipulated hereinafter.
- 5.0 Deviations, if any should be brought out very clearly on deviation sheet enclosed with specification only. Otherwise it will be presumed that the tenderer's offer is in line with what has been stated/ asked for in this specification.
- 6.0 The offer should be complete with technical data, catalogues, brochures and drawings as applicable.
- 7.0 Qualification data: In order to be able to propose to the client the proven-ness of the equipments/ item offered, the bidder is required to elaborate details of experience, capabilities, reference list etc. in the offer.
- 8.0 The documents shall be in English language and MKS system of units.

VOLUME - IIB

SECTION – 'B'

**PROJECT
INFORMATION**

SUB-SECTION-I-B

PROJECT INFORMATION

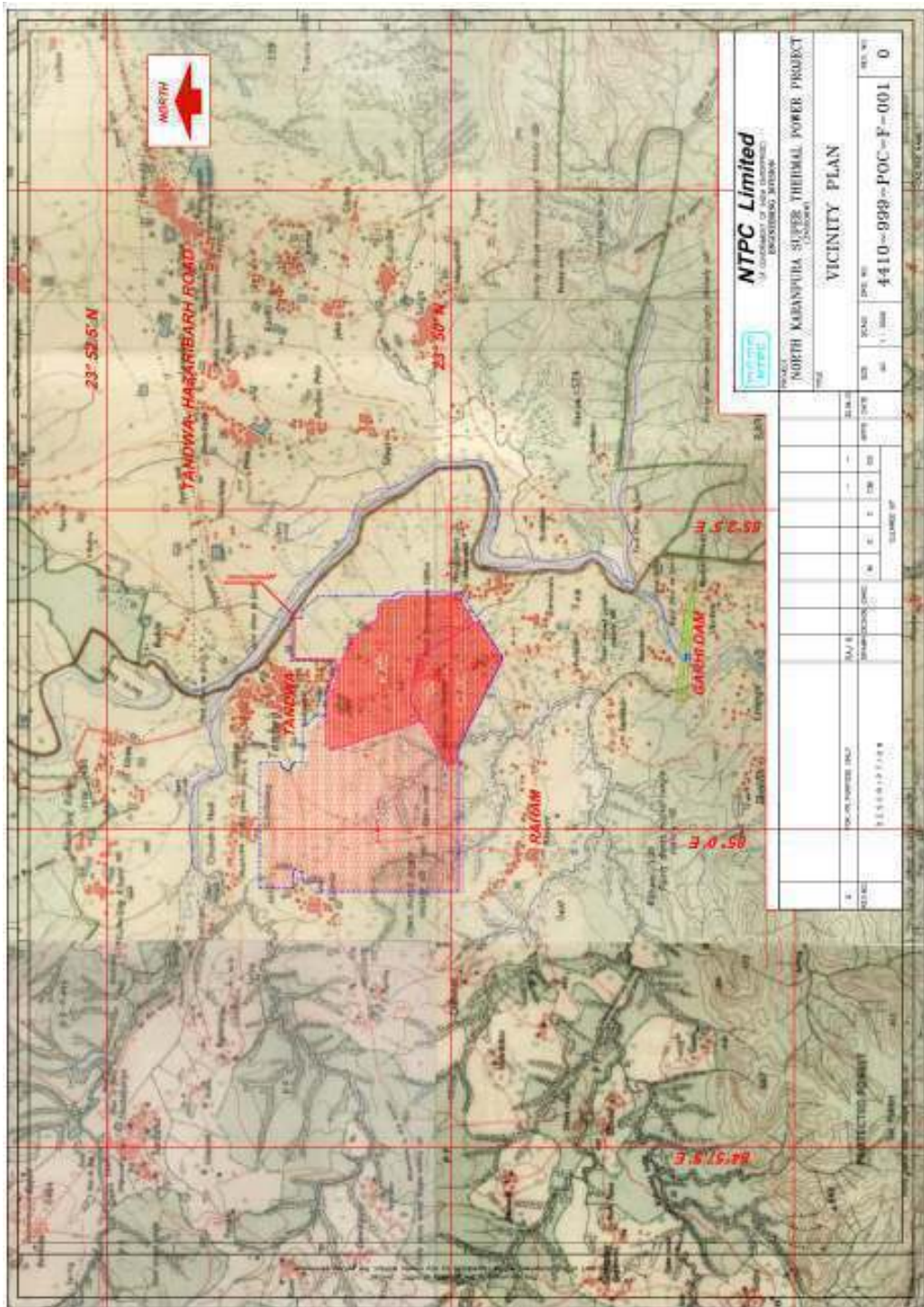
NORTH KARANPURA STPP
(3 X 660 MW)
EPC PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI, PART-A
BID DOC NO: CS-4410-001-2

CLAUSE NO.	PROJECT INFORMATION			एनटीपीसी NTPC									
1.00.00	BACKGROUND North Karanpura Super Thermal Power Project (3x660 MW), a pit head coal based thermal power project, is located in Hazaribagh and Chatra districts of Jharkhand State. Basic inputs i.e. coal, water and land have already been tied up. The project is proposed for the States & Union Territories of Northern, Western and Eastern Regions and the State of Jharkhand. The capacity of the project is 1980 MW comprising of three (3) units of 660 MW each.												
1.01.00	Location and Approach The power project is proposed to be located near Tandwa town in Chatra districts in the state of Jharkhand on Hazaribagh-Chatra State highway at a distance of about 50 kms from Hazaribagh city. The nearest commercial airport is Ranchi at a distance of 150 kms from project site. The nearest railhead Khalari Railway Station on Ranchi-Garhwa section of Eastern Railways is about 40 kms from project site. Major rail/road distances from the project site are as under: <table><tr><td><u>City</u></td><td></td><td><u>Distance Approx. (kms)</u></td></tr><tr><td>Ranchi</td><td>:</td><td>150</td></tr><tr><td>Khalari</td><td>:</td><td>40</td></tr></table> The site is located near Tandwa town having latitude and longitude of about 23 ⁰ 50' N to 23 ⁰ 52' N and 84 ⁰ 59' E to 85 ⁰ 2' E respectively. The Vicinity Plan of the project is placed at Annexure-I . Further to the information given in this sub-section, Bidders are also advised to visit the project site and collect data on local site conditions.				<u>City</u>		<u>Distance Approx. (kms)</u>	Ranchi	:	150	Khalari	:	40
<u>City</u>		<u>Distance Approx. (kms)</u>											
Ranchi	:	150											
Khalari	:	40											
1.02.00	Land About 2245 acres of land is being acquired for the project. About 1500 acres of land is under possession/legal possession and out of 1500 acres, about 890 acres of land is to be used for plant, ash dyke and initial enabling township. No additional land is envisaged to be acquired in plant area. About 15 acres of land is envisaged to be acquired in Hazaribagh city for Township. Commissioner, Chatra vide dated 25.05.1999 and 14.06.2000 has given in-principle clearance for NKSTPP.												
1.03.00	Water Make up water available for this project would be about 22 cusec and will be arranged by constructing a dam/reservoir across river Garhi.												
1.04.00	Fuel (Coal)												
1.04.01	Coal Requirement, Availability and Linkage Coal requirement for the project is estimated as 10.6 Million Tonne/Annum (MTPA), considering a GCV of 3800 kcal/kg. Ministry of Coal vide letter dated 21.10.99 accorded in-principle coal linkage of 10.00 MTPA subject to ratification by Standing Linkage Committee-Long Term (SLC (LT)), of MOC. SLC (LT) in its meeting held on 15.12.2000 firmed up the coal linkage of 10.24 MTPA for the project. Subsequently, the coal linkage was withdrawn by SLC (LT) in its meeting held on 22/23.10.08.												
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 1 OF 10									

CLAUSE NO.	PROJECT INFORMATION			
	Cabinet Committee on Investment (GOI) in its meeting on 20.02.13 decided in-principle to restore the original coal linkage granted to NKSTPP (i.e. from Magadh Coal Block) with the stipulation that the coal supply will commence during the 13th Five Year Plan. MOC vide letter dated 09.05.2013 restored the coal linkage with the stipulation that the coal supply will commence during the 13th five year plan.			
1.04.02	Coal Transportation Coal from Magadh block of North Karanpura Coalfields is proposed to be transported to the project site through conveyor belt system. One external coal handling plant and one internal coal handling plant are envisaged.			
1.05.00	Meteorological Data Important meteorological data from nearest observatory at Hazaribag is placed at Annexure-II.			
1.06.00	Plant Water Scheme The Plant water scheme is described below.			
1.06.01	Condenser Cooling System It is proposed to adopt Air Cooled Condenser for the project.			
1.06.02	Equipment Cooling Water (ECW) System (Unit Auxiliaries) All plant auxiliaries shall be cooled by De-mineralized water (DM) in a closed circuit. The primary circuit DM water shall be cooled through heat exchangers by auxiliary cooling water system. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system.			
1.06.03	Ash Water System It is proposed to have HCSD (High concentration Slurry Disposal) system for combined fly ash and bottom ash. No recirculation of ash water from ash disposal area is envisaged.			
1.06.04	Other Miscellaneous Water Systems (a) Raw water shall be used for meeting the Fly ash and bottom ash system requirement etc. (b) The service water shall be taken from clarified water tank of Pretreatment plant. Service water (wash water) collected from various areas shall be treated using oil water separators, tube settlers, coal settling pits etc. as per requirement and treated water from liquid effluent treatment plant shall be recycled back to the service water system for re-use. (c) The drinking water requirement of the plant shall be provided from water treatment plant.			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 2 OF 10

CLAUSE NO.	PROJECT INFORMATION एनटीपीसी NTPC		
1.07.00	(d) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water and makeup to the hydrogen generation plant shall be provided from Demineralising plant.		
	(e) The quality of Raw water is enclosed with this sub-section as Annexure-III. Criteria for Earthquake Resistant Design of Structures and Equipment All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in the Part - B of this section.		
1.08.00	Criteria for Wind Resistant Design of Structures and Equipment All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part B of this section.		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION PAGE 3 OF 10

CLAUSE NO.	PROJECT INFORMATION			एनटीपीसी NTPC
	Annexure-I			
	VICINITY PLAN			
				
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 4 OF 10	

CLIMATOLOGICAL TABLE

[illegible]

CLAUSE NO.	PROJECT INFORMATION			एनटीपीसी NTPC
	Annexure-III			
	<u>RAW WATER ANALYSIS</u>			
	Sl. No.	Constituent	as	mg per litre
	1.	Calcium	CaCO3	65
	2.	Magnesium	CaCO3	41
	3.	Sodium	CaCO3	98
	4.	Potassium	CaCO3	5
	5.	Total Cations	CaCO3	209
	6.	Total Alkalinity	CaCO3	150
	7.	Chloride	CaCO3	25
	8.	Sulphate	CaCO3	34
	9.	Total Anions	CaCO3	209
	9.	Silica (Reactive)	SiO2	9
	11.	Iron	Fe	1.2
	12.	pH Value	-	7.6-8.2
13.	Turbidity	NTU	200	
14.	Organics(As per KMnO4 method)	Number	2	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 6 OF 10

CLAUSE NO.	PROJECT INFORMATION		एनटीपीसी NTPC																								
	ANNEXURE-IV-1 TABLE-1 LIGHT DIESEL OIL CHARACTERISTICS (AS PER IS 15770-2008) <table><tr><th>Characteristics</th><th>LDO</th></tr><tr><td>1. Pour Point (max)</td><td>21 °C & 12°C for Summer and Winter respectively</td></tr><tr><td>2. Kinematic viscosity in centistokes at 40 deg.C</td><td>2.5 to 15.0</td></tr><tr><td>3. Sediment percent by mass (max)</td><td>0.10</td></tr><tr><td>4. Total sulphur percent by mass (max)</td><td>1.5</td></tr><tr><td>5. Ash percentage by mass (max)</td><td>0.02</td></tr><tr><td>6. Carbon residue (Rams bottom) percent by pass (max.)</td><td>1.50</td></tr><tr><td>7. Acidity inorganic</td><td>Nil</td></tr><tr><td>8. Flash point (Min.) - Pensky Martens</td><td>66 deg.C</td></tr><tr><td>9. Copper strip corrosion for 3 hours at 100°C</td><td>Not worse than No. 2</td></tr><tr><td>10. Water content, % by volume (max)</td><td>0.25</td></tr><tr><td>11. GCV(kcal/kg)</td><td>10,000</td></tr></table>			Characteristics	LDO	1. Pour Point (max)	21 °C & 12°C for Summer and Winter respectively	2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0	3. Sediment percent by mass (max)	0.10	4. Total sulphur percent by mass (max)	1.5	5. Ash percentage by mass (max)	0.02	6. Carbon residue (Rams bottom) percent by pass (max.)	1.50	7. Acidity inorganic	Nil	8. Flash point (Min.) - Pensky Martens	66 deg.C	9. Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2	10. Water content, % by volume (max)	0.25	11. GCV(kcal/kg)	10,000
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NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION																								
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CLAUSE NO.	PROJECT INFORMATION			
	TABLE-2 ANNEXURE-IV-2 <u>HIGH SPEED DIESEL OIL CHARACTERISTICS</u> [AS PER IS 1460-2005 (BS-II)]			
	S. No.	Particulars	Unit	Value
	1.	PHYSICAL PROPERTIES		
		a. Distillation volume recovery @ 350 ⁰ C	% vol. (min)	85
		b. Distillation volume recovery @ 370 ⁰ C	% vol. (min)	95
		c. Kinematic Viscosity @ 40 Degree C	cSt	2.0 – 5.0
		d. Density @ 15 Degree C	kg/m ³	820 – 860
		e. Pour Point		
		- Summer	Degree C (max)	15
		- Winter	Degree C (max)	03
		f. Cold Filter Plugging Point		
		- Summer	Degree C (max)	18
		- Winter	Degree C (max)	06
		g. Flash Point (Abal)	Degree C (max)	35
		h. Lubricity WSD 1.4 @ 60 Degree C	Microns (max)	460
	2.	HEATING VALUE		
		a. Higher Heating Value (HHV)	Kcal/Kg	11,000
		b. Lower Heating Value (LHV)	Kcal/Kg	10,300
	3.	ACIDITY		
		a. Inorganic	mg KOH/g	Nil
		b. Total	mg KOH/g	0.2 (max.)
	4.	Copper Strip Corrosion 3 hours @100 ⁰ C	No.	1 (max)
	5.	RCR on 10% residue	% wt.	0.3 (max)
	6.	CONTAMINANTS		
		a. Ash	ppm (wt.)	100 (max)
		b. Sediments	% wt	0.05 (max)
		c. Total Sulphur	% wt	0.05 (max)
		d. Water Content	% volume	0.05 (max)
		e. Trace Metals		
		- Na + K	ppm (wt)	0.30 (max)
		- Vanadium	ppm (wt)	0.50 (max)
		- Lead	ppm (wt)	0.50 (max)
		- Calcium	ppm (wt)	2.0
		- Ni + Zn	ppm (wt)	Nil
	7.	Nitrogen content (FBN)	% wt.	0.015
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 8 OF 10

TABLE-3

ANNEXURE-IV-3

PROPOSED COAL CHARACTERISTICS FOR NORTH KARANPURA

STPP (3 x 660 MW)

S.No.	Characteristics (as received basis)	Range of 95 % coal supplies			Range of 5 % coal supplies
		Column - 1	Column - 2	Column - 3	
1.0	PROXIMATE ANALYSIS	Design	Worst	Best	
1.1	Total Moisture (%)	15	18	12	12-18
1.2	Ash (%)	40	46	36	33-46
1.3	Volatile Matter (%)	19	18	22	23-18
1.4	Fixed Carbon (%)	26	18	30	31-18
1.5	Total (%)	100	100	100	
2.0	ULTIMATE ANALYSIS				
2.1	Carbon (%)	29.73	23.08	37.32	40.62-23.08
2.2	Hydrogen (%)	3.7	3.54	3.92	4.02-3.54
2.3	Sulphur (%)	0.5	0.6	0.4	0.4-0.6
2.4	Nitrogen (%)	1.8	1.45	1.6	1.4-1.45
2.5	Oxygen (%) (By difference)	8.66	6.7	8.32	8.12-6.7
2.6	Carbonates (%)	0.58	0.6	0.4	0.4-0.6
2.7	Phosphorous (%)	0.03	0.03	0.04	0.04-0.03
2.8	Total Moisture (%)	15	18	12	12-18
2.9	Ash (%)	40	46	36	33-46
	Total	100	100	100	
2.10	GCV (Kcal/Kg)	3300	2800	4000	4300-2800
2.11	Hard Grove Index	55	50	60	50-65
3.0	ASH ANALYSIS				
3.1	Silica (%)	59.79	61.3	56.7	62-56
3.2	Alumina (%)	25.36	28	23.5	28-23
3.3	Iron Oxide (%)	7.2	6	10	6-10
3.4	Titania	1.2	1	1.5	1-1.7
3.5	Phosphoric Anhydride (%)	2.6	1.5	3	1-3
3.6	Lime (%)	0.88	0.5	1.5	0.5-1.7
3.7	Magnesia (%)	0.55	0.4	1	0.4-1.1
3.8	Sulphuric Anhydride (%)	1.2	0.5	1.4	0.5-1.7
3.9	Alkalies (by difference)	1.22	0.8	1.4	0.6-1.8
	Total	100	100	100	
4.0	ASH FUSION RANGE				
	REDUCING ATMOSPHERE				
4.1	Initial Deformation Temp. (oC)	1100	1100	1100	1100-1150
4.2	Hemispherical Temp. (oC)	1300	1250	1350	1250-1400
4.3	Fusion Temperature (oC)	1400	1400	1400	1400-1450

CLAUSE NO.	PROJECT INFORMATION एनटीपीसी NTPC																																																																																																																																																										
	ANNEXURE-IV-4 TABLE – 4 TYPICAL IMPORTED COAL AND ASH CHARACTERISTICS <table> <tr> <th>Sl.No.</th><th>Characteristics (as received basis)</th><th colspan="2">Imported Coal</th></tr> <tr> <th></th><th></th><th>Worst</th><th>Best</th></tr> <tr> <td>1.0</td><td>Proximate Analysis</td><td></td><td></td></tr> <tr> <td>1.1</td><td>Total Moisture (%)</td><td>20</td><td>16</td></tr> <tr> <td>1.2</td><td>Ash (%)</td><td>10</td><td>10</td></tr> <tr> <td>1.3</td><td>Volatile Matter (%)</td><td>30</td><td>45</td></tr> <tr> <td>1.4</td><td>Fixed Carbon (%)</td><td>40</td><td>29</td></tr> <tr> <td>1.5</td><td>Total (%)</td><td>100</td><td>100</td></tr> <tr> <td>2.0</td><td>Ultimate Analysis</td><td></td><td></td></tr> <tr> <td>2.1</td><td>Carbon (%)</td><td>56.4</td><td>62.4</td></tr> <tr> <td>2.2</td><td>Hydrogen (%)</td><td>4.5</td><td>4.9</td></tr> <tr> <td>2.3</td><td>Sulphur (%)</td><td>0.9</td><td>0.8</td></tr> <tr> <td>2.4</td><td>Nitrogen (%)</td><td>0.9</td><td>0.5</td></tr> <tr> <td>2.5</td><td>Oxygen (%) (By difference)</td><td>7.3</td><td>5.4</td></tr> <tr> <td>2.6</td><td>Carbonates (%)</td><td>0</td><td>0</td></tr> <tr> <td>2.7</td><td>Phosphorous (%)</td><td>0</td><td>0</td></tr> <tr> <td>2.8</td><td>Total Moisture (%)</td><td>20</td><td>16</td></tr> <tr> <td>2.9</td><td>Ash (%)</td><td>10</td><td>10</td></tr> <tr> <td></td><td>Total</td><td>100</td><td>100</td></tr> <tr> <td>2.10</td><td>GCV (Kcal/Kg)</td><td>5800</td><td>6500</td></tr> <tr> <td>2.11</td><td>Hard Grove Index</td><td>45</td><td>60</td></tr> <tr> <td>2.12</td><td>YGP (mg/kg)</td><td>100</td><td>70</td></tr> <tr> <td>3.0</td><td>Ash Analysis</td><td></td><td></td></tr> <tr> <td>3.1</td><td>Silica (SiO₂) (%)</td><td>32.74</td><td>34.94</td></tr> <tr> <td>3.2</td><td>Alumina(Al₂O₃) (%)</td><td>30.5</td><td>28.43</td></tr> <tr> <td>3.3</td><td>Iron Oxides(Fe₂O₃) (%)</td><td>18.2</td><td>15.2</td></tr> <tr> <td>3.4</td><td>Titania (TiO₂)</td><td>1.56</td><td>1.76</td></tr> <tr> <td>3.5</td><td>Phosphoric Anhydride(P₂O₅) (%)</td><td>0.44</td><td>0.54</td></tr> <tr> <td>3.6</td><td>Lime (CaO) (%)</td><td>6.12</td><td>7.62</td></tr> <tr> <td>3.7</td><td>Magnesia (MgO) (%)</td><td>1.83</td><td>1.93</td></tr> <tr> <td>3.8</td><td>Sulphuric Anhydride (%)</td><td>6.95</td><td>7.65</td></tr> <tr> <td>3.9</td><td>Sodium Oxide (Na₂O) (%)</td><td>0.3</td><td>0.4</td></tr> <tr> <td>3.10</td><td>Balance alkalies (by difference)</td><td>1.36</td><td>1.56</td></tr> <tr> <td></td><td>Total</td><td>100</td><td>100</td></tr> <tr> <td>4.0</td><td>Ash Fusion Temperature reducing temperature</td><td></td><td></td></tr> <tr> <td>4.1</td><td>Initial deformation Temp (°C)</td><td>1100</td><td>1250</td></tr> <tr> <td>4.2</td><td>Hemispherical Temp. (°C)</td><td>1300</td><td>1350</td></tr> <tr> <td>4.3</td><td>Flow Temp. (°C)</td><td>1400</td><td>1400</td></tr> </table>			Sl.No.	Characteristics (as received basis)	Imported Coal				Worst	Best	1.0	Proximate Analysis			1.1	Total Moisture (%)	20	16	1.2	Ash (%)	10	10	1.3	Volatile Matter (%)	30	45	1.4	Fixed Carbon (%)	40	29	1.5	Total (%)	100	100	2.0	Ultimate Analysis			2.1	Carbon (%)	56.4	62.4	2.2	Hydrogen (%)	4.5	4.9	2.3	Sulphur (%)	0.9	0.8	2.4	Nitrogen (%)	0.9	0.5	2.5	Oxygen (%) (By difference)	7.3	5.4	2.6	Carbonates (%)	0	0	2.7	Phosphorous (%)	0	0	2.8	Total Moisture (%)	20	16	2.9	Ash (%)	10	10		Total	100	100	2.10	GCV (Kcal/Kg)	5800	6500	2.11	Hard Grove Index	45	60	2.12	YGP (mg/kg)	100	70	3.0	Ash Analysis			3.1	Silica (SiO ₂) (%)	32.74	34.94	3.2	Alumina(Al ₂ O ₃) (%)	30.5	28.43	3.3	Iron Oxides(Fe ₂ O ₃) (%)	18.2	15.2	3.4	Titania (TiO ₂)	1.56	1.76	3.5	Phosphoric Anhydride(P ₂ O ₅) (%)	0.44	0.54	3.6	Lime (CaO) (%)	6.12	7.62	3.7	Magnesia (MgO) (%)	1.83	1.93	3.8	Sulphuric Anhydride (%)	6.95	7.65	3.9	Sodium Oxide (Na ₂ O) (%)	0.3	0.4	3.10	Balance alkalies (by difference)	1.36	1.56		Total	100	100	4.0	Ash Fusion Temperature reducing temperature			4.1	Initial deformation Temp (°C)	1100	1250	4.2	Hemispherical Temp. 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NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 10 OF 10																																																																																																																																																								

SUB-SECTION – B-06

LT SWITCHGEARS & LT BUSDUCTS

CLAUSE NO.	TECHNICAL REQUIREMENTS	
1.00.00	DESIGN PHILOSOPHY / PRACTICE FOR LV BOARD SIZING The sizing of LV boards shall be primarily dependent on the following conditions such as total load connected onto a Board, diversity factors for various loads connected, Fault Level and Voltage Regulation Considerations. As far as practicable the system shall provide segregated supplies to main and standby auxiliaries so that failure of supply to main auxiliary shall in no way jeopardize the standby auxiliary feed. Automatic changeover at critical switchgear/ MCC sections shall be provided as necessary to prevent the loss of a unit or to ensure the equipment safety.	
1.01.00	Design Considerations:	
1.01.01	Sizing of Unit and Station boards a) Input KVA for a Drive = (Rating KW X Load Factor) / (Efficiency X Power Factor) where values of load factor , power factor and efficiency are defined below: b) Load (service) factor for 415 V loads is taken as 0.85 c) Power factor 415 V Uni-Directional drives is taken as 0.8 and efficiency as 0.85 d) Power factor of 415 V bidirectional drive Loads is taken as 0.65 and efficiency as 0.8 for motor rating less than 15 KW For motor ratings above 15 KW and above the corresponding values are 0.75 and 0.8. e) The Finally selected Bus Bar ratings for switchboards, MCC s and ACDB and Busduct shall include a 10 % margin over the calculated values. f) The LDB' s shall be considered to be loaded to 70 % of their KVA rating g) A spare capacity of about 10 % shall be kept for addition of loads during detail engineering as many of the LT loads cannot be predicted during the Rating selection of the Board. h) Busbar Ratings of valves/dampers boards shall be derived by summing up to 5% of the total KVA load connected. With the largest Value /damper Connected. i) Welding sockets shall be connected from Welding DBs. j) ESP consumption for 100 % BMCR operation shall be considered and further this load shall be uniformly divided among ESP Switchgears.	
1.01.02	Sizing of Offsite Boards a) The loads for mechanical auxiliary systems shall be met by auxiliary transformers based on the criteria that each switchgear/MCC/Distribution board shall be fed either by 2x100% or 3x50% transformers/feeders and, these shall be rated to carry the maximum load expected to be imposed. Each of the above boards shall be sectionalized. b) The sizing of Unit Emergency boards shall be in according to the DG rating. The Emergency board shall have tie to both sections of Unit Service Switchgear for catering unit loads in Blackout Conditions.	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2 SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT PAGE 1 OF 71		

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.02.00	Layout Criteria The switchboards can be split into two sections based on layout constraints in case of long switchboards to optimize Switchgear room layouts. The two sections of the split shall be connected by Bus duct/Cable as per layout requirements.			
1.03.00	Spare capacity and Future Requirements Each of the LV switchboards shall be designed for 1.1 times the required rating as a spare capacity. Further all LV Switchboard shall be provided with 10 % spare modules of each rating and type of module.			
1.04.00	Standardization The LV Boards shall be fed through either LT auxiliary transformers. MCC, and Distributed boards are fed further through these main boards. The Standard rating of the main boards fed through Unit Auxiliary Service and Station Service Transformers shall be 3500 Amp .Other Standard ratings used shall be 3000,2500, 2000 Amp, 1600 Amp, 1000 Amp, 600 Amp, 400 & 250 Amp. Preferred ratings for LV Busduct rating are 3500 Amp, 3000 Amp, 2500 Amp and 1600 amp. It shall be preferred to have all LV Switchboards for the entire plant from a One/Two/Three manufacturer from maintainability and spares management point of view. It shall be preferred to follow a standardization of Terminal Numbers across all LV Modules for ease of Interconnection and standardization.			
1.05.00	Plant control cable Interconnections a) Standard control cable sizes shall preferably be 3CX1.5, 5CX1.5, 7CX1.5 & 10CX1.5 b) Cable size for motor space heater application shall be 2CX2.5 c) Interconnections for Current Transformer terminals shall use two cores of 1.5mm ² size per phase d) Core identification shall be using core color for up to 5-core cable and core number for cable with more cores e) Separate control cables shall be used for current transformers. f) At least one spare core shall be made available in each of the control cable			
1.00.00	CODES AND STANDARDS			
1.01.00	All equipment shall, generally, comply with the updated issues of (a.) Applicable Indian Standards (b.) Indian Electricity Act. (c.) Indian electricity rules			
1.02.00	Equipment complying with any other authoritative / internationally recognized standards such as IEC, British, U.S.A., German, etc. will also be considered if it ensures performance equivalent or superior to Indian Standards. In such cases the contractor shall clearly indicate the standard adopted and furnish the copy of latest English version of the same along with the bid and bring out the salient features for comparison.			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 2 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.03.00	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as published one month prior to the date of opening of bids. In case of conflict between this specification and those (IS codes, Standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following codes and standards.			
	IS: 5	Colors for ready-mixed paints and enamels.		
	IS: 694	PVC insulated cables for working voltages upto and including 1100V.		
	IS: 722	A.C. Electricity Meters		
	IS: 1248	Electrical Indicating instruments		
	IS/IEC: 60947-1	Degree of protection provided by enclosures for low voltage Switchgear and Control gear		
	IS/IEC: 60947-2	A.C. circuit Breakers		
	IS: 2551	Danger Notice Plates		
	IS: 2629	Hot dip galvanising		
	IS: 2705	Current Transformers		
	IS/IEC: IEC-60947-4-1	Contactors and motors starter for voltages not exceeding 1000 V AC or 1200 V DC		
	IS: 3043	Code of practice for earthing.		
	IS: 3072	Code of practice for installation and maintenance of Switchgear		
	IS: 3156	Voltage Transformers		
	IS: 3202	Code of practice for climate proofing of electrical equipment.		
	IS: 3231	Electrical relays for power system protection.		
	IS/IEC 60947	Air-Break Switches, air break disconnectors, air break disconnector and fuse combination units for voltages not exceeding 1000V AC or 1200 V DC.		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 3 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS/IEC 60947-1 / IEC-60947-1	General Requirements for Switchgear and Control gear for voltages not exceeding 1000 V.		
	IS: 5082	Wrought Aluminum and Aluminum alloys for electrical purposes.		
	IS: 6005	Code of practice of phosphating of iron and steel.		
	IS/IEC 60947-5-1 / IEC-60947-5-1	LV switchgear and Control gear Control current devices and switching element.		
	IS: 8623 (3 parts) / IEC: 60439	Specification for factory built assemblies of Switchgear & Control gear for voltages upto and including 1000 V AC & 1200 V DC.		
	IS: 8686	Static Relays		
	IS: 13703 / IEC: 60269	HRC Cartridge fuses		
	IS: 10118 (4 parts)	Code of practice for selection, installation and maintenance of switchgear and control gear.		
	IS: 11171	Specification for dry type transformers.		
	IEC: 60255	Electrical Relays		
	IEC: 61850	Communication networks and systems in substations		
	IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals		
	IS: 12021	Specification of control transformers for switchgear and Control gear for voltage not exceeding 1000V AC.		
	IEC: 60947-7-1	Terminal blocks for copper conductors		
	IS :513 (2008)	Cold Rolled Low Carbon Steel Sheets and Strips		
	IEC 60439(1&2)/ IS 8623(1&2)	Bus trunking system (sandwich busduct)		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 4 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
2.00.00	TECHNICAL PARAMETERS		
2.01.00	POWER SUPPLY		
2.01.01	AC SYSTEM		
	1) Voltage	415 V ± 10%,3 Phase, 4 wire, solidly earthed	
	2) Frequency	50 Hz +/- 5%	
	3) Combined variation (in volts & frequency)	10% absolute sum	
	4) Fault Level	50KA(RMS)	
2.01.02	DC SYSTEM		
	1) System Voltage	240VDC 2-Wire, Unearthed	
	2) Fault Level	20 KA	
2.01.03	CONTROL SUPPLY VOLTAGE		
	1) Trip & closing coil of circuit breaker	240V DC/120V DC	
	2) Spring charging motor	240V DC/120V DC	
	3) MCC control supply	110V AC Neutral solidly earthed	
	4) Space heater & lighting	240V AC Neutral solidly earthed	
2.02.00	CUBICLE DATA		
	Busbar Rating		
	1) Continuous Current rating	As per requirement	
	2) Short time rating where		
	a) CB is used as incomer	50KA(RMS) for one sec	
	b) Fuse protection is used in Incomer	Prospective current of 50KA(RMS) for the fuse clearing time	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
2.03.00	3)	Dynamic Rating where		
	a)	CB is used as incomer	105KA(PEAK)	
	b)	Fuse Protection is used in incomer	Prospective current of 105KA (PEAK) as limited by fuse	
	4)	Busbar insulation		
	a)	For switchgear	PVC Sleeve insulated	
	b)	For MCC	PVC Sleeve insulated	
	c)	ACDB	PVC Sleeve insulated	
	d)	DCDB	PVC Sleeve insulated	
	e)	For fuse boards	PVC Sleeve insulated/ epoxy coated	
	CIRCUIT BREAKER			
	1)	Type	Air break spring charged stored energy type	
	2)	Operating duty	B-3 MIN-MB-3 MIN-MB	
	3)	Symmetrical interrupting	50KA(RMS)	
	4)	Short circuit rating	105KA(PEAK)	
	5)	Short Circuit Breaking current		
	a)	AC Component	50KA(RMS)	
	b)	DC Component	As per IS/IEC 60947	
6)	Short time withstand	50KA(RMS) for one sec		
7)	No of aux. contacts	4 NO + 4 NC for DDCMIS interface		
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2.04.00	METERS - Accuracy class 2.0 - One min. power frequency withstand test voltage 2.0 KV (rms)		
2.05.00	CURRENT TRANSFORMERS - Type Cast Resin Bar Primary - Voltage class and frequency 650 V, 50 HZ - Class of insulation E or better - Accuracy class & burden - For protection 5P20, 5VA PS Class for REF - For metering class 1.0, 5VA (min) - Short time withstand - For CT Associated with circuit breaker 50KA(RMS) for 1 sec - For CT Associated with fuse protected feeders Prospective current of 50KA(RMS) for the Fuse clearing time - Dynamic withstand - For CTs Associated with circuit breaker 105KA(PEAK) - For CT Associated with fuse protected feeders Prospective current of 105KA(PEAK) as Limited by fuse		
2.06.00	BUSDUCT - Type Non-Segregated - One minute power frequency withstand voltage 2.5 kV		
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2.07.00	3)	One second short ckt withstand current	50KA(RMS)	
	4)	Momentary dynamic current withstand	105KA(PEAK)	
	BUSDUCT (SANDWICH TYPE)			
	1)	Type	Bus Trunking	
	2)	Rated Insulation voltage	1000V	
	3)	One second short ckt withstand current	50KA(RMS)	
	4)	Momentary dynamic current withstand	105KA(PEAK)	
	5)	Power frequency withstand voltage	3.5kv	
	6)	Impulse withstand voltage	8kV	
	7)	Insulation	Class F	
	VOLTAGE TRANSFORMERS			
	1)	Type	Cast Resin	
	2)	Voltage Ratio	415 / 110 V for line PT 415/ $\sqrt{3}$ / 110/ $\sqrt{3}$ V for Bus PT	
	3)	Method of Construction	Vee Vee	
	4)	Accuracy Class	0.5	
	5)	Rated Voltage factor	1.1continuous, 1.5 for 30 sec.	
	6)	Class of insulation	E or better	
7)	One minute power frequency withstand voltage	2.5 KV		
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2.08.00	HRC FUSES		
	1) Voltage Class	650 Volts	
	2) Rupturing capacity	80 KA (rms) for AC ckt. 20 KA for DC ckt.	
2.09.00	CONTACTORS		
	Type	Air break electro magnetic	
	2) Utilising Category	AC3 of IS/IEC 60947 for non reversible AC4 of IS/IEC 60947 for reversible drives	
2.10.00	RELAYS		
	1) Power frequency withstand voltage	2.5KV for 1 sec. or 2.0 KV for 1 min.	
2.11.00	CONTROL TRANSFORMERS		
	1) Type	Dry / Cast Resin	
	2) Voltage Ratio	415 / 110 with taps $\pm$ 5% in steps of 2.5%	
	3) Class of insulation	Class-B or better	
	4) One minute power frequency withstand voltage	2.5 KV	
	5) Rating	1.5 x Adequate for application.	
2.12.00	LIGHTING TRANSFORMER / WELDING TRANSFORMER		
	1) Type & Rating	Dry type / 100 KVA	
	2) Voltage Ratio	415/415V, +/- 5% taps in steps of 2.5%	
	3) Class of insulation	B or better	
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2.13.00	4)	One minute power frequency withstand 2.5 KV voltage		
	5)	Enclosure protection	IP-42	
	TRANSDUCERS			
	1)	Current transducers		
	a)	Input	0-1 A (CT secondary)	
	b)	Rated frequency	50HZ	
	c)	Output	4-20 mA (2 Nos. decoupled)	
	d)	Over current	Transducer for motor current ammeters shall be capable of withstanding min. 6 times CT sec. current of 1A for a min period of 30 seconds	
	e)	Accuracy	1.0	
	2)	Voltage Transducers		
2.14.00	a)	Input	110 V(VT secondary) ,50 HZ (for AC)/240 V DC (for DC)	
	b)	Output	4-20 mA (2 Nos. decoupled)	
	c)	Accuracy	1.0	
	MCCB			
	1)	Rated voltage	415V	
	2)	Rated insulation level	690V	
	3)	Rated ultimate &Service S.C. breaking capacity	50KA	
	4)	Rated making capacity	105KA	
	5)	Utilization category	A	
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3.00.00	CONSTRUCTIONAL DETAILS OF SWITCHBOARDS		
3.01.00	All Switchboards i.e., 415 V Switchgears, Motor Control Centres (MCCs), AC Distribution Boards (ACDBs), 220 V DC Distribution Boards (DCDBs) and Solenoid Valve Distribution Boards, shall be of metal enclosed, indoor, floor-mounted, free-standing type.		
3.02.00	All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material.		
3.03.00	All panel edges and cover / door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members. The top covers of the panels should be designed such that they do not permanently bulge/ bend by the weight of maintenance personnel working on it.		
3.04.00	The switchboards shall be of bolted design. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cutouts shall be true in shape and devoid of sharp edges.		
3.05.00	All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. However, the busbar chambers having a degree of protection of IP: 42 are also acceptable where continuous busbar rating is 1600A and above. Provision shall be made in all compartments for providing IP: 5X degree of protection, when circuit - breaker or module trolley has been removed. All cutouts shall be provided with EPDM / Neoprene gaskets.		
3.06.00	Provision of louvers on switchboards would not be preferred. However, louvers backed with metal screen are acceptable on the busbar chambers where continuous busbar rating is 1600 A and above.		
3.07.00	The enclosure for outdoor oil filtration panels shall be constructed of stainless steel sheets in order to have protection against corrosion. The Degree of protection for outdoor panels shall be IP-65. The panels shall be mounted on a pedestal at a height of 500mm from ground level.		
3.08.00	All switchboards shall be of uniform height not exceeding 2450 mm.		
3.09.00	Switchboards shall be easily extendable on both sides by the addition of vertical sections after removing the end covers.		
Switchboards shall be supplied with base frames made of structural steel sections, along with all necessary mounting hardware required for welding down the base frame to the foundation			
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/ steel insert plates. The base frame height shall be such that floor finishing (50 mm thick) to be done by Contractor after erection of the switchboards does not obstruct the movement of doors, covers, withdraw able modules etc.

3.10.00

All switchboards shall be divided into distinct vertical sections (panels), each comprising of the following compartments:

(a.) BUSBAR COMPARTMENT

A completely enclosed bus bar compartment shall be provided for the horizontal and vertical bus bars. Bolted covers shall be provided for access to horizontal and vertical busbars and all joints for repair and maintenance, which shall be feasible without disturbing any feeder compartment. Auxiliary and power bus bars shall be in separate compartments.

(b.) SWITCHGEAR / FEEDER COMPARTMENT

All equipment associated with an incoming or outgoing feeder shall be housed in a separate compartment of the vertical section. Two-tier breaker arrangement in a vertical section shall be offered for outgoing breaker feeders of rating up to 1600A. The design of the vertical section for such an arrangement shall ensure ease of termination of power cables of size & quantity as specified in clause 4.2.00.00. The compartment shall be sheet steel enclosed on all sides with the withdraw able units in position or removed. Insulating sheet at rear of the compartment is also acceptable. The front of the compartment shall be provided with the hinged single leaf door with captive screws for positive closure.

(c.) CABLE COMPARTMENT OR CABLE ALLEY

A full-height vertical cable alley of minimum 250mm width shall be provided for power and control cables. Cable alley shall have no exposed live parts and shall have no communication with busbar compartment. Cable terminations located in cable alley shall be designed to meet the Form IVb Type 7 (as per IEC 60439) for safety purpose. The termination for each module shall have its own integral glanding facility. Wherever cable alleys are not provided for distribution boards, segregated cable boxes for individual feeders shall be provided at the rear for direct termination of cables. For circuit breaker external cable connections, a separately enclosed cable compartment shall also be acceptable. The contractor shall furnish suitable plugs to cover the cable openings in the partition between feeder compartment and cable alley. Cable alley door shall be hinged.

(d.) CONTROL COMPARTMENT

A separate compartment shall be provided for relays and other control devices associated with a circuit breaker.

3.11.00

Sheet steel barriers shall be provided between two adjacent vertical panels running to the full height of the switchboard, except for the horizontal busbar compartment. EPDM / Neoprene gasket shall be provided between the panel sections to avoid ingress of dust into panels.

3.12.00

After isolation of power and control circuit connections it shall be possible to safely carryout maintenance in a compartment with the busbar and adjacent circuit live. Necessary shrouding arrangement shall be provided for this purpose. Wherever two breaker compartments are provided in the same vertical section insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit.

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3.13.00	All 415V switchgear (circuit-breaker) panels shall be of single-front type. MCCs and DBs shall be of single-front / double-front construction as per the requirements. All single-front switch boards shall be provided with single-leaf, hinged or bolted covers at the rear. The bolts shall be of captive type. The covers shall be provided with "DANGER" labels. All panel doors shall open by 90 deg or more. In case of double-front MCCs, if this cannot be achieved for panels adjacent to a breaker panel, suitable dummy panel shall be provided by the Contractor wherever necessary.
4.13.01	MCCs located on the Stacker reclaimers, paddle feeders, traveling trippers shall be fixed type, compartmentalized, single front and suitable for the system fault level. No spare feeders are to be provided on these MCCs. Degree of protection for the MCCs mounted on paddle feeders and traveling trippers shall be IP-65.
3.14.00	All ACDBs, DCDBs and Solenoid Valve DBs shall be of fixed module type. All 415V circuit-breaker modules and contactor controlled motor modules shall be of fully draw out type having distinct 'Service' and 'Test' positions. The equipment pertaining to a draw out type incomer or feeder module shall be mounted on a fully withdrawable chassis which can be drawn out without having to unscrew any wire or cable connection. Suitable arrangement with cradle/ rollers, guides along with tool/lever operated racking in/out mechanism shall be provided for smooth and effortless movement of the chassis. For modules of size more than half the panel height, double guides shall be provided for smooth removal or insertion of module. All identical module chassis of same size shall be fully interchangeable without having to carryout any modifications. Suitable interlock shall be provided in DCDB for prevention of opening of Isolator (Incomer) when the bus coupler is open and vice-versa.
3.15.00	All disconnecting contacts for power and control circuits of drawout modules shall be of robust and proven design, fully self aligning and spring-loaded. Both fixed and moving contacts shall be silver-plated and replaceable. The spring-loaded power and control drawout contacts shall be on withdrawable chassis and the same on fixed portion shall not be accepted. Detachable plug and socket type control terminals shall also be acceptable.
3.16.00	Individual opening in the vertical bus enclosure shall permit the entry of moving contacts from the drawout modules into vertical droppers.
3.17.00	As indicated in schematic drawings of DDCMIS controlled modules, contractor shall supply & mount two (2) coupling relays in the corresponding modules.
3.18.00	All equipment and components shall be neatly arranged and shall be easily accessible for operation and maintenance. The internal layout of all modules shall be subject to owner's approval. The Contractor shall submit dimensional drawings showing complete internal details of busbars and module components, for each type and rating for approval of owner.
3.19.00	Owner reserves the right to alter the cable entries, if required during detailed engineering, without any additional commercial implication.
3.20.00	Each switchboard shall be provided with undrilled, removable type gland plate, which shall cover the entire cable alley. Contractor shall ensure that sufficient cable glanding space is
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available for all the cables coming in a particular section through gland plate. For all single core cables, gland plate shall be of non-magnetic material. The gland plate shall preferably be provided in two distinct parts for the easy of terminating addition cables in future. The gland plate shall be provided with gasket to ensure enclosure protection. Recommended drilling chart of gland plates for all power and control cables in the vertical panels shall be indicated by the Contractor in the respective G.A. drawings of the boards.

3.21.00

The Contractor shall consider layout of panels in a switchboard consisting of various feeder modules in a straight line, unless specified otherwise. The actual composition and disposition of various modules in a switchboard shall be finalised during detailed engineering. The Contractor shall provide adopter panel / dummy panel required to meet various configuration / arrangement of busbars adopted by the Contractor. The Switchboards fed from indoor transformer will be flange connected to the same and the same shall be located as close as desirable to the transformer. The details of transformer flanges for those transformers not being supplied under this package shall be given to the contractor for matching the connections. The switchboards fed from outdoor transformers of rating 1MVA and above shall preferably be connected through busducts. Busduct connections wherever applicable shall be preferably in a straight line alignment. The centre line of the busduct will be finalized during detailed engineering. Adopter panels and dummy panels shall be provided wherever required.

3.22.00

Adequate space in a separate compartment shall be identified for mounting of Ethernet Switch (19" rack mounting) in all switchgears provided with numerical relays. Further, mounting of Ethernet switch in the above compartment and inter-panel wiring of Ethernet cable for connection of numerical relays to Ethernet switch shall be in the contractor's scope. Arrangement to provide required control supply to Ethernet switch shall be made in the switchgear.

3.23.00

CLEARANCES

The minimum clearance in air between phases and between phases and earth for the entire run of horizontal and vertical busbars and bus-link connections at circuit-breaker shall be 25 mm. For all other components, the clearance between "two live parts", "a live part and an earthed part", shall be atleast ten (10) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers. However, for horizontal and vertical busbars the clearances specified above should be maintained even when the busbars are sleeved or insulated. All connections from the busbars upto switch / fuses shall be fully shrouded / insulated and securely bolted to minimize the risk of phase to phase and phase to earth short circuits.

4.00.00

CONSTRUCTIONAL DETAILS OF AC & DC FUSE BOARDS

4.01.00

All fuse boards shall be metal enclosed, fixed type, non-compartmentalized construction, suitable for indoor/ outdoor mounting on wall or steel structure.

4.02.00

The fuse board frame shall be fabricated using suitable mild steel structures or pressed and shaped cold rolled sheet steel of thickness not less than 2.0 mm. The frames shall be enclosed by cold rolled sheet steel of thickness not less than 1.6 mm.

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4.03.00	The fuse boards shall be provided with doors on the front. The doors shall preferably be in two halves with hinges at the extreme ends and locking facility at the centre.			
4.04.00	Suitable EPDM/Neoprene gaskets shall be provided to make fuse boards completely dust and vermin-proof with a degree of protection of IP-52 for indoor and IP-54 for outdoor application, as per IS/IEC 60947.			
4.05.00	Each DC fuse board shall comprise of the following :			
	(a.) 1 no. 63 A switch as incomer			
	(b.) 100 A fully insulated (PVC sleeved or epoxy coated) busbars.			
	(c.) 8 nos. 16A outgoing Fuse feeders.			
	(d.) 1 no. auxiliary contactor for supply monitoring.			
	(e.) 1 no. indicating lamp with resistor and blue coloured lens.			
4.06.00	Each AC fuse board shall comprise of the following :			
	(a.) 1 no. 63A TPN switch as incomer.			
	(b.) 100 A, 3-phase, 4-wire, fully insulated (PVC sleeved or epoxy coated) busbars.			
	(c.) 9 nos. 16 A single phase switch fuse units and 3 nos. 16 A TPN switch fuse units as outgoing feeders or alternatively 16 amps MCCB can be provided.			
	(d.) 3 nos. indicating lamps with resistors and coloured lenses (R, Y, B) for incoming supply monitoring.			
4.07.00	The fuses shall be mounted in an insulating fuse carrier and it shall be possible to replace the outgoing feeder fuses without disturbing the other feeders. The handle of incoming switch shall be mounted on the door of the fuse board, with padlocking facility in both 'ON' and 'OFF' positions. The outgoing feeder switches shall preferably be of rotary type.			
4.08.00	Cable entry facilities shall be provided at top / bottom with removable gland plates of suitable thickness. All incoming and outgoing cables shall be terminated on suitable terminal blocks.			
5.00.00	POWER BUSBARS AND INSULATORS			
	All 415 V Switchboards, MCCs and ACDBs shall be provided with three phase and neutral busbars as specified in BOM. Two separate sets of vertical busbars shall be provided in each panel of double front MCCs. Interleaving arrangement for busbars shall be adopted for switchboards with a rating of more than 1600A. DCDBs shall be provided with two (2)			
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busbars. Entire busbar system shall be insulated with PVC sleeves. Busbar sleeves shall be compliant to UL224 (Extruded insulating tubing), CE/UL certified, having fire retardant properties and working temperature of 105°C.

5.01.00 All busbars and jumper connections shall be of high conductivity aluminum alloy / copper of adequate size.

5.02.00 The cross-section of the busbars shall be uniform throughout the length of switchboard section and shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents. Neutral busbar short circuit strength shall be same as main busbars.

5.03.00 All busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength sheet molded compound or equivalent type polyester fiber glass molded insulator. Separate supports shall be provided for each phase and neutral busbar. If a common support is provided, anti-tracking barriers shall be provided between the supports. Insulator and barriers of inflammable material such as Hyfam shall not be accepted. The busbar insulators shall be supported on the main structure.

5.04.00 All busbar joints shall be provided with high tensile steel bolts, Belleville / spring washers and nuts, so as to ensure good contacts at the joints. Non-silver plated busbar joints shall be thoroughly cleaned at the jointed locations and suitable contact grease shall be applied just before making a joint. All bolts shall be tightened by torque spanner to the recommended value. The overlap of the busbars at each joint surface shall be such that the length of overlap shall be equal to or greater than the width of the busbar. All copper to aluminum joints shall be provided with suitable bimetallic washers.

5.05.00 All busbars shall be color coded as per IS: 375.

5.06.00 Wherever the busbars are painted with black Matt paint, the same should be suitable for temperature encountered in the switchboard under normal operating conditions.

5.07.00 The Contractor shall furnish calculations establishing the adequacy of bus bar sizes for specified current ratings.

AUXILIARY BUSBARS AND CONTROL TRANSFORMERS

6.00.00 AC CONTROL SUPPLY BUSBAR

Each bus-section of all Switchgears and MCCs shall be provided with two (2) nos. 415V / 110V control transformers. The 110V AC control supply from the control transformers shall be run through the MCC by means of two sets of control supply busbars of electrolytic copper. In case of one transformer failure, whole bus section can be fed through single transformer. The control supply to different modules shall be tapped individually from the control supply busbars.

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DC CONTROL SUPPLY BUSBARS

Electrically controlled circuit breaker boards shall be provided with DC control supply busbars. The manually controlled breakers shall also be provided with such busbars in case relays are provided. Each section of the switchboard shall be provided with a DC supply by the Contractor. The Contractor shall provide suitable terminals, switch-fuse etc. to receive the DC supply and distribute the same through above mentioned control busbars to the required modules of the respective section. The DC control supply bus of one section shall be coupled to the control supply of other section through a switch located in the bus-coupler breaker panel. The DC supply to the bus-coupler breaker may be given from any of the control buses. For emergency switchgear, Contractor shall provide two DC supplies. The contractor shall provide suitable diodes to derive the control supply through diode auctioneering from the above two supplies. Power Supply to Numerical Relay and Ethernet switch shall be an independent circuit with switch and fuse tapped from the panel DC supply. Exact scheme for segregation of switchgear & numerical relay DC supplies shall be finalized during detailed engineering.

6.03.00

SPACE HEATER BUSBARS

Panel and motor space heaters shall be fed from separate AC auxiliary busbars running throughout the switchboard. The supply for these busbars shall be tapped from incoming, before the isolating switch/circuit breaker. Incoming circuit to space-heater bus shall have an isolating switch, HRC fuse and neutral link of suitable rating. Suitable terminals shall also be provided to facilitate energisation of space-heater bus from outside during long shutdowns of unit / switch-board.

6.04.00

CONTROL TRANSFORMERS

The control transformers shall be 415 V/110 V with neutral point-earthed, of insulation class 'B' or better. The sizing of Control transformers shall be carried out by Contractor considering the actual load of power contactors, auxiliary contactors, indicating lamps and other equipment in the module circuit. An additional load of 15 watts should also be considered for each module, for remote auxiliary relays and lamps to be connected in the control circuit of modules. Contractor shall also ensure that control transformers are adequately designed for meeting the momentary loading requirements & the voltage drop during this condition shall not be more than 5%.

7.00.00

EARTH BUS AND EARTHING

A galvanized steel / Copper / Aluminum earth bus shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded / bolted to the framework of each panel and breaker earthing contact bar. Vertical earth bus shall be provided in each vertical section which shall in turn be bolted / welded to main horizontal earth bus.

7.02.00

The earth bus shall have sufficient cross section to carry the momentary short circuit and short time fault current to earth, as indicated in "Technical Parameters", without exceeding the allowable temperature rise.

7.03.00

Suitable arrangements shall be provided at each end of the horizontal earth bus for bolting to Contractor's earthing conductors. The horizontal earth bus shall project out of the switchboard ends and shall have predrilled holes for this connection. All joint splices to earth bus shall be made through at least two bolts, and taps by proper lug and bolt connection.

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7.04.00	All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosure framework and truck shall be maintained even after painting.
7.05.00	The carriage and breaker frame shall get earthed while being inserted in the panel and positive earthing of the breaker frame shall be maintained in all positions, i.e. SERVICE & ISOLATED, as well as throughout the intermediate travel.
7.06.00	Each module frame shall get engaged to the vertical earth bus before the disconnecting contacts on the module are engaged to the vertical busbars.
7.07.00	All metallic cases of relays, instruments and other panel-mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. All the equipment mounted on the door shall be earthed through flexible wire/braids. Insulation color code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors, soldering is not acceptable. Looping of earth connections, which would result in loss of earth connections to other devices, when a device is removed, is not acceptable. However, looping of earth connections between equipment to provide alternative paths to earth bus is acceptable.
7.08.00	VT and CT secondary neutral point earthing shall be at one place only, i.e. on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit.
7.09.00	All hinged doors having potential carrying equipment mounted on it shall be earthed by flexible wire/ braid. For doors not having potential carrying equipment mounted on it, earth continuity through scraping hinges/ hinge pins of proven design may also acceptable. The Contractor shall establish earth continuity at site also.
8.00.00	CIRCUIT BREAKERS
8.01.00	Circuit breakers shall be three pole, air break, horizontal draw out type, and shall have fault making and breaking capacities as specified in "Technical Parameters". The circuit breakers which meet specified parameters of continuous current rating and fault making / breaking capacity only after provision of cooling fans or special device shall not be acceptable.
8.02.00	Circuit breakers along with its operating mechanism shall be provided with suitable arrangement for easy withdrawal. Suitable guides shall be provided to minimize misalignment of the breaker.
8.03.00	There shall be "SERVICE", "TEST" and "FULLY WITHDRAWN" positions for the breakers. In "Test" position the circuit breaker shall be capable of being tested for operation without energizing the power circuits i.e. the power contacts shall be disconnected, while the control circuits shall remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the "SERVICE", "TEST" or "FULLY WITHDRAWN"
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8.04.00	position. It shall be possible to close the door in "Test" position. The circuit breaker rack in and rack out from Service to Test, Test to Isolated position or vice-versa shall be possible only in the door closed position. All circuit breakers shall be provided with "6 NO" and "6NC" potential free auxiliary contacts. These contacts shall be in addition to those required, for internal mechanism of the breaker and should be directly operated from breaker operating mechanism. In case the manufacturer does not have a proven arrangement for providing the required number of circuit breaker auxiliary contacts on the fixed portion of the cubicle, necessary electrically reset latched relays shall be provided complete with all wiring in series with service position limit switch contacts, for multiplying the circuit breaker mounted auxiliary contacts and provide 4 NO and 4 NC contacts. Separate limit switches, each having required numbers of contacts shall be provided in both "SERVICE" and "TEST" position of the breaker. All contacts shall be rated for making, continuously carrying and breaking 10 Amp at 240 V AC and 1 Amp (Inductive) at 240 V DC respectively. Suitable mechanical indications shall be provided on all circuit breakers to show "OPEN", "CLOSE", "SERVICE", "TEST" AND "SPRING CHARGED" positions.
8.05.00	Main poles of the circuit breakers shall operate simultaneously in such a way that the maximum difference between the instants of contacts touching during closing shall not exceed half a cycle of rated frequency.
8.06.00	All circuit breakers shall be provided with the following interlocks :
8.07.00	Movement of a circuit breaker between "SERVICE" and "TEST" position shall not be possible unless it is in open position. Attempted withdrawal of a closed circuit breaker shall preferably not trip the circuit breaker. In case the offered circuit breaker trips on attempted withdrawal as a standard interlock, it shall be ensured that sufficient contact exists between the fixed and draw out contact at the time of breaker trip so that no arcing takes place even with the breaker carrying its full rated current.
8.07.01	Closing of a circuit breaker shall not be possible unless it is in "SERVICE" position, "TEST" position or in "FULLY WITHDRAWN" position.
8.07.02	Circuit-breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage, to cover the stationary isolated contacts when the breaker is withdrawn. It shall however be possible to open the shutters intentionally against pressure for testing purposes.
8.07.03	A breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.
8.07.04	Circuit breakers shall be provided with coded key / electrical interlocking devices, as per requirements.
8.07.05	

8.08.00	Circuit breaker shall be provided with anti-pumping feature (soft) and trip free feature, even if mechanical anti-pumping feature is provided.
8.09.00	Mechanical tripping shall be possible by means of front mounted Red "trip" push-button. In case of electrically operated breakers these push buttons shall be shrouded to prevent accidental operation.
8.10.00	Complete shrouding / segregation shall be provided between incoming and outgoing bus links of breakers. In case of bus coupler breaker panels the busbar connection to and from the breaker terminals shall be segregated such that each connection can be approached and maintained independently with the other bus section live. Dummy panels if required to achieve the above feature shall be included in the Contractor's scope of supply.

8.11.00

Circuit breaker shall be provided with Power operated mechanism as follows:

1.	Power operated mechanism shall be provided with a universal motor suitable for operation on 240 V DC / 240 AC Control supply, with voltage variation from 198 V to DC to 242 V DC. Motor insulation shall be class "E" or better.
2.	The motor shall be such that it requires not more than 30 seconds for fully charging the closing spring at minimum available control voltage.
3.	Once the closing springs are discharged, after one closing operation of circuit breaker, it shall automatically initiate recharging of the spring.
4.	The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.
5.	Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.
6.	All circuit breakers shall be provided with closing and trip coils. The closing coil shall operate correctly at all values of voltage from 187-242 V DC. The trip coil shall operate satisfactorily at all values of voltage from 154-242V DC / 77 V-121 V DC.
7.	Provision for mechanical closing of the breaker only in "Test" and "WITHDRAWN" positions shall be made. Alternately, the mechanical closing facility shall be normally made inaccessible; accessibility being rendered only after deliberate removal of shrouds.
8.	It shall not be possible to open the ACB panel door in breaker closed condition.

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8.12.00	Further, the racking mechanism shall be accessible only after opening the breaker panel door.			
	Note: The circuit breakers for DC applications shall have manually operated mechanism of spring charged, stored energy type. The closing operation of the circuit breaker shall charge the tripping spring. Necessary interlocks shall be provided to inhibit closing of the circuit breaker unless the closing spring is fully charged.			
	TELESCOPIC TROLLEY			
	Telescopic trolley or suitable arrangement shall be provided for maintenance of circuit-breaker module in a cubicle. The trolley shall be such that the top most breaker module can be withdrawn on the trolley and can be lowered for maintenance purpose. The telescopic trolley shall be such that all type, size and rating of breaker can be withdrawn /inserted of particular switchgear. The quantity of telescopic trolleys to be supplied shall be adequate for the number of switchgears / switchgear rooms.			
	9.00.00			
	AIR BREAK SWITCHES			
	9.01.00 Air break switches shall be of heavy duty, single throw, group operated, load break, fault make type when associated with fuses. All switches for motor circuits shall be of utilization category AC-23A with 1NO +1NC auxiliary contact, which shall be wired to the control circuit as shown in the schematic drawings. All switches for other outgoing feeders shall be of utilization category AC-22A. All switches for DC circuits shall be suitable for 240 V DC and shall be of DC-22 utilization category.			
	9.02.00 Continuous current rating of the switches shall be selected from the 'Module Selection tables' for various feeders.			
	10.03.00 The combination of switch-fuse unit would be preferred. However, if separate switch and fuses are provided, switch shall be located before fuses.			
	10.04.00 The main switches shall be operable from outside the module door. The switch handle shall clearly indicate the position of switch. Switch operating handles shall be provided with padlocking facilities. However, incomer switches of switchboards shall be provided with padlocking facility in both 'ON' and 'OFF' positions.			
10.05.00 Interlocks shall be provided such that the cubicle door will not open when the switch is in closed position and the switch will close only when the door is closed.				
10.06.00 Switches and fuses for AC/DC control supply and heater supply wherever required, shall be mounted inside the cubicles. Toggle switch is not acceptable.				
10.07.00 Even if a single phase feeder is required for certain applications, Contractor shall provide TPN switch, fuse-bases and cable/ link connections between switch/fuse and vertical busbars for all the three phases, so that changing from single phase feeder to three phase feeder is possible without any modification other than inserting fuses at site.				
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10.00.00	MCCB
10.01.00	MCCB shall be fixed type/part of withdraw able feeder module as per specification, three pole, air break type having trip free mechanism with quick make and quick break type contacts. MCCB shall have current limiting feature. MCCB of identical ratings shall be physically and electrically interchangeable. MCCB shall be provided with 1 NO and 1NC auxiliary contacts.
10.02.00	MCCB shall be provided with Microprocessor based inbuilt front adjustable releases (overload & short circuit) and shall have adjustable earth fault protection unit also. The protection settings shall have suitable range to achieve the required time & current settings. LED indications shall also be provided for faults, MCCB status(on/off etc).
10.03.00	MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit rating. Extended cable terminal arrangement for higher size cable may also be offered. ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. The compartment door shall be interlocked mechanically with the MCCB, such that the door can not be opened unless the MCCB is in OFF position. MCCB shall be provided with padlocking facility to enable the operating mechanism to be padlocked. The MCCBs being offered shall have common/interchangeable accessories for all ratings like aux. switch ,shunt trip, alarm switch etc. The MCCBs shall have the current discrimination up to full short circuit capacity and shall be selected as per manufacturers discrimination table.
10.04.00	The auxiliary contacts of the MCCB shall be fed to the digital inputs available in the numerical relays of Incomer/bus coupler/motor circuit breaker feeders , for integration in to the numerical relay network.
11.00.00	CONTROL AND SELECTOR SWITCHES
11.01.00	Control and selector switches shall be of heavy duty, rotary type with escutcheon plates clearly marked to show the positions. The control & selector switches should be as per IS/IEC 60947 Part V section 1. The switches shall be of sturdy construction suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred.
11.02.00	Ammeter and voltmeter selector switches shall have four stay put positions with adequate number of contacts for 3-phase 4-wire system. These shall have oval handles. Ammeter selector switches shall have make before break type contacts to prevent open circuiting of CT secondary.
11.03.00	Contacts of the switches shall be spring assisted and shall be of suitable material to give a long trouble free service.

11.04.00

The contact ratings shall be at least the following :

1.	Make and carry, continuously, 10 A at 240 V DC and 110 V AC
2.	Breaking current at 240 V DC, 1 A (inductive)
3.	Breaking current at 110 V AC and 0.3 lagging p.f., 5A

12.00.00

CONTACTORS

12.01.00

Motor starter contactors shall be of air break, electromagnetic type rated for uninterrupted duty as per IS/IEC 60947 Part-4 Section- 1.

12.02.00

Contactors shall be double-break, non-gravity type and their main contacts shall be silver faced.

12.03.00

Direct-on-line contactors shall be of utilization category AC3. Reversing starters shall comprise of Forward and Reverse contactors mechanically and electrically interlocked with each other. These contactors shall be of utilization category AC4. DC contactors shall be of DC3 utilization category. For CHP conveyor motors, minimum rating of power contactors shall be 240% of full load current of the motors. For other CHP drives, minimum rating of power contactors shall be 160% of full load current of motor.

12.04.00

The number of normally open (NO) and normally closed (NC) auxiliary contacts of a contactor shall be as per requirement shown in the respective module drawings. It shall, however, be not less than 2NO+2NC.

12.05.00

Operating coil of contactors shall be of 110 V AC unless otherwise specified elsewhere. The contactor shall operate satisfactorily between 85% and 110% of the rated voltage. The contactor shall not drop out at 70% of the rated voltage but shall definitely drop out at 20% of the rated voltage.

12.06.00

Contactors for DC drives shall have a coil voltage of 240 V DC. DC operated contactor coil shall have an economy resistor and shall be suitable for satisfactory continuous operation at 187-242 V DC/ 93.5-121 V

13.00.00

FUSES

13.01.00

All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC circuits shall be rated for 80kA rms (prospective) breaking capacity at 415V AC and for DC circuits, 20kA rms breaking capacity at 240V DC.

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13.02.00	Fuse shall have visible operation indicators. Insulating barriers shall be provided between individual power fuses.			
13.03.00	Fuse shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchboard.			
13.04.00	Fuse ratings shall be selected by the Contractor from the 'Module Selection Tables' for various feeder ratings. However, the fuse ratings for motor feeders given in the 'Motor Module Selection Table' are indicative only, and the same shall be coordinated by the Contractor to achieve class-II protection coordination and also to match the motor characteristics. Switch rating shall in no case be less than the fuse rating.			
13.05.00	The Neutral links shall be mounted on fuse carriers which shall be mounted on fuse bases.			
14.00.00	INSTRUMENT TRANSFORMERS			
14.01.00	All current and voltage transformers shall be completely encapsulated, cast resin insulated type suitable for continuous operation at the temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated condition and the specified ambient temperature. The class of insulation shall be 'E' or better.			
14.02.00	All instrument transformers shall be able to withstand the thermal and mechanical stresses resulting from the maximum RMS short circuit breaking and peak making current ratings of the associated switchgear.			
14.03.00	All instrument transformers shall have clear indelible polarity markings. All secondary terminals shall be wired to separate terminals on an accessible terminal block where star point formation and earthing shall be done.			
14.04.00	Current transformers may be multi or single-core type. All voltage transformers shall be single phase type.			
14.05.00	The bus VTs shall be housed in a separate compartment. All VTs shall have readily accessible HRC current limiting fuses on both primary and secondary sides.			
14.06.00	All CTs shall be provided with supports independent of busbar / busbar supports.			
14.07.00	The CTs shall be located in such a way that they can be easily approached for maintenance without necessitating shut down of adjacent feeders.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
15.00.00	NUMERICAL RELAYS & NETWORKING			
15.01.00	All relays in protective circuits shall be flush mounted on panel front with connections from the inside. The protective relays shall be communicable numerical relays. These numerical relays shall be of types as proven for the application and shall be subject to owner's approval. Numerical relays shall have appropriate setting ranges, accuracy, resetting ratio and other characteristics to provide required sensitivity. All equipments shall have necessary protections as detailed in the standard scheme drawings.			
15.02.00	The circuit breaker will normally be controlled from remote control panels (DDCMIS) through closing and shunt trip coils. Additionally, control shall be carried out from the Switchgear SCADA System through the Numerical relay. The Local control console of the relay flush mounted on the switchgear would normally be used only for testing of circuit breaker in isolated position, and for tripping it in an emergency. Provision for closing & tripping of the circuit breaker locally from laptop through serial port shall be possible to facilitate commissioning activities. The basic control scheme of breaker feeders shall be developed as per the schematic logics in the relay. The schematics shall be developed in soft inside the relay. Numerical relays shall be interfaced with DDCMIS through 24V DC signal for closing / opening operations.			
15.03.00	The numerical relay shall be capable of measuring and storing values of a wide range of quantities, events, faults and disturbance recordings. The alarm / status of each of protection function and trip operation shall be communicated to DDCMIS. The numerical relays shall have built in feature / hardware interface to provide such inputs to DDCMIS for analog / digital values. All the numerical relays shall have communications on three ports; local front port communication to laptop and a dual port on IEC 61850 to communicate with the data concentrator through LAN and Ethernet switches. Ethernet switches shall be connected through Fibre Optic cable to Numerical Relay network as specified elsewhere. Preferably, the numerical relays shall be capable of communicating simultaneously on both the redundant ring networks for seamless switchover.			
15.04.00	All relays and timers shall be rated for control supply voltage as mentioned elsewhere under parameters and shall be capable of satisfactory continuous operation between 80-120% of the rated voltage. Making, carrying and breaking current ratings of their contacts shall be adequate for the circuits in which they are used.			
15.05.00	The protective relays shall have at least 10 Nos programmable potential free contacts. Programmable Auxiliary relays shall have contacts as required.			
15.06.00	Failure of a control or auxiliary supply and deenergisation of a relay shall not initiate any circuit breaker /contactor operation. All relay digital output contacts shall withstand a minimum test voltage of 2kV AC rms for one minute.			
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15.07.00	All the numerical relays shall have adequate processor memory for implementing the programmable scheme logic required for the realization of the protection / control schemes, in addition to the built in protection algorithms.
15.08.00	Relays shall be suitable for electrical measurement including voltage, current, power (active/reactive) and energy parameters.
15.09.00	Relays shall have separate output for individual functionality and the master trip shall be software configurable in case of multi output relays. Relays shall have event recording feature, recording of abnormalities and operating parameters with time stamping
15.10.00	Preferably comprehensive single numerical relay shall have provision of both current and voltage inputs. The current operated relay shall have provision for 4 sets of CT inputs, 3 nos. for phase fault & 1 CT input for earth fault. Relay shall be suitable for both residually connected CT input as well as CBCT input. The voltage-operated relay shall have provision for 3 PT inputs. Relays shall be suitable for CT secondary current of 1A / 5A selectable at site. Relays used in incomers and bus couplers shall have provision of two sets of voltage signal inputs for the purpose of synchronization.
15.11.00	All CT & PT terminals shall be provided as fixed type terminals on the relay to avoid any hazard due to loose connection leading to CT opening or any other loose connection. In no circumstances Plug In type connectors shall be used for CT / PT connections. Contractor to ensure the same for all protective relay models offered.
15.12.00	All numerical relay shall have key pad / keys to allow relay settings from relay front. All hand reset relays shall have reset button on the relay front. Relay to be self or hand reset shall be software selectable. Manual resetting shall be possible from remote.
15.13.00	Relays shall have suitable output contact for breaker failure protection.
15.14.00	Relays shall have self diagnostic feature with self check for power failure, programmable routines, memory and main CPU failures.
15.15.00	Relays shall have at least two sets or groups of two different sets of adaptable settings. Relays shall have multiple IEC / ANSI programmable characteristics. Relays shall have self reset auxiliary contacts of programmable type.
15.16.00	Design of the relay must be immune to any kind of electromagnetic interference. Contractor to submit all related type test reports for the offered model along with the offer.
15.17.00	Relay shall be immune to capacitance effect due to long length of connected control cables. Any external hardware, if required for avoiding mal operation of the relay due to cable capacitance shall be included as a standard feature.

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	All I/Os shall have galvanic isolation. Analog inputs shall be protected against switching surges, harmonics etc. Relays shall be provided with suitable harsh environment coating for protection against failure due to high temperature, humidity and dust.			
15.18.00	Numerical relays shall have two level password protections, one for read only and other for authorization for modifying the setting etc.			
15.19.00	Time clock synchronization feature shall be provided for synchronization of clocks of numerical relay and metering LAN with data concentrator time clock. Required hardware and software interface to receive GPS/Time signal to achieve time synchronization shall be supplied by the contractor. The resolution of time synchronization shall be +/- 1.0 millisecond or better throughout the entire system.			
15.20.00	Relays shall be suitable to accept both AC & DC supplies with range 110V or 240V with tolerance of 70 % to 120 % of rated voltage & shall be finalized during detailed engineering.			
16.00.00	OTHER PROTECTIONS AND CONTROL FUNCTIONS IN THE RELAYS			
16.01.00	For control from DDCMIS, 24V DC signal shall be provided from DDCMIS to the numerical relays. Preferably, no separate coupling relays shall be provided.			
16.02.00	Trip circuit supervision shall be provided for all feeders to monitor the circuit breaker trip circuit both in pre trip and post trip conditions.			
16.03.00	Schematics requiring auxiliary relays /timers for protection function shall be a part of numerical relay. The number of auxiliary relay and timer function for protection function shall be as required. Auxiliary relays for interlocking purpose shall be of self reset type.			
16.04.00	Bus no volt condition shall be configured to a output contact of the relay of all incomers for suitably interfacing with DDCMIS.			
16.05.00	Timer functions shall be programmable for on/off delays.			
16.06.00	The numerical relay shall be able to provide supervisory functions such as trip circuit monitoring, circuit breaker state monitoring, PT and CT supervisions and recording facilities with Post fault analysis.			
16.07.00	The numerical processor shall be capable of measuring and storing values of a wide range of quantities, all events, faults and disturbance recordings with a time stamping using the internal real time clock. Battery back up for real time clock in the event of power supply failure shall be provided.			
16.08.00	250 time tagged events /records should be able to store with time stamping Last 5 faults storage including the indication, protection operated , fault location relay and operating time, currents, voltage and time.			
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16.09.00	Diagnostics Automatic testing, power on diagnostics with continuous monitoring to ensure high degree of reliability shall be shall be provided. The results of the self reset functions shall be stored in battery back memory. Test features such as examination of input quantities, status of digital inputs and relay outputs shall be shall be available on the user interface.			
16.10.00	The alarm/status of each individual protection function and trip operation shall be communicated to DDCMIS.			
16.11.00	Sequence of events shall have 1 ms resolution at device level.			
16.12.00	Measurement accuracy shall be 1 % for RMS Current and voltage (20-120% of rated value).			
16.13.00	It shall be possible to carryout open / close operation of breakers from a laptop by interfacing from the relay front port during initial commissioning.			
16.14.00	Required no. of extra digital inputs shall be provided in the numerical relay for digital inputs from various outgoing MCCB feeders on that switchgear section.			
16.15.00	At least two licensed copies of necessary software for numerical relay configuration / setting / disturbance analysis and other utilities shall be supplied. Numerical relay configuration for all relays being supplied under the package shall be carried out in line with the approved schematics and shall be submitted for owner's approval. Setting calculations and relay settings configured in relay software for all relays shall be submitted for owner's approval. Approved relay configuration / settings shall be loaded in all the relays prior to dispatch to site.			
17.00.00	TRAINING The contractor shall arrange for training on system design, engineering, operation and maintenance of Numerical relays and Switchgear networking system at the principal's facility for duration of two (2) man-months. Workshop Training at site shall aim for familiarization of Site Engineers for commissioning and day to day O & M of Numerical Relays and trouble shooting. The scope shall include Two No's of Numerical Relay and Training for a batch of 20 Engineers at Project Site. One such Workshop shall be organized before the commissioning of First LV Switchboard and the Second workshop shall be conducted before Unit Commissioning. Owner shall provide the required Infrastructure such as Training Conference room, Projection systems etc.			
18.00.00	INDICATING INSTRUMENTS			
18.01.00	All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96mm square size with 90 degree linear scale and shall have an accuracy			
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	class of 1.0 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.			
18.02.00	All instruments shall be compensated for temperature errors and factory calibrated to directly read the primary quantities. Means shall be provided for zero adjustment without removing or dismantling the instruments.			
18.03.00	All instruments shall have white dials with black numerals & lettering. Black knife edge pointer shall be provided for meters.			
18.04.00	Ammeters provided for motor feeders (for motors of rating $\geq 30\text{kW}$ & $< 100\text{kW}$) shall have a compressed scale at the upper current region to cover the starting current upto 6.0 times the CT primary current.			
18.05.00	All motor feeders of rating $\geq 30\text{ kW}$ and $< 110\text{ kW}$ and all motors of Dust Suppression System shall be provided with Multifunction Digital Energy Meter with communication facility to display the current, voltage, power factor, power energy related data locally as well as communicate these for remote metering/audit/analysis purposes. These meters shall The technical specification for Digital indicating energy meter shall be as follows: a) Input Voltage:110VAC / 240VDC b) Input Current:1A c) Size:96X96 SQ.MM d) Power & Energy Accuracy: 1.0 e) Mounting: Flush mounting f) Type: True RMS 3-PHASE V,I, kW,PF & kWh indication g) 4 Digit, seven segment LED display/LCD display, with floating decimal h) Communication: In built RS 485 bus port i) Operating Frequency: 45 HZ-65HZ j) Dielectric Test: 2KV RMS for 1 minute k) Over Current: 10 times for 3 sec. l) Aux supply: 90V-300V AC/DC m) Compliance: EMC/EMI n) Field programmable CT ratio o) Analog Current Output (4-20 mA)			
19.00.00	PUSH BUTTONS			
19.01.00	Push-buttons shall be of spring return, push-to-actuate type. Their contacts shall be rated to make, continuously carry and break 10 A at 110 V AC and 1 A (inductive) at 240 V DC.			
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19.02.00	All push buttons shall have two (2) normally open and two (2) normally closed contact, unless specified otherwise. The contact faces shall be of silver alloy.			
19.03.00	All push-buttons shall be provided with integral escutcheon plates marked with its function.			
19.04.00	The color of the button shall as follows :			
	Green	for motor START, breaker CLOSE , valve/ damper OPEN commands.		
	Red	for motor trip, breaker open, valve / damper close commands.		
	Black	for all annunciation functions, overload reset and miscellaneous commands including reverse for clinker grinder etc.		
19.05.00	All push buttons on panels shall be located in such a way that Red push button shall always be to the left of Green push button. In case of clinker grinder etc. the push buttons would be black - red-green from left to right.			
19.06.00	All emergency push buttons shall have mushroom knobs.			
20.00.00	INDICATING LAMPS			
20.01.00	Indicating lamps shall be of CLUSTER LED type. The lamps shall have escutcheon plates marked with its function, wherever necessary.			
20.02.00	Lamps shall have translucent lamp-covers of the following colours, as warranted by the application :			
	Red	for motor ON, valve / damper OPEN, breaker CLOSE.		
	Green	for motor OFF , valve / damper CLOSE, breaker OPEN.		
	White	for motor AUTO TRIP.		
	Blue	for all healthy conditions (e.g. control supply, and also for SPRING CHARGED").		
	Amber	for all Alarm Conditions (e.g. overload). Also for "SERVICE" and "TEST" position indications.		
20.03.00	Bulbs and lamp covers shall be easily replaceable from the front of the cubicle. The method of mounting indicating lamp fittings on panels shall prevent their rotation under the action of lamp removal or replacements, reliance upon the tightness of ring nut for the purpose is not sufficient.			
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20.04.00	Indicating lamps should be located just above the associated push-button / control switches. Red lamps shall invariably be located to the right of green lamps. In case a white lamp is also provided, it shall be placed between the red and green lamps along the centre line of control switch / push button pair. Blue and Amber should normally be located above the Red and Green lamps.			
20.05.00	When associated with push-buttons, red lamps shall be directly above the green push-button and green lamp shall be directly above the red push button.			
20.06.00	All indicating lamps shall be suitable for continuous operation at 90% to 110% of their rated voltage.			
21.00.00	SPACE HEATER			
21.01.00	Space heaters shall be provided in the switchboards wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.			
21.02.00	The space heaters shall be suitable for continuous operation on 240 V AC, 50 Hz, single phase supply, and shall be automatically controlled by thermostats. Necessary switches and fuses shall be provided.			
21.03.00	The circuit for each panel and motor space heater should have an isolating switch, HRC fuse and isolating link. In addition, the space heater circuit of each panel shall also have a thermostat of suitable rating.			
22.00.00	INTERNAL WIRING			
22.01.00	All switchboards shall be supplied completely wired internally upto the terminals, ready to receive external cables.			
22.02.00	All intercubicle and interpanel wiring and connections between panels of same switchboard including all bus wiring for AC and DC supplies shall be provided by the Contractor.			
22.03.00	All auxiliary wiring shall be carried out with 650V grade, single core stranded copper conductor, color coded, PVC insulated wires. Conductor size shall be 1.5 mm ² (min.) for control circuit wiring and 2.5 mm ² (min) for CT and space heater circuits.			
22.04.00	Extra flexible wires shall be used for wiring to devices mounted on moving parts such as hinged doors. The wire bunches from the panel inside to the doors shall be properly sleeved or taped.			
22.05.00	All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminal blocks.			
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22.06.00	All internal wiring terminations shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor or an equally secure method. Similar lugs shall also be provided at both ends of component to component wiring. Insulating sleeves shall be provided over the exposed parts of lugs to the extent possible. Screw-less (spring loaded) / cage clamp type terminal shall also be provided with lugs.			
22.07.00	Printed single tube ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The wire identification marking shall be in accordance with IS: 375. Red Ferrules should be provided on trip circuit wiring.			
22.08.00	Wiring for equipment, which are to be supplied by the Contractor and for which the Contractor has to provide mounting arrangement in his panels, shall also be provided by the Contractor, upto the terminal blocks.			
22.09.00	All connections from vertical busbars for individual modules above 100 A shall be by Copper / Aluminum links only. The cable connections for modules less than 100 A shall be selected in such a way that there will not be any melting / shorting in case of a short circuit inside the module and the cable shall have current rating to carry the let through energy of the corresponding fuses in case of a fault. The insulation of the cable and its cross section shall be decided considering the high ambient temperature within the module. For all modules where use of cable is envisaged by the Contractor specific approval from the Contractor regarding cable details are to be taken. For power wiring color coded wire insulation / tapes shall be provided.			
23.00.00	CONTROL TERMINAL BLOCKS			
23.01.00	Terminal blocks shall be 650V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be either screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design.			
23.02.00	Terminal blocks for CT and VT secondary leads shall be of stud type, made up of unbreakable polyamide 6.6 grade. They shall be provided with links to facilitate testing, isolation star / delta formation and earthing. Terminal blocks for CT secondary shall have the short circuiting facility. The terminals for remote ammeter connection etc. shall also be disconnecting type only. All metal parts shall be of non-ferrous material. Screws shall be captive.			
23.03.00	In all circuit breaker panels MCC modules at least 10% spare terminals for external connections shall be provided and these spare terminals shall be uniformly distributed on all terminal blocks.			
23.04.00	All terminal blocks shall be suitable for terminating on each side two (2) nos. stranded copper conductors of size upto 2.5 sq. mm each, or alternatively, the terminal blocks shall have the			
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	possibility of double shorting space to facilitate looping. However for DDCMIS terminals shall be suitable for 1.5 mm2 cable.			
23.05.00	All terminals shall be numbered for identification and grouped according to the function. Engraved white-in-black labels shall be provided on the terminal blocks.			
25.06.00	Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.			
25.07.00	Terminal blocks shall be arranged with at least 100mm clearance between two sets of terminal blocks. The minimum clearance between the first row of terminal blocks and the associated cable gland plate shall be 250 mm.			
24.00.00	POWER CABLE TERMINATION			
24.01.00	Cable termination compartment and arrangement for power cables shall be suitable for heavy duty, 1.1 kV grade, stranded aluminum conductor, PVC/ XLPE insulated, armored / unarmored and PVC sheathed cables. The size and type of cable for individual modules shall, preferably, be as indicated in the 'Module Selection Tables'. All necessary cable terminating accessories such as supporting clamps and brackets, hardware etc. for cables shall be provided by the contractor to suit the final cable sizes.			
24.02.00	All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS: 8309. All lugs shall be insulated/ sleeved.			
25.00.00	LOCAL PUSH BUTTON STATIONS			
25.01.00	The local push button stations shall be metal enclosed, suitable for outdoor / indoor mounting on wall or steel structures. The enclosure shall be die-cast aluminum or cold-rolled sheet steel of at least 1.6 mm thickness. The enclosure shall be provided with a hinged guard at the front, covering full length, to avoid inadvertent operation of push buttons. LPBS shall be painted to shade no. RAL: 9002. Support structure for mounting the LPBS shall also be supplied by Contractor.			
25.02.00	The local push button stations shall be dust and vermin proof and shall have a degree of protection of IP -55 as per IS/IEC 60947. The DOP shall be IP-65 in case the same are located in dusty areas.			
25.03.00	The push button stations shall be suitable for bottom cable entry and shall be provided with removable undrilled gland plates or knockouts. Adequate space shall be available inside the push button station enclosure for terminating external cables directly on pushbutton terminals. Overall size of push button stations shall be subject to owner's approval.			
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25.04.00	The push button station shall comprise of a latched type EMERGENCY STOP push button with two (2) NO and two (2) NC contacts.			
26.00.00	LOCAL MOTOR STARTERS			
26.01.00	Local motor starters shall be suitable for manual switching of 415 V, 3-phase, squirrel cage motors rated upto 5.5 KW. They shall have constructional features similar to those specified for local push button stations.			
26.02.00	Each starter shall comprise of :			
	1.	A 3-pole contactor, mechanically latched type.		
	2.	Start push button, colored green.		
	3.	Stop push button, colored red.		
	4.	Ambient temperature compensated, thermal over load relay with single phasing protection. The continuously variable relay setting range shall be suitable for the motor rating which shall be advised to the Contractor in due course. The relay shall trip the contactor.		
26.03.00	The start push button, when pressed, shall preferably remain in depressed position and shall be released along with the contactor when the stop push button is pressed or when thermal overload relay operates.			
26.04.00	Local starters shall be suitable for loop-in and loop-out of incoming cable and for one outgoing cable to motor. Final cable sizes and number of lugs required will be intimated to the contractor. Support structure for mounting in local motor starters shall be supplied by the Contractor.			
27.00.00	NAME PLATES AND LABELS			
27.01.00	All Switchgears, MCCs, Distribution Boards, Fuse boards, all feeders, local push-button stations and local motor starters shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear switchgear also.			
27.02.00	All name plates shall be of non-rusting metal or 3-ply Lamicoid, with white engraved lettering on black background. Inscription & lettering sizes shall be subject to owner's approval.			
27.03.00	Suitable stenciled paint mark shall be provided inside the panel/module for identification of all equipment in addition to the plastic sticker labels, if provided. These labels shall be			
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	positioned so as to be clearly visible and shall have the device number, as mentioned in the module wiring drawings.			
27.04.00	Caution name plate "Caution Live Terminals" shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end.			
28.00.00	METAL ENCLOSED NON SEGREGATED PHASE BUSDUCT(AIR INSULATED)			
28.01.00	Three phase and neutral metal enclosed non segregated phase bus duct assemblies shall be supplied for incoming connections from the transformers to the switch boards and inter connecting sections between switch boards, wherever called for.			
28.02.00	The enclosure shall be made of minimum 3 mm thick aluminum alloy. The section of the bus duct shall be rectangular. The design of the bus duct enclosures shall be of sturdy construction such that it will withstand the internal or external forces resulting from the various operating conditions.			
28.03.00	The entire bus duct shall be designed for dust, vermin and weather proof construction. A suitable aluminum sheet flange-protection hood shall be provided to cover all outdoor bus duct enclosure joints to facilitate additional protection against rain water ingress. All horizontal runs of bus ducts shall have a suitable sloped enclosure top to prevent retention of water for both indoor and out door portion of bus ducts. Bus duct enclosure shall have a degree of protection of IP-55.			
28.04.00	The inside of the bus enclosure may be treated with black paint to enable efficient heat dissipation. The matt paint used shall be suitable for temperature experienced during continuous loading of the bus conductor. The bus duct exterior paint shade shall be RAL 5012.			
28.05.00	Flexible expansion joints for the enclosure shall be provided wherever deemed necessary by the Contractor. Necessary bonding shall be provided at the expansion joints if made of insulating materials.			
28.06.00	Enclosures shall be provided with flanged ends with drilling dimensions to suit the flanges at the switchgear and transformer terminals. Any adapter boxes required for this purpose are in the Contractor's scope of supply. The flanges shall be provided with gaskets, nuts, bolts, etc. Details of the flanges provided on transformer ends will be furnished to the successful Contractor.			
28.07.00	Suitable Inspection covers shall be provided for periodic inspection of insulators. Handle shall be provided on each inspection cover to facilitate easy lifting.			
28.08.00	The EPDM / Neoprene gaskets shall be provided so as to satisfy the operating conditions imposed by temperature, weathering, durability etc. Flange gaskets shall be provided at the equipment terminal connections.			
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28.09.00	Necessary earthing arrangement as applicable shall be provided with clamps to receive station earthing bus. All accessories and hardware required for the earthing arrangement shall be provided by the Contractor. This shall be a GI strip of adequate size, continuously running along the bus duct and shall be earthed at both ends. Bus duct enclosures shall be bolted type.		
28.10.00	The material of the conductor shall be aluminum. The minimum clearance in air between phase to phase, phase to neutral and phase to earth for the entire run of bus duct shall be 25 mm The bus bars shall be rated in accordance with the service conditions and the rated continuous and short time current ratings calculated for specific application / specified elsewhere.		
28.11.00	All steel structures required for bus duct support shall be hot dip galvanized.		
28.12.00	Space heaters shall be provided in the bus duct wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.		
28.13.00	The space heaters shall be suitable for continuous operation on 240 V AC, 50 Hz single phase supply and shall be automatically controlled by thermostats. Necessary wiring upto junction boxes mounted on bus duct and from junction boxes to switch boards shall be provided by the Contractor.		
29.00.00	BUS TRUNKING SYSTEM (SANDWICH TYPE BUSDUCT)		
29.01.00	Three phase Bus trunking system conforming to IEC 60439 (Parts 1 & 2) / IS 8623 (Parts 1 & 2) shall be provided for connecting the Main and Standby DG sets to Unit Emergency Switchgears as indicated in the BOQ.		
29.02.00	The enclosure shall be made of CRCA (1.6mm thick) / GI (1.6mm thick) / Aluminium (2.5mm thick) sheet. The design of the bus duct enclosure shall be of sturdy construction such that it will withstand the internal or external forces resulting from the various operating conditions.		
29.03.00	The entire bus duct shall be designed for dust, vermin and weather proof construction. A suitable aluminium sheet flange-protection hood shall be provided to cover all outdoor bus duct enclosure joints to facilitate additional protection against rain water ingress. All horizontal runs of bus ducts shall have a suitable sloped enclosure top to prevent retention of water for both indoor and out door portion of busducts. Busduct enclosure shall have a degree of protection of IP-55.		
29.04.00	The busduct exterior paint shade shall be RAL 5012.		
29.05.00	Enclosures shall be provided with flanged ends with drilling dimensions to suit the flanges at the switchgear and DG terminals. Any adapter boxes required for this purpose are in the contractor's scope of supply. The flanges shall be provided with gaskets, nuts, bolts, etc.		
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29.06.00	EPDM / Neoprene gaskets shall be provided so as to satisfy the operating conditions imposed by temperature, weathering, durability etc. Flange gaskets shall be provided at the equipment terminal connections.			
29.07.00	Necessary earthing arrangement as applicable shall be provided with clamps to receive station earthing bus. All accessories and hardware required for the earthing arrangement shall be provided by the contractor. This shall be a GI strip of adequate size, continuously running along the busduct and shall be earthed at both ends. busduct enclosures shall be bolted type.			
29.08.00	The material of the conductor shall be high conductivity aluminum / copper. The busbars shall be rated in accordance with the service conditions and the rated continuous and short time current ratings specified elsewhere.			
29.09.00	All steel structures required for busduct support shall be hot dip galvanized.			
29.10.00	Space heaters shall be provided in the busduct wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.			
29.11.00	The space heaters shall be suitable for continuous operation on 240 V AC, 50 Hz single phase supply and shall be automatically controlled by thermostats. Necessary wiring upto junction boxes mounted on busduct and from junction boxes to switch boards shall be provided by the contractor.			
30.00.00	LIGHTING / WELDING TRANSFORMERS			
	Each AC Lighting Distribution Board (LDB) / Welding DB shall be fed from 415V / 415V, 100kVA isolating transformer. The lighting / welding transformer may, preferably, be located inside the LDB / Welding DB panel itself. Otherwise, the same shall be located by the side of respective LDB / Welding DB. Lighting / Welding transformers shall be dry type, natural air cooled with class B insulation or better. Impedance of lighting / Welding transformer shall be so selected that the fault level of lighting /Welding system shall be reduced to 3 to 5 KA. Lighting / Welding transformers shall be tested as per IS: 2026. Off-circuit tap changer with ± 2.5% and ± 5% tapping shall be provided. In case the transformers are not mounted inside the LDB panels, the same shall be housed in a separate 2 mm thick CR sheet steel enclosure with IP-42 degree of protection as per IS/IEC 60947. However, the transformer terminal box shall have IP-52 degree of protection.			
31.00.00	PAINTING			
	All sheet steel work shall be pretreated, in tanks, in accordance with IS: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "Class-C" as specified in IS: 6005. The phosphated surfaces shall be rinsed and passivated. After passivation, Electrostatic Powder Coating shall be used. Powder should meet requirements of IS 13871 (Powder costing specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the owner. The paint thickness shall not be less than 50 microns. Finished parts shall be suitably packed and wrapped with protective covering to protect the finished surfaces from scratches, grease, dirt and oil spots during testing, transportation, handling and erection.			
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32.00.00	GASKETS The gaskets, wherever specified, shall be of good quality EPDM / Neoprene with good ageing, compression and oil resistance characteristics suitable for panel applications.			
33.00.00	TEMPERATURE –RISE The temperature rise of the horizontal and vertical busbars and main bus links including all power drawout contacts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg C with silver plated joints and 40 deg C with all other types of joints over an outside ambient temperature of 50 deg C. The temperature rise of the accessible parts/external enclosures expected to be touched in normal operation shall not exceed 20deg. C. The temperature rise of manual operating means shall not exceed 10deg. C for metallic & 15 deg. C for insulating material. Temperature rise for the busbars shall be carried out at 90% of the rated current. The above temperature rise limits are applicable for busducts also without any current derating.			
34.00.00	DERATING OF EQUIPMENTS The Contractor shall ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per Indian Standards / Specification. Continuous current rating at 50 deg C ambient in no case shall be less than 90% of the normal rating specified. The Contractor shall indicate clearly the derating factors if any employed for each component and furnish the basis for arriving at these derating factors duly considering the specified current ratings and ambient temperature of 50 deg C.			
35.00.00	PROTECTION CO-ORDINATION It shall be the responsibility of the Contractor to fully coordinate the overload and short circuit tripping of the circuit breakers with the upstream and downstream circuit breakers / fuses / motor starters, to provide satisfactory discrimination. Further the various equipment supplied shall meet the requirements of Type II class of Co-ordination as per IS: 8544.			
36.00.00	TESTS AND TEST REPORTS GENERAL (a.) All equipments to be supplied shall be of type tested design. The Contractor shall submit for owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. (b.) In case the Contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract at no additional cost either at third party lab or in presence of client/owner's representative and submit the reports for approval.			
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	(c.) All routine tests as per the specification and relevant standards shall be carried out..					
	The following type test certificates on each type & rating of L.T. Switchgear and MCC panel shall be submitted.					
	1)	Switchgear / MCC panels of each rating				
		a)	Short time withstand test.			
		b)	Temperature rise test.			
		c)	Degree of protection test			
	2)	Circuit breaker of each rating				
		a)	Test sequence 1			
			-	Dielectric properties.		
			-	Mechanical operation and operational performance capability		
			-	Verification of dielectric withstand.		
			-	Verification of temperature-rise		
		b)	Combined test sequence (With Circuit breakers mounted inside the Switchgear panel)			
			-	Rated short-time withstand current		
			-	Rated service short-circuit breaking capacity		
			-	Verification of dielectric withstand		
			-	Verification of temperature-rise		
	3)	MCC modules of any three ratings, as selected by the owner, for class - II protection Co-ordination.				
	4)	Test for single phasing protection feature on 3 nos. bimetallic thermal overload relay selected by owner. The relay shall be tested for compliance with manufacturer's printed / declared characteristic curve.				
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36.01.00	For the following equipment the contractor shall submit the reports of all the type tests as per applicable standards and carried out within last ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. In case the Contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owner's representative and submit the reports for approval. (a.) NUMERICAL RELAYS (b.) ETHERNET SWITCHES (c.) FIBRE OPTIC CABLE (d.) LOCAL PUSH BUTTON STATION (e.) LOCAL MOTOR STARTER (f.) LIGHTING / WELDING TRANSFORMER (g) MCCB																			
36.02.00	Type test reports for the following tests on the model of the Numerical relays, Ethernet switches shall be submitted for owner's review. <table><thead><tr><th>Test</th><th>Specification</th></tr></thead><tbody><tr><td colspan="2">1 Functional requirements</td></tr><tr><td>1 Features and logics</td><td>IEC61850</td></tr><tr><td>2 Checking of compatibility with co-operating devices</td><td>IEC61850</td></tr><tr><td>3 Communication</td><td>IEC61850</td></tr><tr><td colspan="2">2 Mechanical construction requirements</td></tr><tr><td>1 General inspection</td><td>Manufacturer's document</td></tr><tr><td>2 Inspection of marking and data</td><td>IEC 60255-6</td></tr></tbody></table>				Test	Specification	1 Functional requirements		1 Features and logics	IEC61850	2 Checking of compatibility with co-operating devices	IEC61850	3 Communication	IEC61850	2 Mechanical construction requirements		1 General inspection	Manufacturer's document	2 Inspection of marking and data	IEC 60255-6
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	3	Clearances and creepage distances	IEC 60255-5
	4	Degree of protection by enclosure	IEC 60529
	3	Insulation requirements	
	1	Dielectric test	IEC 60255-5
	2	Impulse voltage test	IEC 60255-5
	3	Insulation resistance measurements	IEC 60255-5
	4	Accuracy requirements	
	1	Measurement accuracy of characteristic quantity and specified time	IEC 60255-6
	2	Limits of frequency range and frequency dependence	IEC 60255-6
	3	Limits of ambient temperature and ambient temperature dependence	IEC 60255-6
	4	Limits of operative range of auxiliary energizing inputs and auxiliary voltage dependence	IEC 60255-6
	5	Rated burden requirements	
	1	Measuring circuits	IEC 60255-6
	2	Auxiliary circuits	IEC 60255-6
	3	Signalling inputs	IEC 60255-6
	6	Thermal requirements	
	1	Temperature rise	IEC 60255-6
	2	Limiting continuous thermal withstand values	IEC 60255-6
			IEC 60255-6
	3	Limiting short-time thermal withstand values	
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	7 Limiting dynamic value requirements IEC 60255-6 8 Power supply requirements 1 Limiting duration of interruptions to dc auxiliary voltage IEC 60255-11 2 Limiting value of ripple in dc auxiliary voltage IEC 60255-11 3 Limiting value of voltage dips to ac auxiliary voltage IEC 61000-4-11 4 Limiting duration of interruptions to ac auxiliary voltage IEC 61000-4-11 5 Limiting variations of ac auxiliary voltage IEC 61000-4-11 9 Electromagnetic compatibility requirements 1 High frequency disturbance test IEC 60255-22-1 2 Electrostatic discharge test IEC 60255-22-2, 61000-4-2 3 Radiated, radio-frequency, electromagnetic field immunity test IEC 60255-22-3, 61000-4-3 4 Fast transient disturbance test IEC 60255-22-4, 61000-4-4 5 Surge immunity test IEC 60255-22-5, 61000-4-5 6 Immunity to conducted disturbances, induced by radio-frequency fields IEC 60255-22-6, 61000-4-6 7 Power frequency immunity test IEC 60255-22-7 8 Conducted and Radiated radio-frequency emission tests IEC 60255-25, EN55011-CISPR 11 9 Power frequency magnetic field immunity test IEC 61000-4-8		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
37.05.00	10 Environmental requirements			
	1	Dry cold test	IEC 60068-2-1	
	2	Dry heat test	IEC 60068-2-2	
	3	Storage temperature test	IEC 60068-2-8	
	4	Damp heat test, cyclic (12 + 12 hour cycle)	IEC 60068-2-30	
	11 Contact performance requirements			
	1	Make and carry for dc	IEC 60255-23	
	2	Breaking capacity for dc	IEC 60255-23	
	3	Make and break ac	IEC 60255-23	
	12 Mechanical performance requirements			
	1	Durability of relay operation	IEC 60255-6	
	2	Durability of plug-in relays	IEC 60255-6	
	3	Durability of relay setting controls	IEC 60255-6	
	4	Vibration response and endurance test	IEC 60255-21-1	
	5	Shock response and withstand test	IEC 60255-21-2	
	6	Bump test	IEC 60255-21-2	
	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet. All routine tests as per the specification and relevant standard IS 8623 shall be carried out. An indicative lists of tests / checks is mentioned as QA chapter . However, the manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.			
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37.06.00	All procedures for type tests shall be approved by owner before commencement of type tests. However, the following points may be specifically noted.			
	1)	For temperature rise tests, the connection arrangement between the source and the test equipment shall be such that the temperature gradient in the connection piece of cable at a distance of one meter away from the test equipment shall be restricted to 5 deg C.		
	2)	Milli Volt drop test shall be done on switching devices before and after the type tests.		
	3)	Bolt tightness of busbar joints shall be checked with torque wrench before and after short time rating tests on the circuit breaker and MCC panels.		
37.07.00	Routine checking to observe compliance to degree of protection, first numeral , on switchboard enclosures and busbar chambers shall be as under :			
	1) IP -4 X	It shall not be possible to insert a one mm dia. Steel wire into the enclosure from any direction, without using force.		
	2) IP-5X	It shall not be possible to insert a thin sheet of paper under gaskets and through enclosure joints.		
37.00.00	ERECTION / INSTALLATION OF SWITCHBOARDS AND OTHER EQUIPMENTS			
37.01.00	Each equipment shall be installed in a neat, workman-like manner so that it is leveled, plumbed, squared and properly aligned and oriented. Tolerances shall be as established in Contractor's drawings or as stipulated by owner. No equipment shall be permanently fixed down to foundations until the alignment has been checked and found acceptable by the owner.			
37.02.00	Contractor shall furnish all supervision, labour, tools, equipment, rigging materials, bolts, wedges, anchors, etc., in proper time, required to completely install, test and commission the equipment.			
37.03.00	Manufacturer's and owner's instructions and recommendations shall be correctly followed in handling, setting, testing and commissioning of all equipment.			
37.04.00	Contractor shall move all equipment into the respective rooms through the regular door or openings specifically provided for this purpose. No part of the structure shall be utilised to lift or erect any equipment without prior permission of Engineer.			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
37.05.00	All switchboards shall be installed in accordance with Indian Standard, IS: 3072, and owner's instructions.			
37.06.00	Switchboard panels shall be installed on concrete floor or supported on steel channel / edge angle in concrete trenches. The Contractor shall provide steel insert plates in the concrete floor and / or steel channels / edge angle on the trenches as applicable. The base frame of switchboards shall be welded to the insert plates by the Contractor. The Contractor shall be required to install and align the panels using suitable metallic shims before welding the base frame. In joining shipping sections of switchboards together, adjacent housing of panel sections or flanged throat sections shall be bolted together after alignment has been completed.			
37.07.00	Contractor shall take utmost care in handling instruments, relays and other delicate mechanisms. Wherever the instruments and relays are supplied separately they shall be mounted only after the associated panels have been erected and aligned. the blocking materials employed for safe transit of instruments and relays shall be removed after ensuring that panels have been completely installed and no further movement of the same would be necessary. Any damage shall be immediately reported to Engineer.			
37.08.00	Equipment furnished with finished coats of paint shall be touched up by Contractor if their surface is spoiled or marred during erection / commissioning.			
37.09.00	The room and floor finishing work would be done after erection of the panels and the Contractor shall suitably cover up the panels to protect them from injury and marring of finish.			
38.00.00	COMMISSIONING CHECKS / TESTS			
38.01.00	After installation of panels, power and control wiring and connections, Contractor shall perform operational tests on all switchboards, to verify proper operation of switchboards / panels and correctness of all equipment in each and every respect.			
38.02.00	The Contractor shall carry out the following commissioning checks, in addition to other checks and tests recommended by the manufacturers.			
38.03.00	GENERAL			
	(a.) Check name plate details according to the approved drawings.			
	(b.) Check for physical damage.			
	(c.) Check tightness of all bolted connections, by torque wrench.			
	(d.) Check earth connections.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
38.04.00 38.05.00	(e.) Check cleanliness. (f.) Check all moving parts for proper lubrication. Circuit Breakers (a.) Check alignment of breaker truck for free movement. (b.) Check correct operation of shutters. (c.) Check control wiring for correctness of connections, continuity And IR values. (d.) Manual operation of breakers completely assembled. (e.) Closing /opening operation, manually and electrically. (f.) Trip free and anti-pumping operation. (g.) I.R. values of contacts. (h.) Contact resistance. (i.) Check on spring charging motor, correct operation of limit switches and time or charging. (j.) All functional checks (k.) Breaker closing and tripping time, if required. Current Transformers (a.) Visual inspection. (b.) IR Value (c.) Ratio check. (d.) Magnetising current. (e.) Wiring connection. (f.) Spare CT cores, if any, to be shorted and earthed		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 46 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
38.06.00	Voltage Transformers			
	(a.) Visual inspection.			
	(b.) IR Value			
	(c.) Ratio check			
	(d.) Mangnetising current			
	(e.) Line connection as per connection diagram			
38.07.00	Cubicle Wiring			
	(a.) Check all switch developments			
	(b.) Each wire shall be traced by continuity tests and it shall be ensured that the wiring is as per relevant drawing. All inter-connections between panels / equipment shall be similarly checked.			
	(c.) All the wires shall be meggered to earth.			
	(d.) Functional checking of all control circuit e.g., closing, tripping, control, interlock, supervision and alarm circuit.			
38.08.00	Relays			
	1. Check connections and wiring.			
	2. Megger			
	a) Megger all terminals to body.			
	b) Megger AC to DC terminals.			
	3. Check operating characteristics by secondary injection.			
	4. Check minimum pick up voltage of DC coils.			
	5. Check operation of electrical / mechanical targets.			
	6. Relay settings.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
38.09.00	7. Check CT and VT connections with particular reference to their polarities. Meters (a.) Visual inspection. (b.) Megger all insulated partitions. (c.) Check CT and VT connections with particular reference to their polarities for power type meters. (d.) Calibration.			
39.00.00	AC MODULES DESCRIPTION			
39.01.00	Module type DAE (Circuit Breaker Module) (a.) One (1) Triple-pole circuit breaker, complete with all accessories and power operated mechanism, as specified. (b.) Three (3) Current transformers for Protection and metering. (c.) One (1) DC isolating Switch (d.) Six (6) HRC Control fuses. (e.) Numerical relay for the following: • Short Circuit Protection • Earth Fault Protection • Over Load protection • Energy Metering • Current and Voltage metering • Trip Circuit Supervision • CB Monitoring • Synchronizing Check feature			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
39.02.00	Module Type DAET (Circuit Breaker Incomer From Transformer) Similar to module type DAE; but with additional PS Class Current transformers for Restricted Earth Fault Protection. The Numerical relay shall have provision for REF protection in addition to the features listed against module type DAE.			
39.03.00	Module Type CC (Contactor Changeover Between Two In Coming Supplies) (Note: Main and Reserve incomers shall be housed in separate drawout modules, located in different panels.) The drawout modules shall be provided with service position limit switch having 2 NO+2NC contacts. Main Incomer One (1) Triple pole load break isolating switch . One (1) Triple pole contactor with coil suitable for 415 V AC. Two (2) Auxiliary contactors with coil suitable for 415 V AC. One (1) Indicating lamp with resistor and coloured lens suitable for 415 V AC. Three (3) HRC control fuses. Reserve Incomer One (1) Triple pole load break isolating switch One (1) Triple pole contactor with coil suitable for 415 V AC. One (1) Indicating lamp with resistor and coloured lens suitable for 415 V AC. Two (2) HRC control fuses.			
39.04.00	Module Type CS (AC Control Supply Module) (Note: Module type CS will be of non-drawout type) Two (2) 415/110 V control transformers. Four (4) 110V auxiliary relays. Two (2) Earth links. Eight (8) HRC Control fuses.			
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CLAUSE NO.
TECHNICAL REQUIREMENTS

39.05.00	Two (2) Selector switches	Module Type DG (Circuit Breaker Incoming From DG Set)
(a.) One (1)	Triple-pole circuit breaker, complete with all accessories and power operated mechanism, as specified.	
(b.) Three (3)	Current transformers for protection & metering.	
(c.) One (1)	DC isolating Switch	
(d.) Six (6)	HRC control fuses	
(e.)	Numerical relay for the following:	
•	Differential protection	
•	Over Load protection	
•	Reverse Power Protection	
•	DG Neutral displacement	
•	Energy Metering	
•	Current and Voltage metering	
•	DG Monitoring	
39.06.00	Module Type E/E1/E2 (Switch Fuse Module/MCCB)	
(a.) One (1)	Triple pole switch-fuse unit with three pole isolating switch and three / one / two HRC fuses for E/E1/E2 modules, respectively.	
(b.) One (1)	Neutral link.	
(c.) One (1)	3 pole MCCB (for rating 100A and above)	
39.07.00	Module Type G1 (VT Module with Under Voltage / No Volt Relay)	
(a.) Three (3)	415V $\sqrt{3}$ / 110V $\sqrt{3}$ V single phase voltage transformers, mounted on a common draw-out chassis	
(b.) Three (3)	HRC fuses for VT primary.	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
39.08.00	(c.)	Three (3)	HRC control fuses.	
	Module Type H (Isolating Switch Module)			
	(a)	One (1)	Triple pole load break isolating switch	
	(b)	One (1)	Neutral link	
39.09.00	Module type K1 (Non Reversible Motor Rated Below 30 kW Controlled from MCC)			
	(a)	One (1)	Triple pole fuse switch unit with three pole load break isolating switch and three HRC fuses.	
	(b)	One (1)	Triple pole contactor.	
	(a.) (c)	One (1)	Bimetallic thermal overload relay with single phasing preventer. For motor with high starting time, heavy duty overload relay shall be provided.	
	(d)	Two (2)	Push buttons.	
	(e)	Three (3)	Indicating lamps with resistors and coloured lenses.	
	(f)	One (1)	HRC control fuse.	
	(g)	One (1)	Control link.	
39.10.00	Module Type K11 (Non reversible Motor Rated 30kW to 200kW Controlled from MCC)			
	Similar to module type K1 but with the following additions:			
	One (1) Current transformer for metering.			
	One (1) Ammeter			
	One (1) Single-pole switch and fuse for motor space heater.			
39.11.00	Module type DK2 (Non Reversible Motor rated below 30kW Controlled from DDCMIS)			
	(a)	One (1)	Triple pole switch fuse unit with three pole load break	
			Isolating switch and three HRC fuses.	
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
39.12.00	(b)	One (1) Triple pole contactor.		
	(c)	One (1) Bimetallic thermal overload relay with single phasing preventor. Modules marked with * (DK2* / PK2*) shall not have this relay. For motor with high starting time, heavy duty overload relay shall be provided.		
	(d)	Three (3) Indicating lamps with resistors and coloured lenses.		
	(e)	One (1) HRC control fuse.		
	(f)	One (1) Control link		
	(g)	One (1) Auxiliary contactor		
	(h)	Two (2) Coupling relays suitable for 24V DC.		
	(i)	One (1) digital energymeter with analog output of current (4-20 mA) for CHP dust suppression motors.		
	Module Type DK21 (Non Reversible Motor rated 30kW to up to 110KW (* See Remark) controlled from DDCMIS).			
(* Remark : For CHP Motors –upto 160 KW				
39.13.00	(a)	Similar to module type DK2 but with the following additions :		
	(b)	One (1) Current transformer for metering.		
	(c)	One (1) Ammeter (for motors of rating ≥ 30kW & < 110kW)		
	(d)	One (1) Single-pole switch and fuse for motor space heater.		
	(e)	One (1) Digital Energy Meter with Analog output of Current (4-20 mA) (for motors of rating ≥ 30kW & < 110kW and all dust suppression motors)		
	Module Type DN1 (Reversible Motor Controlled from DDCMIS)			
	(a.)	One (1) Triple pole fuse switch unit with three pole load break solating switch and three HRC fuses.		
	(b.)	Two (2) Triple pole mechanically interlocked, forward / reverse contactors.		
	(c.)	One (1) Bimetallic thermal overload relay with single phasing preventor.		
(d.)	One (1) Indicating lamp with resistor and coloured lens.			
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- (e.) One (1) HRC control fuse
- (f.) One (1) Control link
- (g.) One (1) Auxiliary contactor
- (h.) Two (2) Coupling relays suitable for 240V DC.

39.14.00

Module Type VM (Voltmeter Module)

- (a.) Three (3) HRC fuses.
- (b.) One (1) Voltmeter (0-500 V.)
- (c.) One (1) Four position voltmeter selector switch
- (d.) One (1) 415 V auxiliary contactor with 2 NO + 2 NC contacts.
- (e.) One (1) Voltage transducer with output of 4-20mA between R & Y phases

39.15.00

Module Type DM (Circuit Breaker (DDC /PLC Controlled) Motor Feeder for motor rated 110 KW & above (except for CHP motors).

- (a.) One (1) Triple-pole circuit breaker, complete with all accessories and power operated mechanism, as specified.
- (b.) Three (3) Current transformers for Protection and metering.
- (c.) One (1) DC isolating Switch
- (d.) Six (6) HRC Control fuses.
- (e.) One (1) Single-pole switch and fuse for motor space heater
- (f) Numerical relay for the following:

Short Circuit Protection (50)

Thermal Over Load protection(511)

Earth fault Protection(50N)

Negative sequence Protection(46)

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
	Restart inhibit protection(49) Locked Rotor Protection Energy Metering Current and Voltage metering Trip Circuit Supervision CB Monitoring		
40.00.00	DC MODULES DESCRIPTION		
40.01.00	Module Type -CH (Incomer from Charger)		
	(a)	One (1)	Double pole, 250 V DC fuse -switch unit
40.02.00	Module Type -DB (Incomer from Battery)		
	(a)	Two (2)	HRC fuses with striker pins and Fuse monitoring relays with contacts for alarm. These fuses shall be mounted in a separate fiber glass / plastic enclosure and located in the battery room.
	(b)	One (1)	DC ammeter with shunt and centre zero. This shall be mounted in the DCDB.
40.03.00	Module Type - DC		
	(a)	One (1)	Double pole 250V DC switch / circuit breaker with 2NO+2NC auxiliary contacts.
40.04.00	Module Type - HD (DC Isolating Switch / Circuit - Breaker Module)		
	(a)	One (1)	Double pole , 250 V DC switch isolator / circuit breaker
40.05.00	Module Type-S (DC Metering and Protection Module)		
	(a)	One (1)	Voltmeter, 0-300V DC
	(b)	One (1)	Three position voltmeter selector switch
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
40.06.00	(c)	One (1)	Instantaneous under voltage relay (27) with a setting of 95% of 240V DC. The resetting ratio of relay should not be more than 1.05.	
	(d)	One (1)	Instantaneous over voltage relay (59) which shall operate at 110% of 240 V DC. The resetting ratio of relay should not be less than 0.95.	
	(e)	One (1)	Earth leakage relay having adjustable pick up range between 3 to 7mA. The relay shall be suitable for 240V / 50V DC and 240V AC auxiliary supply. The relay shall be Alstom type CAEM-21 or equivalent.	
	(f)	Two (2)	Indicating lamps with resistors & coloured lenses, one each for 'Earth fault' and 'DC supply failure ' indications.	
	(g)	Three (3)	HRC control fuses.	
	(h)	One (1)	Neutral link	
40.07.00	Module Type -X (DC Isolating Switch Fuse Module)			
40.08.00	(a)	One (1)	Double pole , 250 V DC fuse switch unit with two HRC fuses.	
	Module Type DW1 (DC Solenoid Valve Controlled from DDC)			
	(a)	One (1)	Double pole 250 V DC isolating switch	
	(b)	Two (2)	HRC fuses	
	(c)	One (1)	Contactor with coil suitable for 240 V DC.	
	(d)	One (1)	Auxiliary contactor with coil suitable for 240 V DC	
40.08.00	(e)	One (1)	Coupling relay	
	(f)	One (1)	Diode with peak inverse voltage of 440 V.	
	Module Type Q (Incomer to DC Lighting DB)			
	(a)	One (1)	Double pole , 250 V DC switch isolator	
40.08.00	(b)	One (1)	Power Contactor	
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	(c) Two (2) Instantaneous under voltage relays (27) with a setting of 60% of 110V AC. (d) One (1) Timer having a delay of 0.5 to 3 sec. on pick-up with 2 self reset NO contacts, suitable for 240 Volts DC. (e) Two (2) Indicating lamps with resistors & coloured lenses, one each for 'On' and 'Off' indications. (f) Four (4) HRC control fuses (g) Two (2) Neutral links																																																															
41.00.00	SELECTION TABLES																																																															
41.01.00	Feeder Module, Other than Motor Selection Table (415 V AC) <table> <tr> <th>Sl. No.</th><th>Feeder Rating (Amp.)</th><th>Switch/MCCB Rating (Amp.)</th><th>Fuse Rating (Amp.)</th><th>Cable Size (sq. mm)</th></tr> <tr><td>1.</td><td>0-16</td><td>16</td><td>16</td><td>4CX6</td></tr> <tr><td>2.</td><td>17-32</td><td>32</td><td>32</td><td>4CX16</td></tr> <tr><td>3.</td><td>33-45</td><td>63</td><td>63</td><td>3¹/₂CX35</td></tr> <tr><td>4.</td><td>46-63</td><td>63</td><td>63</td><td>3¹/₂CX70</td></tr> <tr><td>5.</td><td>64-99</td><td>100</td><td>100</td><td>3¹/₂CX70</td></tr> <tr><td>6.</td><td>100</td><td>125A MCCB</td><td></td><td>3¹/₂CX70</td></tr> <tr><td>7.</td><td>101-160</td><td>250A MCCB</td><td></td><td>3CX150+1-1CX150</td></tr> <tr><td>8.</td><td>161-250</td><td>400A MCCB</td><td></td><td>**</td></tr> <tr><td>9.</td><td>251-400</td><td>400A MCCB</td><td></td><td>**</td></tr> <tr><td>10.</td><td>630-1120 (Breaker)</td><td></td><td></td><td>7-1CX630</td></tr> <tr><td>11.</td><td>1121-1680 (Breaker)</td><td></td><td></td><td>10-1CX630</td></tr> </table>				Sl. No.	Feeder Rating (Amp.)	Switch/MCCB Rating (Amp.)	Fuse Rating (Amp.)	Cable Size (sq. mm)	1.	0-16	16	16	4CX6	2.	17-32	32	32	4CX16	3.	33-45	63	63	3 ¹ / ₂ CX35	4.	46-63	63	63	3 ¹ / ₂ CX70	5.	64-99	100	100	3 ¹ / ₂ CX70	6.	100	125A MCCB		3 ¹ / ₂ CX70	7.	101-160	250A MCCB		3CX150+1-1CX150	8.	161-250	400A MCCB		**	9.	251-400	400A MCCB		**	10.	630-1120 (Breaker)			7-1CX630	11.	1121-1680 (Breaker)			10-1CX630
Sl. No.	Feeder Rating (Amp.)	Switch/MCCB Rating (Amp.)	Fuse Rating (Amp.)	Cable Size (sq. mm)																																																												
1.	0-16	16	16	4CX6																																																												
2.	17-32	32	32	4CX16																																																												
3.	33-45	63	63	3 ¹ / ₂ CX35																																																												
4.	46-63	63	63	3 ¹ / ₂ CX70																																																												
5.	64-99	100	100	3 ¹ / ₂ CX70																																																												
6.	100	125A MCCB		3 ¹ / ₂ CX70																																																												
7.	101-160	250A MCCB		3CX150+1-1CX150																																																												
8.	161-250	400A MCCB		**																																																												
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CLAUSE NO.	TECHNICAL REQUIREMENTS						
41.02.00	Note	i) The cables of size below 150 sq. mm shall be PVC insulated and those of size 150 sq. mm and above shall be XLPE insulated ii) All cables shall be of aluminium conductor except for 2.5 sq. mm size which shall be copper conductor. iii) ** - Shall be finalized based on actual requirement during detailed engineering. iv) Termination arrangement suitable for the above cable sizes shall be provided in the switchgear / MCC panels.					
	Motor Module Selection table (Except CHP motors)						
	Sl. No.	Motor rating kW	Max. Motor Amp.	Switch rating Amp.	Fuse rating Amp.	Contactor rating Amp.	Cable size Sq. mm
	1.	1.1-1.5	3.5	16	6/16	16	3CX2.5
	2.	1.6-3.0	7	32	20	16	3CX2.5
	3.	3.1-5.5	11	32	32	16	3CX6
	4.	5.6-7.0	14.4	63	50	32	3CX6
	5.	7.1-13.0	27.3	63	63	32	3CX16
	6.	13.1-24.0	45	125	80/100	63	3CX35
	7.	24.1-37.0	70	125	125	70 (upto 30kW) 100 (above 30kW)	3CX70
8.	37.1-55.0	100	250	160	100(upto 40kW) 160 (upto 55kW)	3CX120	
9.	55.1-80.0	150	250	200	200	3CX150	
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41.03.00	10.	80.1-100	180	As per selected fuse	Suitable for type-II	225	3CX150 (upto 90kW) 3CX240 (above 90kW)
	12.	110.0-200.0	CIRCUIT BREAKER				3-1CX300
	Note i) The cables of size below 150 sq. mm shall be PVC insulated and those of size 150 sq. mm and above shall be XLPE insulated. ii) All cables shall be of aluminum conductor except for 2.5 sq. mm size which shall be copper conductor.						
	Switch Fuse Module Selection Table (220 V DC) For all 220 V DC modules other than for motors, the ratings of switches fuses and cable termination shall be selected from the following table :						
	Sl. No.	Feeder rating Amp.	Switch rating Amp.	Fuse rating Amp.	Cable Size Sq.mm		
	1.	0-6	10	6	2CX2.5		
	2.	6-10	16	10	2CX2.5		
	3.	10-14	16	16	2CX2.5		
	4.	14-19	32	32	2CX6		
	5.	19-32	32	32	2CX16		
6.	32-53	63	63	2CX35			
7.	53-81	100	100	2CX70			
8.	81-114	125	125	2CX120			
9.	114-125	250	250	2-1CX150			
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CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC	
	10.	215-340	400	400	2-1CX300	
	11.	340-560	600	600	2-1CX630	
	12.	560-1000	Circuit Breaker		4-1CX630	
	13.	1000-1400	Circuit Breaker		6-1CX630	
	<i>Note i) The cables of size below 150 sq. mm shall be PVC insulated and those of size 150 sq. mm and above shall be XLPE insulated</i> <i>ii) All cables shall be of aluminum conductor except for 2.5 sq. mm size which shall be copper conductor.</i>					
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT		PAGE 59 OF 71

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LEGEND DESCRIPTION

52	CIRCUIT BREAKER
42	CONTACTOR
S.A.	SURGE ARRESTOR
	CURRENT TRANSFORMER
	CORE BALANCE CURRENT TRANSFORMER
	VOLTAGE TRANSFORMER
50	TRIPLE POLE IDMTL/DMT O/C PROTECTION
51	TRIPLE POLE INSTANTENIOUS O/C PROTN.
50N	IDMTL / DMT SENSITIVE E/F PROTECTION
51N	INSTANTENIOUS E/F PROTECTION
49	THREE PHASE THERMAL O/L PROTN. WITH O/L ALARM & RESTART INHIBITE FUNCTION
50L/R	STALLING / LOCKED ROTOR PROTECTION
45	THREE PHASE NEGATIVE PHASE SEQUENCE PROTECTION
66	NUMBER OF START LIMITATION/REPATIVE START PROTECTION
2	TIME DELAY RELAY
60	FUSE FAILURE PROTECTION
87M	3 PHASE MOTOR DIFFERENTIAL PROTECTION

LEGEND DESCRIPTION

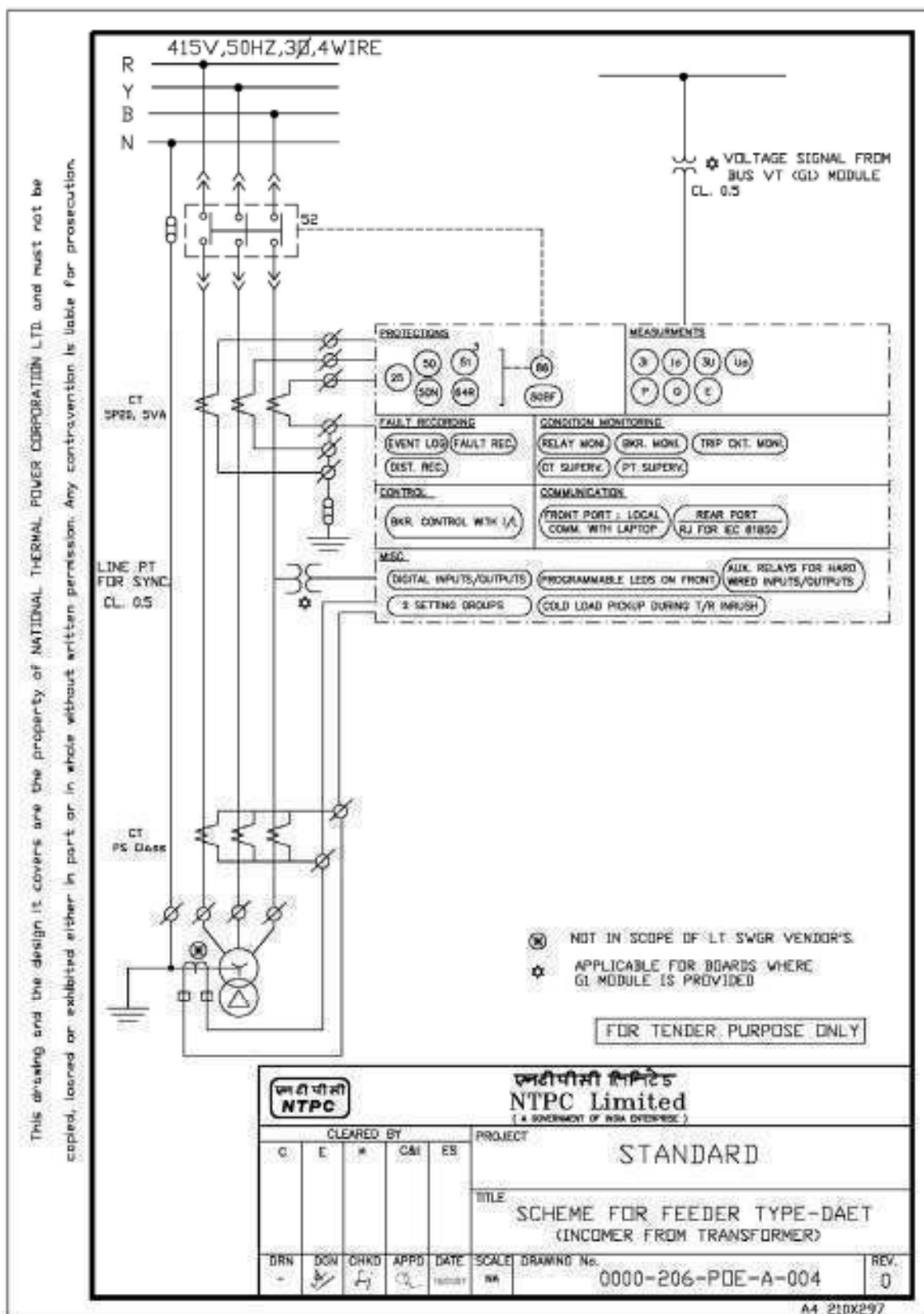
64R	RESTRICTED EARTH FAULT PROTECTION
51G	STAND BY EARTH FAULT PROTECTION
87T	3 PHASE BIASED TRANSFORMER DIFFERENTIAL PROTECTION
27M	3 PHASE UNDER VOLTAGE PROTECTION FOR MOTOR TRIPPING
27U	3 PHASE BUS UNDER VOLTAGE
27N	NO VOLT PROTECTION FOR BUS
50BF	CIRCUIT BREAKER FAILURE PROTECTION
86	LOCKOUT FUNCTION
3I	3 PHASE CURRENT MEASUREMENT
Io	NEUTRAL CURRENT MEASUREMENT
3U	3 PHASE VOLTAGE MEASUREMENT
Uo	RESIDUAL VOLTAGE MEASUREMENT
P	ACTIVE POWER MEASUREMENT
Q	REACTIVE POWER MEASUREMENT
E	ENERGY MEASUREMENT
PF	POWER FACTOR MEASUREMENT
HZ	FREQUENCY MEASUREMENT
HM	HOUR RUN METER

FOR TENDER PURPOSE ONLY

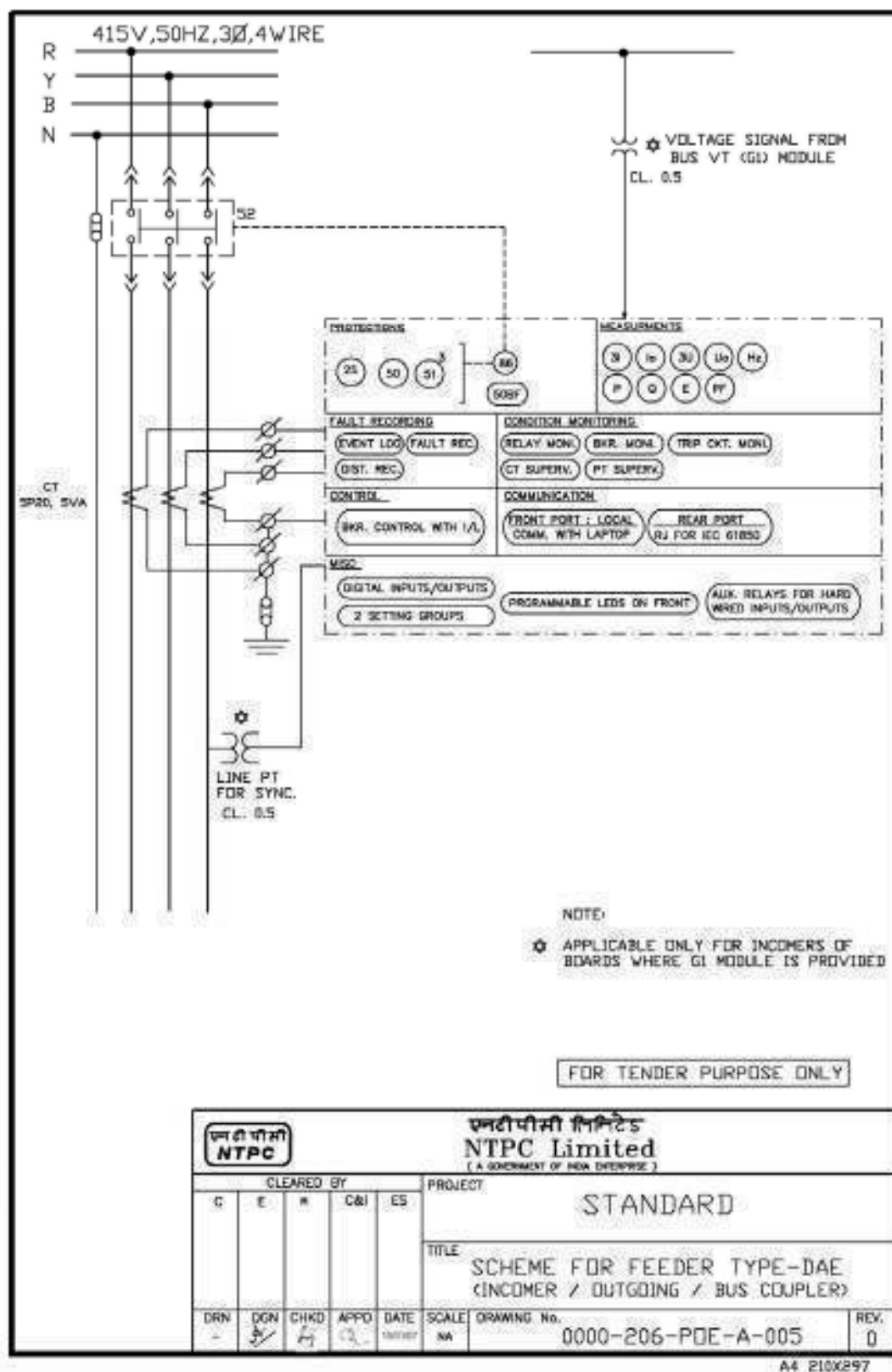
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		STANDARD	
		TITLE	
		LEGEND DETAILS	
DRN	DGN	CHKD	APPD
-			
DATE	SCALE	DRAWING No.	
000107	NA	0000-206-PDE-A-003	
			REV. 0

LEGEND.DWG

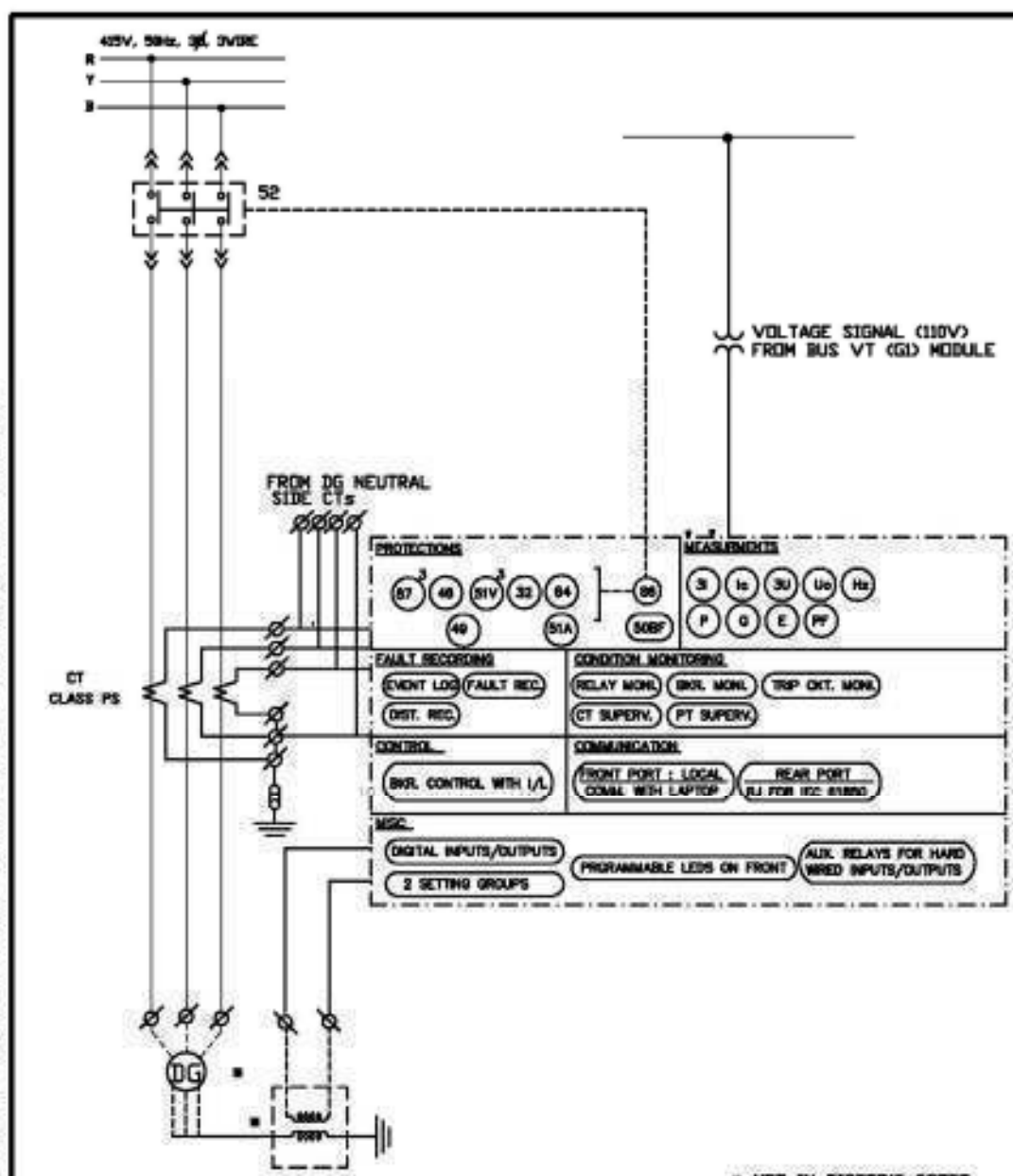
A4 210X297



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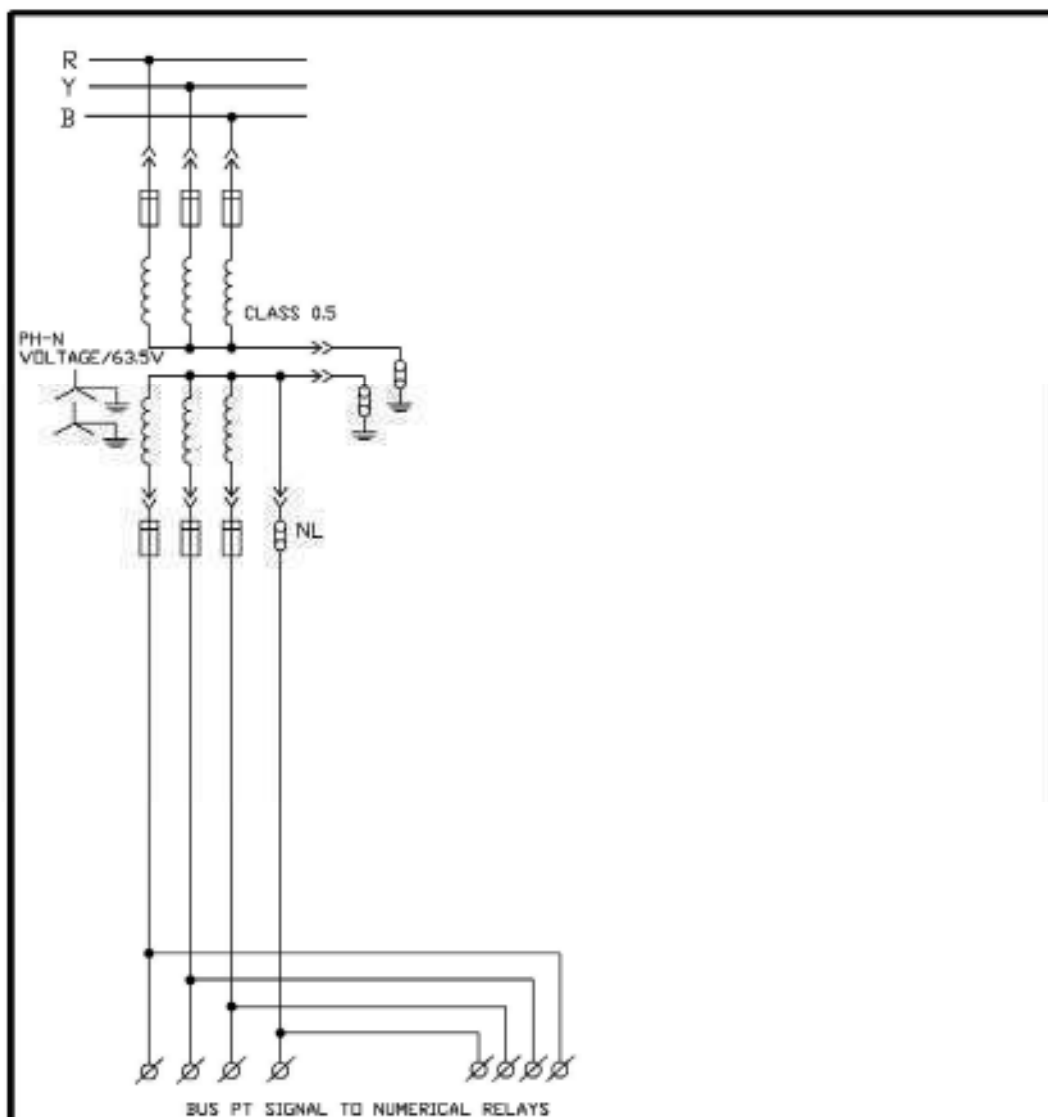


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CLEARED BY C E N C&I ES		PROJECT STANDARD	
TITLE SCHEME FOR FEEDER TYPE-DG (INCOMER FROM DG)		REV. 0	
DRN	DGN	CHKD	APPD
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12/01/07	NA	0000-206-PDE-A-006	0

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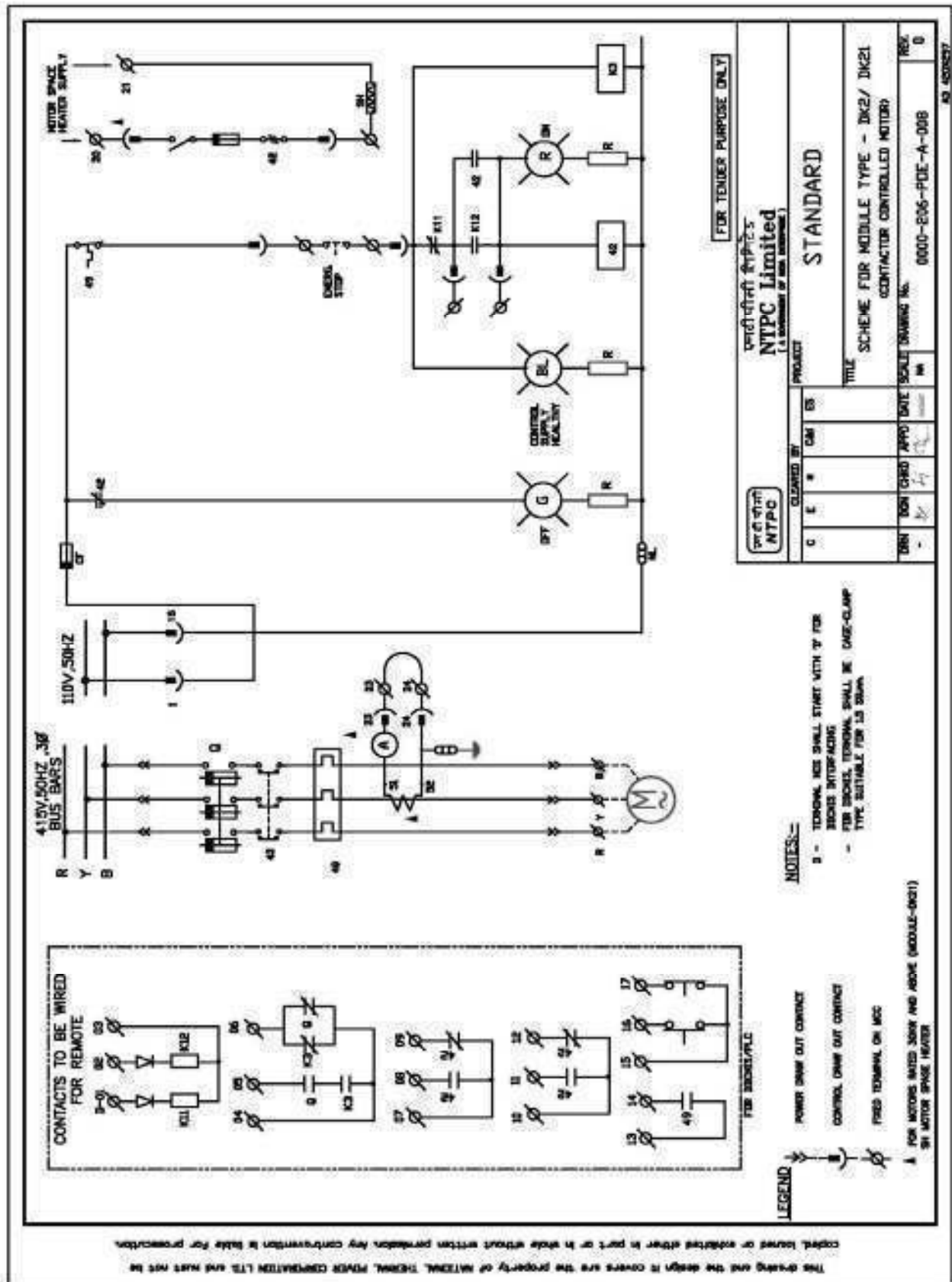
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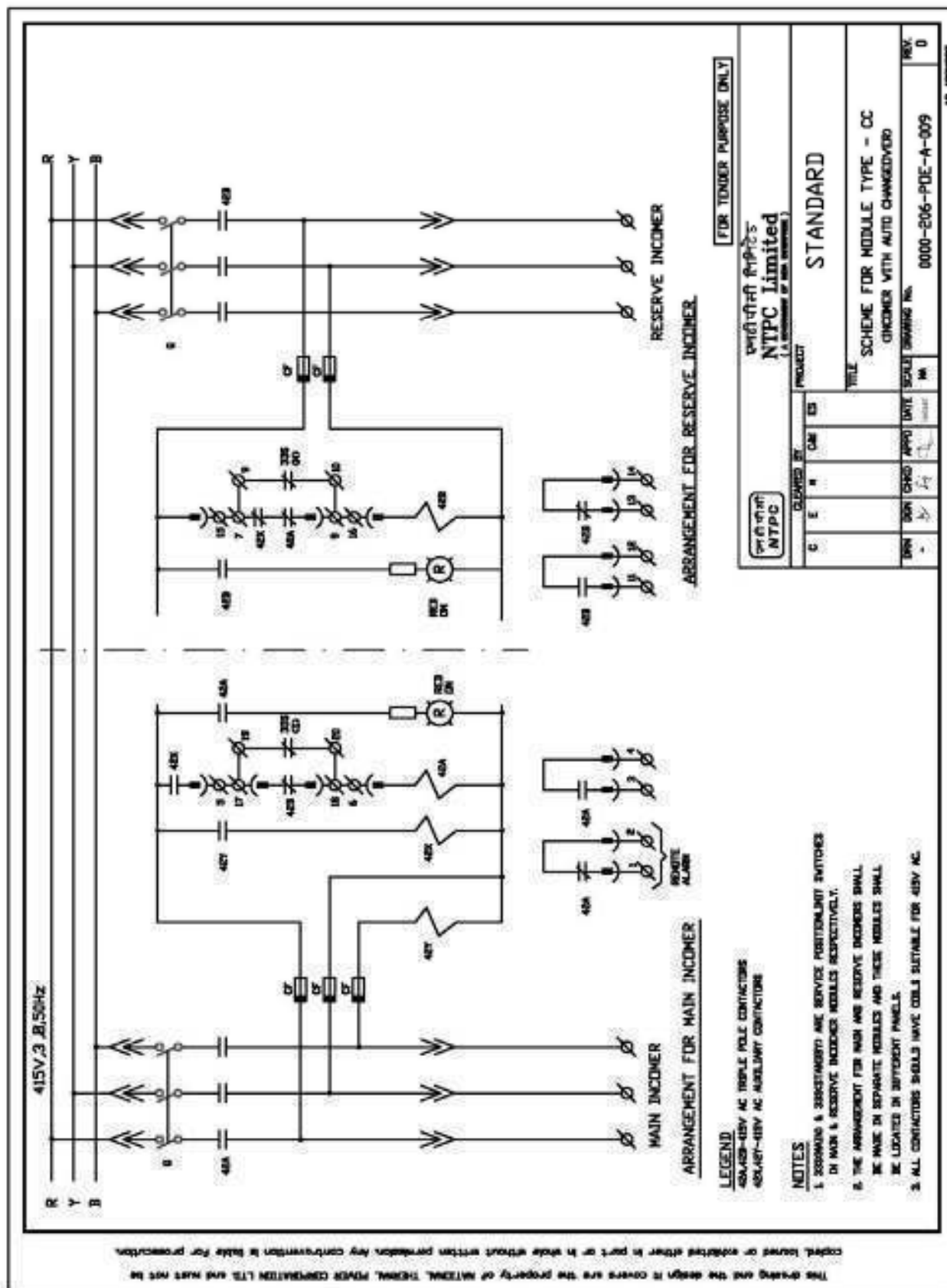


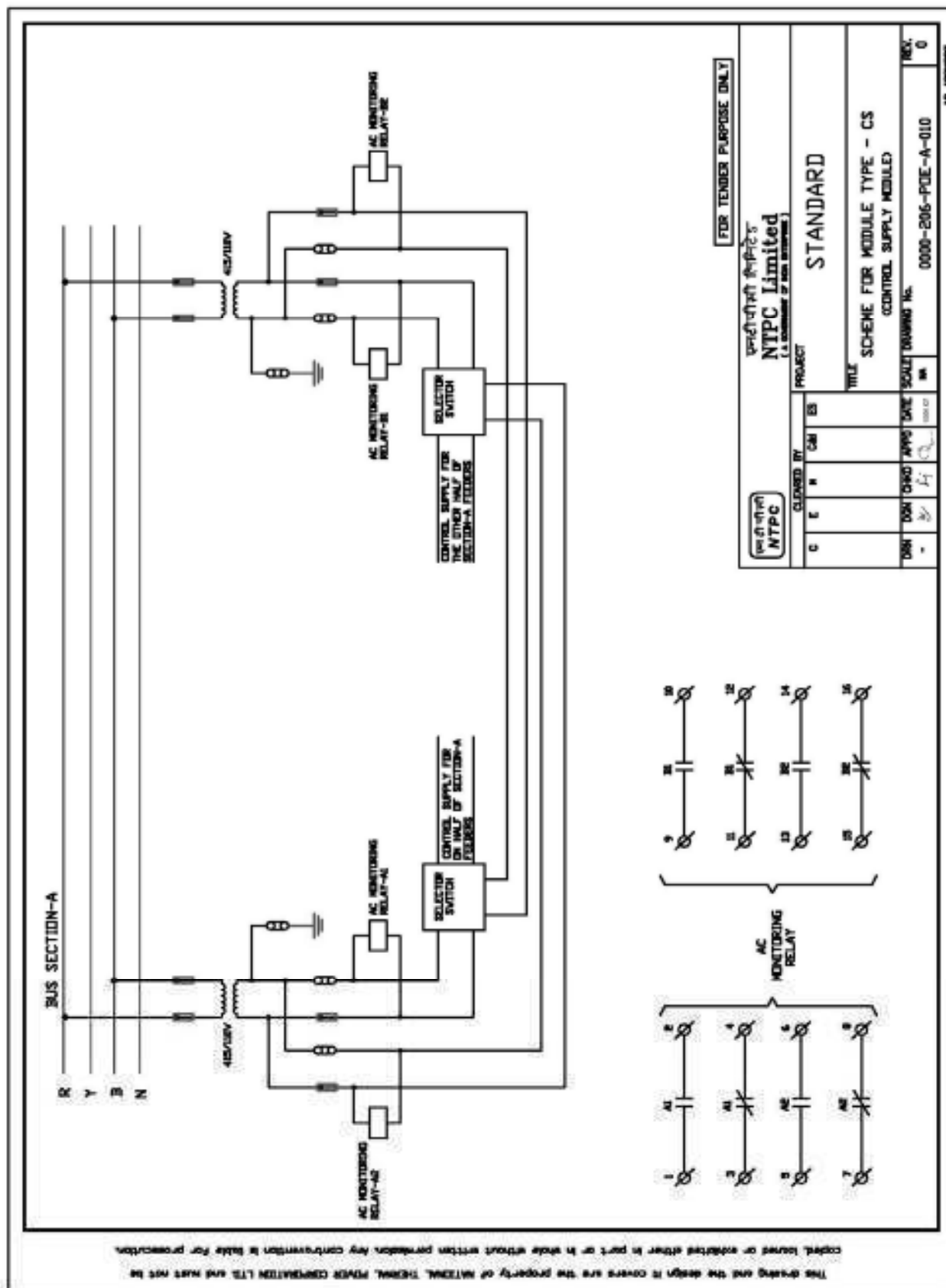
FOR TENDER PURPOSE ONLY

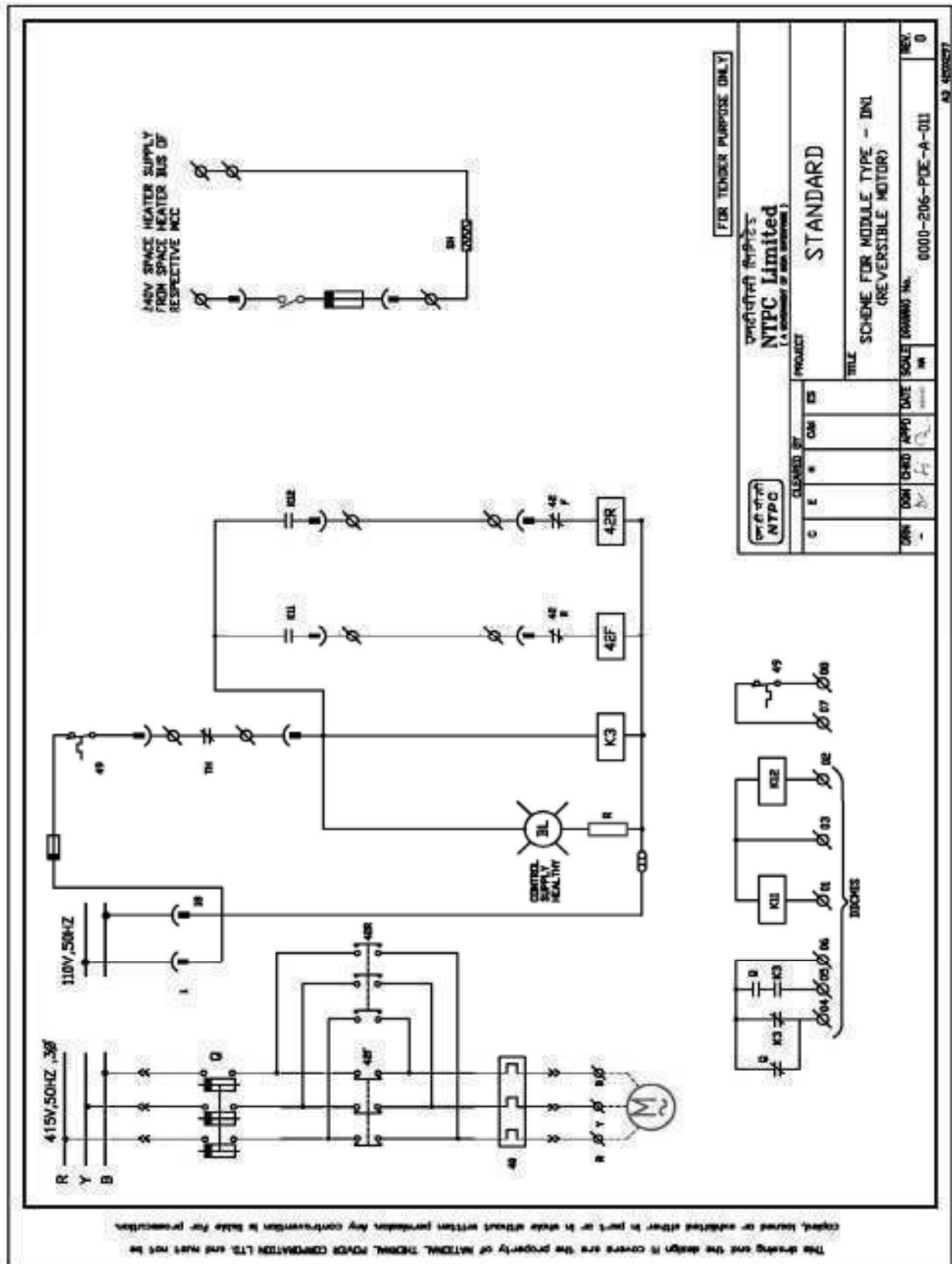
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C	E	M	CM	ES	STANDARD				
					TITLE				
					SCHEME FOR MODULE TYPE - G1 (BUS PT)				
OWN	DGN	CHKD	APPD	DATE	SCALE	DRAWING No.			REV.
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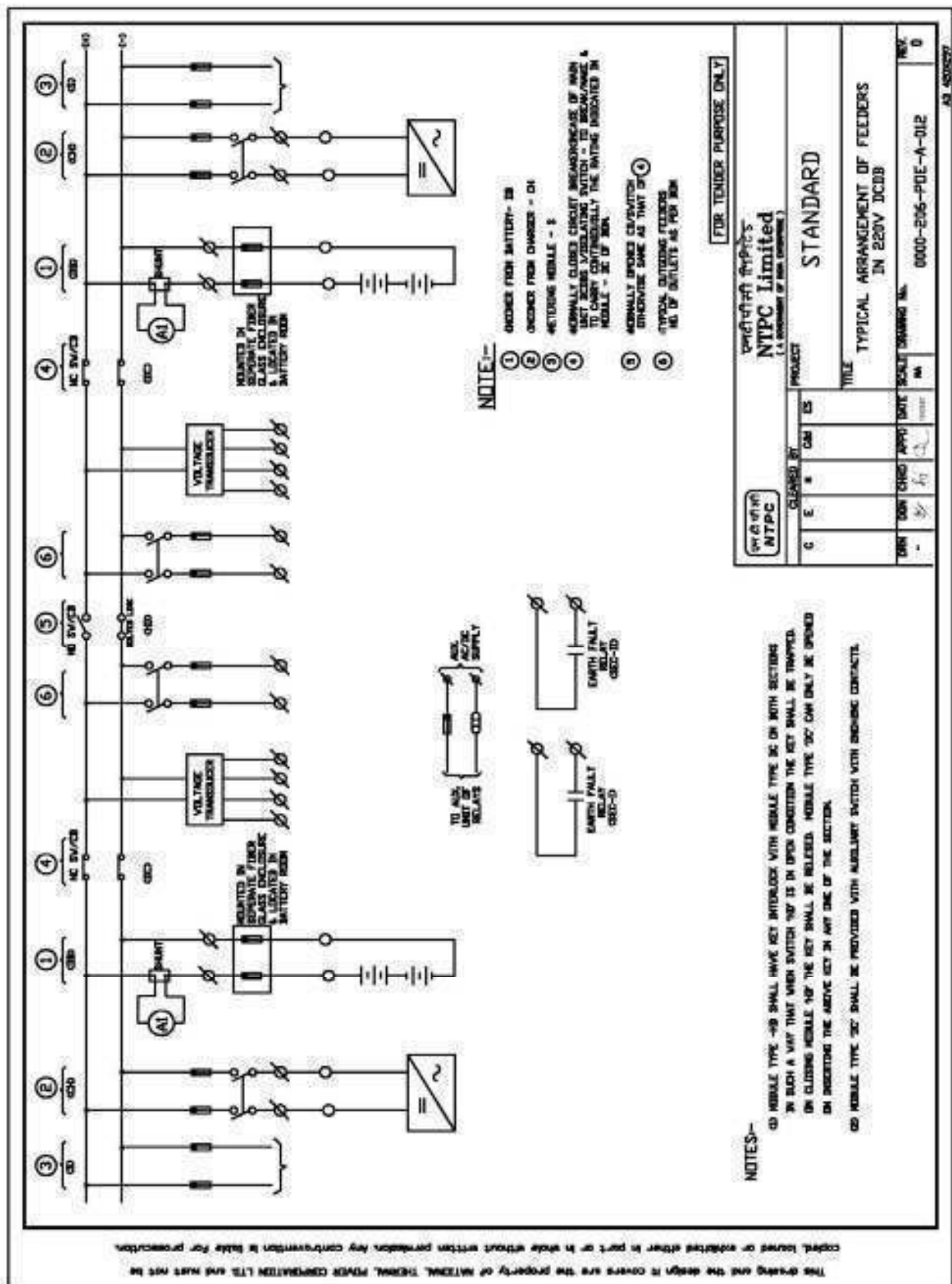
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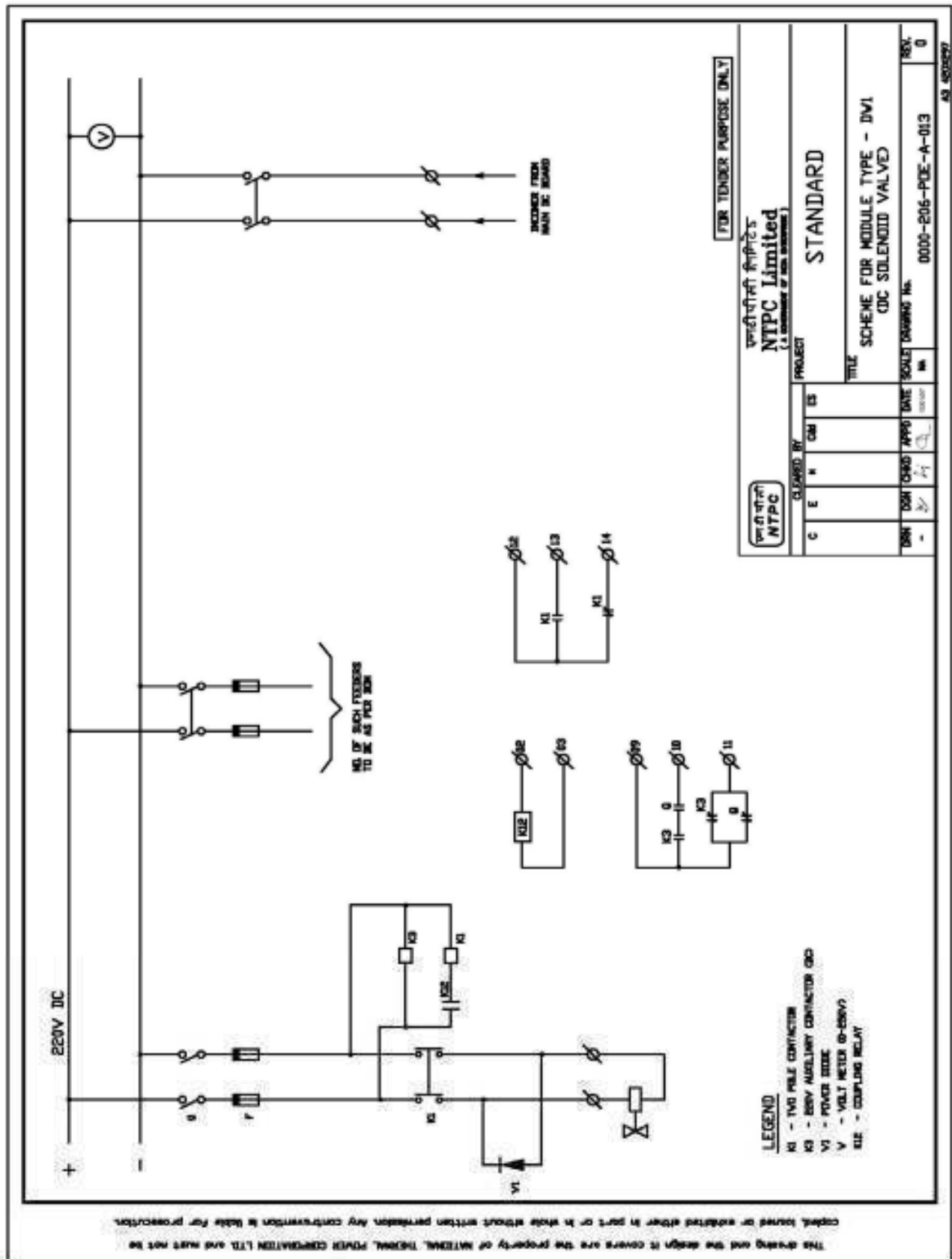












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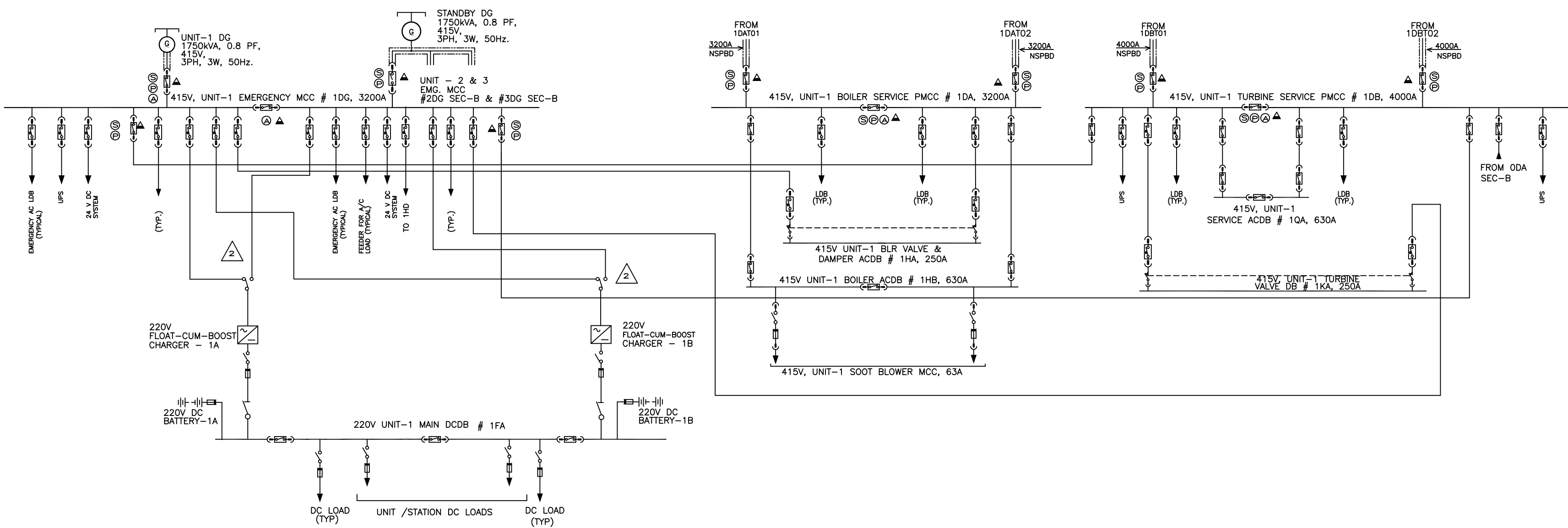
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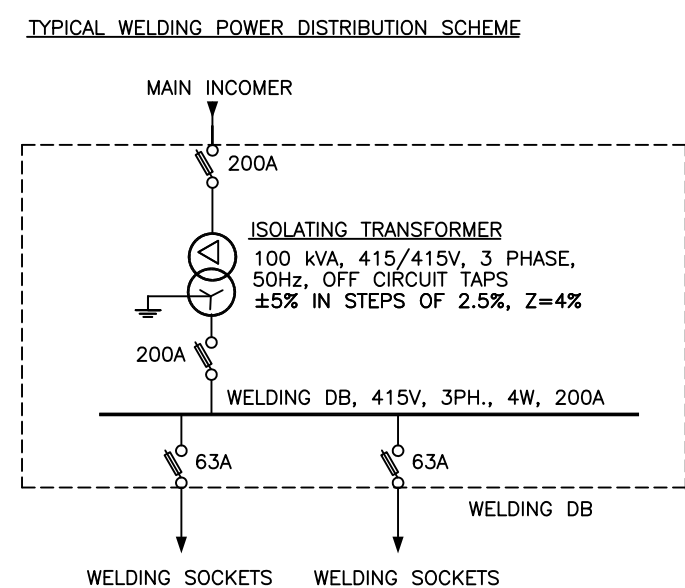
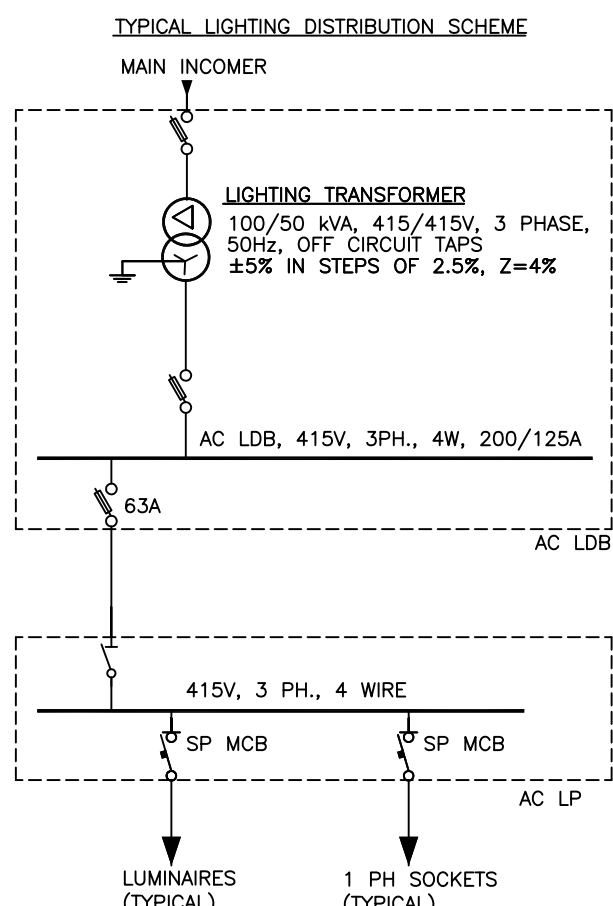
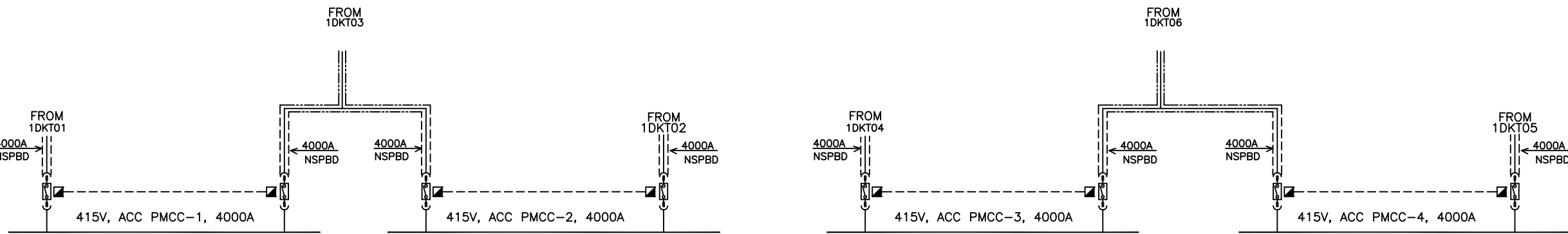
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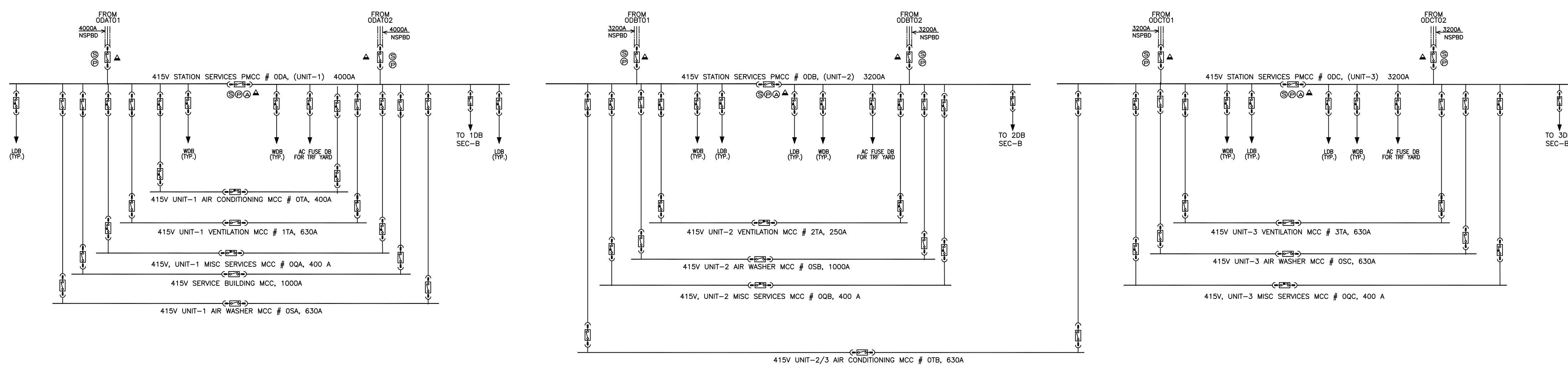
UNIT # 1 LV AUXILIARY SYSTEM DISTRIBUTION (DISTRIBUTION FOR UNIT # 2 & 3 SIMILAR TO UNIT # 1)



UNIT # 1 ACC SYSTEM DISTRIBUTION (DISTRIBUTION FOR UNIT # 2 & 3 SIMILAR TO UNIT # 1)



STATION LV AUXILIARY SYSTEM DISTRIBUTION



UNIT # 1 ESP SYSTEM DISTRIBUTION (DISTRIBUTION FOR UNIT # 2 & 3 SIMILAR TO UNIT # 1)

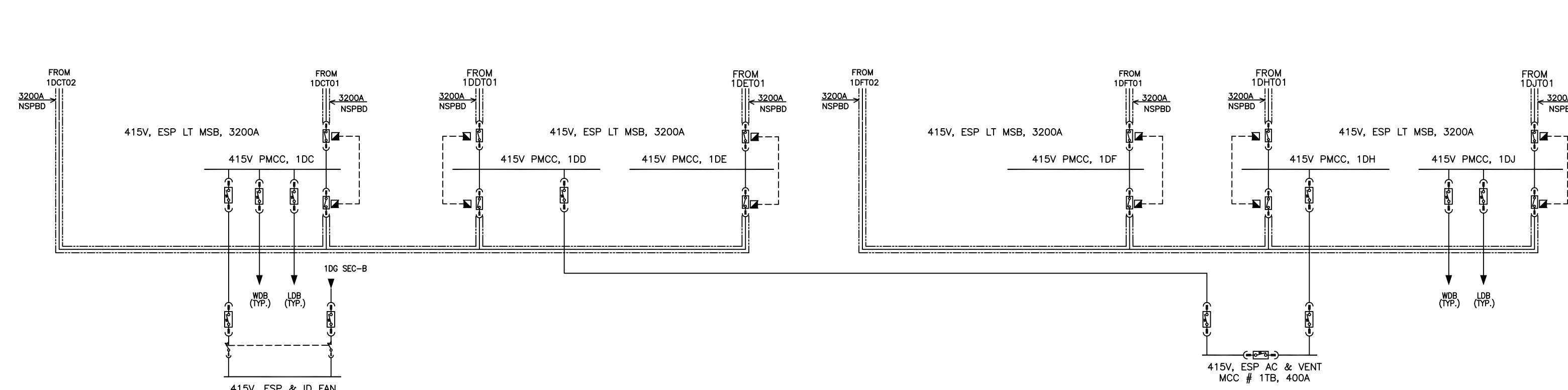
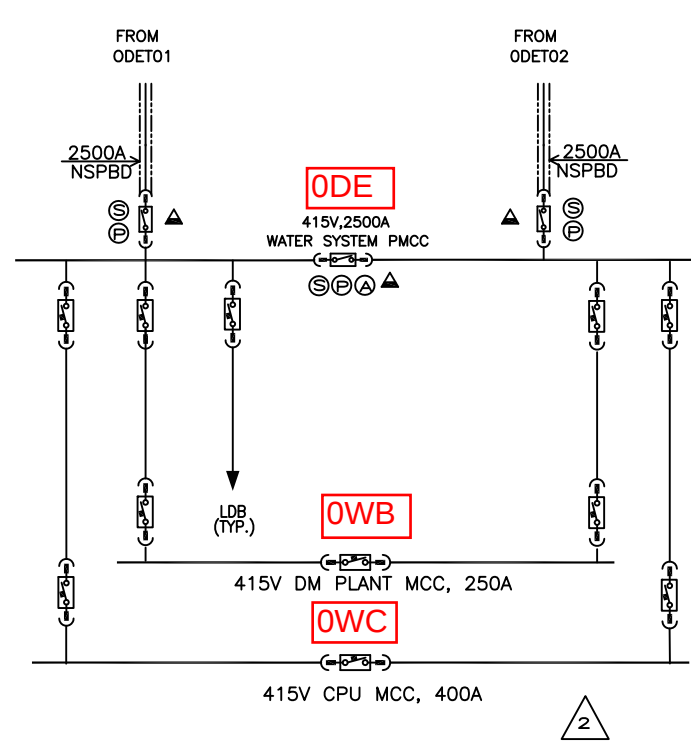


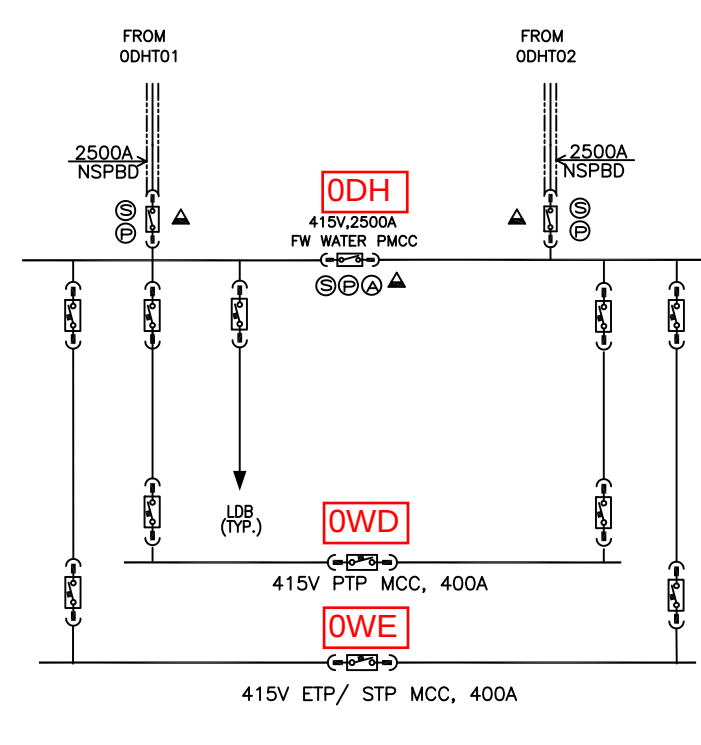
TABLE-4 : 3.3KV MOTORS

S. NO.	MOTOR ID	NAME PLATE RATING	DRIVE NO. CONNECTED ON											
			1CA		2CA		3CA		OCA		OCB		OCC	
			SEC-A	SEC-B	SEC-A	SEC-B	SEC-A	SEC-B	SEC-A	SEC-B	SEC-A	SEC-B	SEC-A	SEC-B
1.	MILLS	866 KW	1A,1C,1E,1G	1B,1D,1F,1H	2A,2C,2E,2G	2B,2D,2F,2H	3A,3C,3E,3G	3B,3D,3F,3H	-	-	-	-	-	-
2.	BCW PUMP	500 KW	1A	-	2A	-	3A	-	-	-	-	-	-	-
3.	COMPRESSOR	710 KW	-	-	-	-	-	-	-	-	-	-	A, C, E, G,	B, D, F
4.	DMCW PUMP (TG)	200 KW	1A,1C	1B	2A,2C	2B	3A,3C	3B	-	-	-	-	-	-
5.	CEP	1450 KW	1A	1B,1C	2A	2B,2C	3A	3B,3C	-	-	-	-	-	-
6.	ACW PUMP	280 KW	1A,1C	1B	2A,2C	2B	3A,3C	3B	-	-	-	-	-	-
7.	HYDRANT MAIN PUMP	220 KW	-	-	-	-	-	-	-	-	-	-	A	B, C
8.	SPRAY PUMP	230 KW	-	-	-	-	-	-	-	-	-	-	A	B
9.	APH WASH PUMP	315 KW	-	-	-	-	-	-	-	-	-	-	A	B
10.	AUX BOILER FD FAN	250 KW	A	B	-	-	-	-	-	-	-	-	-	-
11.	HOGGING PUMP	500 KW	1A	-	2A	-	3A	-	-	-	-	-	-	-
12.	AHS COOLING PUMP	160 KW	-	-	-	-	-	-	-	-	-	-	A	B
13.	TRANSPORT AIR COMP	500 KW	-	-	-	-	-	-	A, C, E, G, I, K, M, O	B, D, F, H, J, L, N	-	-	-	-
14.	BA SLURRY PUMP	310 KW	-	-	-	-	-	-	A, C, E, G,	B, D, F, H	-	-	-	-
15.	CRUSHER MOTOR	1000 KW	-	-	-	-	-	-	-	-	A, C	B, D	-	-
16.	CONVEYER	1000 KW	-	-	-	-	-	-	-	-	2A	2B	-	-
17.	CONVEYER	400 KW	-	-	-	-	-	-	-	-	1A, 3A, 4A	1B, 3B, 4B	-	-
18.	CONVEYER	260 KW	-	-	-	-	-	-	-	-	5A, 9A	5B, 9B	-	-
19.	CONVEYER	225 KW	-	-	-	-	-	-	-	-	6A, 7A, 8A	6B, 7B, 8B	-	-
20.	CONVEYER	350 KW	-	-	-	-	-	-	-	-	10A, 11A	10B, 11B	-	-

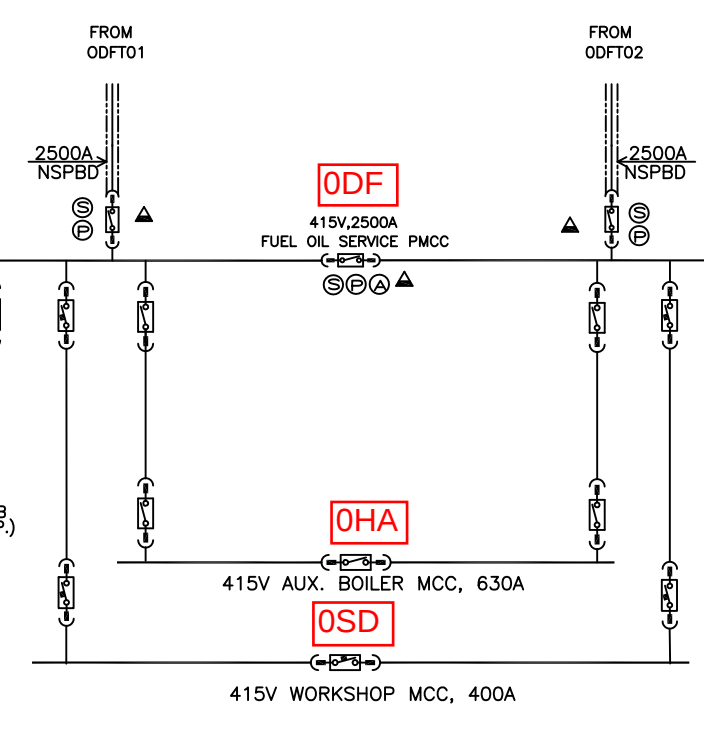
WATER SYSTEM PMCC



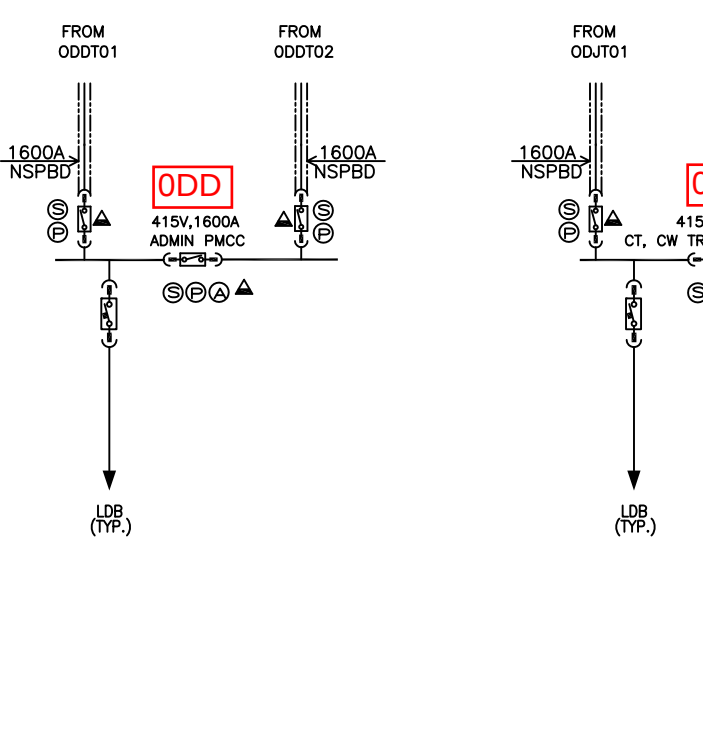
FW WATER PMCC



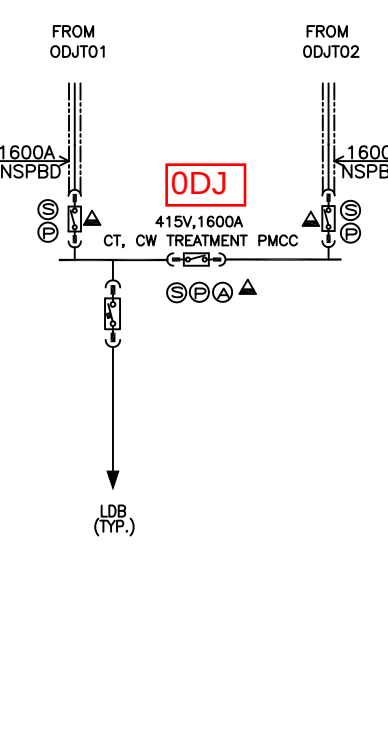
FUEL OIL SERVICE PMCC



ADMIN PMCC



CT. CW TREATMENT PMCC



NTPC DRG. No. 4410-001-200-PGE-U-011

CUSTOMER
NTPC LTD.
PROJECT

NORTH KARANPURA STPP (3X660MW)

JOB NO. 405
STATUS CONTRACT
DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

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DEPT. CODE
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18.12.14
CHD
PD/RG
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DATE
18.12.14
APPD
MK
SIGN
SIGNED
DATE
18.12.14

TITLE
ELECTRICAL SINGLE LINE DIAGRAM
FOR AUXILIARY POWER DISTRIBUTION

DEPT. SCALE NTS
SIGN
DATE
DRAWING NO.
PE-DG-405-565-E001
SHEET 2 OF 2
REV. 02

REV. 02
DATE 10.03.15
ALTD AS
CHD PD/RG
APPD MK

REV. 01
DATE 09.01.15
ALTD AS
CHD PD/RG
APPD MK

DRAWING REVISED IN LINE WITH
NTPC COMMENT DTD. 31.03.15
AND BHEL REPLY.

DRAWING REVISED IN LINE WITH
NTPC COMMENT DTD. 09.01.15
AND BHEL REPLY.

SIZE-A0

Name of the Board: EMERGENCY MCC # 1DG

TYPE OF CONNECTION: SANDWITCH BUSUDCT TOP ENTRY

DOUBLE FRONT D/O TYPE

FLOOR MOUNTED

RATING	NKP FEEDER TYPE	
		ACTUAL
3200A	DAE(I/C)	2
3200A	DAEG(I/C)	2
3200A	DAEG(B/C)	1
UPTO 5.5KW	DK2	44
7.1-13KW	DK2	20
13.1-24KW	DK2	2
UPTO 5.5KW	DK2**	10
7.1-13KW	DK2**	10
30.0-37.0KW	DK21	8
40.1-55KW	DK21	5
80.1-90KW	DK21	10
UP TO 32A	E3	35
63A	E3	8
100A	E3	2
125A	E3	8
250A	E3M	6
400A	E3M	13
	G2	2
5KVA	CS	2
3000A	ACB I/C PANELS	2
3000A	ACB B/C PANEL	1
2500A	ACB I/C PANELS	2
3000A	MCC (DF)	29
3000A	300mm DUMMY PANEL	1

Name of the Board: BOILER SERVICE PMCC# 1DA

TYPE OF CONNECTION: TOP/SIDE BUSDUCT ENTRY

DOUBLE FRONT D/O TYPE

FLOOR MOUNTED

RATING	NIORTH KARANPURA FEEDER TYPE	
		ACTUAL
2500A	DAET (I/C)	2
2500A	DAET(B/C)	1
630A	DAE(O/G)	3
UPTO 5.5KW	DKE2	5
5.6-7.0KW	DKE2	8
7.1-13KW	DKE2	3
13.1-24KW	DKE2	2
UPTO 5.5KW	DK2**	16
UPTO 5.5KW	DK2	28
13.1-24KW	DK2	4
30.0-37.0KW	DK21	2
80.1-90KW	DK21	4
110-124.9KW	DM	4
63A	E	5
250A	E	6
	G1	2
5KVA	CS	2
2500A	ACB I/C PANELS	2
2500A	ACB B/C PANEL	1
2500/630A	ACB O/G PANELS	4
2500A	MCC (DF)	16
	DUMMY PANEL 500MM	1

Name of the Board: BOILER VALVE AND DAMPER BOARD#1HA

TYPE OF CONNECTION: CABLE ENTRY

DOUBLE FRONT D/O TYPE

FLOOR MOUNTED

RATING	FEEDER TYPE	ACTUAL
250A	CC I/C	2
UP TO 32A	E3	180
63A	E3	35
	VM	1
250A	MCC (DF)	18
	DUMMY PANEL 3	1

Name of the Board: BOILER ACDB#1HB

TYPE OF CONNECTION: CABLE ENTRY

DOUBLE FRONT D/O TYPE

FLOOR MOUNTED

RATING	FEEDER TYPE	ACTUAL
630A	DAE-I/C	2
630A	DAE-B/C	1
UP TO 32A	E3	85
63A	E3	20
UP TO 32A	E1	99
63A	E1	2
	G1	2
630A	ACB I/C PANELS	2
630A	ACB B/C PANEL	1
630A	MCC (DF)	19
630A	DUMMY PANEL	1

Name of the Board: ESP ID FAN AREA MCC #1HD

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
400A	E3M-I/C	2
400A	E3M-B/C	1
UP TO 5.5KW	DK2	10
7.1-13KW	DK2	4
13.1-24KW	DK2	5
UP TO 32A	E3	15
63A	E3	9
UP TO 32A	E1	12
	VM	2
1KVA	J4 (110V AC CONTROL SUPPLY)	2
400A	MCC (DF)	7

Name of the Board: TURBINE SERVICE PMCC# 1DB

TYPE OF CONNECTION: TOP/SIDE BUSDUCT ENTRY

DOUBLE FRONT D/O TYPE

FLOOR MOUNTED

RATING	North Karanpura FEEDER TYPE	
		ACTUAL
4000A	DAET(IC)	2
4000A	DAET(B/C)	1
3200A	DAE-TIE(OG)	3
630A	DAE O/G	3
125-160KW	DM	3
UPTO 5.5KW	DKE2	13
7.1-13KW	DKE2	3
13.1-24KW	DKE2	2
24.1-29KW	DKE2	3
40.1-55KW	DKE21	3
90.1-109.9KW	DKE21	10
UPTO 5.5KW	DK2	22
13.1-24KW	DK2	4
UP TO 32A	E3	10
63A	E3	3
125A	E3	3
200A	E3	2
250A	E3	6
32A	E1	6
11KW	DK2**	6
	G1 BUSPT	2
5KVA	CS (110V AC CONTROL SUPPLY)	2
4000A	ACB I/C PANELS	2
4000A	ACB B/C PANEL	1
4000/630A	ACB O/G PANELS	6
4000/3200A	ACB O/G PANELS	3
4000A	MCC (DF)	16
	DUMMY PANELS 500MM	2

Name of the Board: BOILER ACDB#1HB

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
630A	DAE(I/C)	2
630A	DAE (B/C)	1
UP TO 32A	E3	40
63A	E3	12
UP TO 32A	E1	42
	VM	2
630A	ACB I/C PANELS	2
630A	ACB B/C PANEL	1
630A	MCC (DF)	10

Name of the Board: TURBINE VALVE AND DAMPER BOARD#1KA

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	QUANTITY	
		as per PO	ACTUAL
250A	CC		2
UP TO 32A	E3	288	288
63A	E3	52	25
	VM		2
250A	MCC (DF)	30	22
630A	DUMMY PANEL	2	2

Name of the Board: STATION SERVICE PMCC# 0DA

TYPE OF CONNECTION: TOP/SIDE BUSDUCT ENTRY

DOUBLE FRONT D/O TYPE

FLOOR MOUNTED

SL.NO.	RATING	MODULE TYPE	QUANTITY
1	4000A	DAET-I/C	2
2	4000A	DAET-B/C	1
3	1000A	DAE-O/G	3
4	630A	DAE-O/G	2
5	630A	EM3	7
6	400A	EM3	8
7	250A	EM3	6
8	125A	E3	8
9	63A	E3	8
		G1 BUSPT	2
	5KVA	CS (110V AC CONT	2
	4000A	ACB I/C PANELS	2
	4000A	ACB B/C PANEL	1
	4000/630A	ACB O/G PANELS	6
	4000/3200A	ACB O/G PANELS	5
	4000A	MCC (DF)	10
	4000A	DUMMY PANELS 50	2

Name of the Board: AIR CONDITIONING MCC#0TA

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	TYPE OF FEEDER	QTY
400A	EM3 IC	2
UP TO 5.5KW	DK2	27
13.1-24KW	DK2	10
30.0-37.0KW	DK21	4
UP TO 32A	E3	37
63A	E3	12
UP TO 32A	E1	8
125A	DK21** HEATER	4
	G1	2
1KVA	CS (110V AC CONTROL SUPPLY)	2
400A	MCC (DF)	14

Name of the Board: VENTILLATION MCC# 1TA

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
630A	DAE-IC	2
630A	DAE-BC	1
13.1-24KW	DK2	14
30.0-37.0KW	DK21	9
UP TO 5.5KW	DK2	20
UP TO 32A	E3	37
63A	E3	4
UP TO 32A	E1	25
	G1 (BUS PT)	2
2KVA	CS(110V AC CONTROL SUPPLY)	2
630A	ACB I/C PANELS	2
630A	ACB B/C PANEL	1
630A	MCC (DF)	14

Name of the Board: ESP AC & VENT MCC #1TB

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
400A	E3M-I/C	2
400A	E3M-B/C	1
UP TO 5.5KW	DK2	6
7.1-13KW	DK2	4
13.1-24KW	DK2	5
UP TO 32A	E3	15
63A	E3	9
UP TO 32A	E1	12
	VM	2
1KVA	J4 (110V AC CONTROL SUPPLY)	2
400A	MCC (DF)	7

Name of the Board: MISC. SERVICE MCC#0QA

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	TYPE OF FEEDER	QTY
400A	EM3 IC	2
UP TO 5.5KW	DK2	27
13.1-24KW	DK2	10
30.0-37.0KW	DK21	4
UP TO 32A	E3	37
63A	E3	12
UP TO 32A	E1	8
125A	DK21** HEATER	4
	G1	2
1KVA	CS (110V AC CONTROL SUPPLY)	2
400A	MCC (DF)	14

Name of the Board: SERVICE BUILDING MCC#

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	QTY
1000A	DAE IC	2
1000A	DAE BC	1
UP TO 5.5KW	DK2	18
13.1-24KW	DK2	14
UP TO 32A	E3	60
63A	E3	15
250A	E3	6
UP TO 32A	E1	20
UP TO 5.5KW	DK2**	30
	G1 (BUS PT)	2
2KVA	CS (110V AC CONTROL SUPPLY)	2
630A	ACB I/C PANELS	2
630A	ACB B/C PANEL	1
630A	MCC (DF)	17

Name of the Board: AIR WASHER MCC#0SA

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
630A	DAE IC	2
630A	DAE BC	1
30.0-37.0KW	DK21	9
13.1-24KW	DK2	12
UP TO 5.5KW	DK2	4
UPTO 32A	E3	62
125A	E3	3
	G1(BUS PT)	2
2KVA	CS (CONTROL SUPPLY)	2
630A	ACB PANELS	3
630A	MCC DF PANEL	11

Name of the Board: 220V MAIN DCDB#1FA
TYPE OF CONNECTION: CABLE ENTRY BOTTOM
DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	QTY
400A	CH I/C	2
800A	DB ACB I/C	2
UP TO 32A	SFU-O TYPE	121
63A	SFU-O TYPE	12
100A	SFU-O TYPE	8
125A	SFU-O TYPE	4
250A	SFU-O TYPE	2
	M (BUS PT)	2
630A	MCC (DF)	15

Name of the Board: AIR CONDITIONING MCC #0TB (UNIT-2&3)

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	
		ACTUAL
630A	DAE-IC	2
630A	DAE-IC	1
UP TO 5.5KW	DK2	23
13.1-24KW	DK2	4
30.0-37.0KW	DK21	4
UP TO 32A	E3	76
63A	E3	17
100A	E3	4
125A	E3	6
250A	E3M	5
315A	E3M	4
UP TO 32A	E1	23
	G1 BUSPT	2
	CS (110V TEST SUPPLY)	2
630A	ACB I/C PANELS	2
630A	ACB B/C PANEL	1
630A	MCC (DF)	19

Name of the Board: WATER SYSTEM PMCC

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
2500A	DAET IC	2
2500A	DAET-BC	1
1600A	DAE- ACB O/G	4
630A	DAE- ACB O/G	4
125-160KW	DM	4
30.0-37.0KW	DK21	7
40.1-55KW	DK21	9
80.1-90KW	DK21	5
110-125KW	DM	3
UP TO 5.5KW	DK2	2
7.1-13KW	DK2	14
UP TO 32A	E3	46
63A	E3	4
250A	E3M	2
400A	E3M	6
UP TO 32A	E1	8
	J2 (110V TEST SUPPLY)	2
2500A	ACB I/C PANELS	2
2500A	ACB B/C PANEL	1
2500/1600A	ACB O/G PANELS	4
2500/630A	ACB O/G PANELS	8
2500A	MCC (DF)	20

Name of the Board: DM PLANT MCC

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
250A	CC	2
UP TO 5.5KW	DK2	10
7.1-13KW	DK2	4
13.1-24KW	DK2	5
UP TO 32A	E3	15
63A	E3	9
UP TO 32A	E1	12
	VM	2
1KVA	J4 (110V AC CONTROL SUPPLY)	2
250A	MCC (DF)	7

Name of the Board: CPU PLANT MCC

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
250A	CC	2
UP TO 5.5KW	DK2	12
7.1-13KW	DK2	5
13.1-24KW	DK2	7
UP TO 32A	E3	15
63A	E3	9
UP TO 32A	E1	12
	VM	2
1KVA	J4 (110V AC CONTROL SUPPLY)	2
250A	MCC (DF)	7

Name of the Board: FIRE WATER PMCC

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
2500A	DAET IC	2
2500A	DAET-BC	1
1600A	DAE- ACB O/G	4
630A	DAE- ACB O/G	4
125-160KW	DM	4
30.0-37.0KW	DK21	7
40.1-55KW	DK21	9
80.1-90KW	DK21	5
110-125KW	DM	3
UP TO 5.5KW	DK2	2
7.1-13KW	DK2	14
UP TO 32A	E3	46
63A	E3	4
250A	E3M	2
400A	E3M	6
UP TO 32A	E1	8
	J2 (110V TEST SUPPLY)	2
2500A	ACB I/C PANELS	2
2500A	ACB B/C PANEL	1
2500/1600A	ACB O/G PANELS	4
2500/630A	ACB O/G PANELS	8
2500A	MCC (DF)	20

Name of the Board: PTP MCC

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
400A	E3M-I/C	2
400A	E3M-B/C	1
UP TO 5.5KW	DK2	10
7.1-13KW	DK2	4
13.1-24KW	DK2	5
UP TO 32A	E3	15
63A	E3	9
UP TO 32A	E1	12
	VM	2
1KVA	J4 (110V AC CONTROL SUPPLY)	2
400A	MCC (DF)	7

Name of the Board: STP MCC

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

400A	E3M-I/C	2
400A	E3M-B/C	1
UP TO 5.5KW	DK2	10
7.1-13KW	DK2	4
13.1-24KW	DK2	5
UP TO 32A	E3	15
63A	E3	9
UP TO 32A	E1	12
	VM	2
1KVA	J4 (110V AC C	2
400A	MCC (DF)	7

Name of the Board: FUEL OIL SYSTEM PMCC

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
2500A	DAET IC	2
2500A	DAET-BC	1
1600A	DAE- ACB O/G	4
630A	DAE- ACB O/G	4
125-160KW	DM	4
30.0-37.0KW	DK21	7
40.1-55KW	DK21	9
80.1-90KW	DK21	5
110-125KW	DM	3
UP TO 5.5KW	DK2	2
7.1-13KW	DK2	14
UP TO 32A	E3	46
63A	E3	4
250A	E3M	2
400A	E3M	6
UP TO 32A	E1	8
	J2 (110V TEST SUPPLY)	2
2500A	ACB I/C PANELS	2
2500A	ACB B/C PANEL	1
2500/1600A	ACB O/G PANELS	4
2500/630A	ACB O/G PANELS	8
2500A	MCC (DF)	20

Name of the Board: AUXILLIARY BOILER MCC

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	
		ACTUAL
630A	DAE-IC	2
630A	DAE-IC	1
UP TO 5.5KW	DK2	23
13.1-24KW	DK2	4
30.0-37.0KW	DK21	4
UP TO 32A	E3	76
63A	E3	17
100A	E3	4
125A	E3	6
250A	E3M	5
315A	E3M	4
UP TO 32A	E1	23
	G1 BUSPT	2
	CS (110V TEST SUPPLY)	2
630A	ACB I/C PANELS	2
630A	ACB B/C PANEL	1
630A	MCC (DF)	19

Name of the Board: WORKSHOP MCC

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
400A	E3M-I/C	2
400A	E3M-B/C	1
UP TO 5.5KW	DK2	10
7.1-13KW	DK2	4
13.1-24KW	DK2	5
UP TO 32A	E3	15
63A	E3	9
UP TO 32A	E1	12
	VM	2
1KVA	J4 (110V AC C	2
400A	MCC (DF)	7

Name of the Board: ADMIN MCC

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	ARANPURA FEEDER TYPE	
		ACTUAL
1600A	DAET (I/C)	2
1600A	DAET(B/C)	1
630A	DAE(O/G)	2
UPTO 5.5KW	DKE2	2
5.6-7.0KW	DKE2	6
UPTO 5.5KW	DKE2	3
5.6-7.0KW	DKE2	2
7.1-13KW	DKE2	3
13.1-24KW	DKE2	2
UPTO 5.5KW	DKE2**	16
UPTO 5.5KW	DK2	28
13.1-24KW	DK2	4
80.1-90KW	DK2	4
30.0-37.0KW	DK21	2
110-124.9KW	DM	4
63A	E	5
250A	E	6
	G1	2
5KVA	CS	2
1600A	ACB I/C PANEL	2
1600A	ACB B/C PANEL	1
1600/630A	ACB O/G PANEL	4
1600A	MCC (DF)	16
	DUMMY PANEL	1

Name of the Board: CT CW MCC

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	RANPURA FEEDER TYPE	
		ACTUAL
1600A	DAET (I/C)	2
1600A	DAET(B/C)	1
630A	DAE(O/G)	2
UPTO 5.5KW	DKE2	2
5.6-7.0KW	DKE2	6
UPTO 5.5KW	DKE2	3
5.6-7.0KW	DKE2	2
7.1-13KW	DKE2	3
13.1-24KW	DKE2	2
UPTO 5.5KW	DKE2**	16
UPTO 5.5KW	DK2	28
13.1-24KW	DK2	4
80.1-90KW	DK2	4
30.0-37.0KW	DK21	2
110-124.9KW	DM	4
63A	E	5
250A	E	6
	G1	2
5KVA	CS	2
1600A	ACB I/C PAN	2
1600A	ACB B/C PAN	1
1600/630A	ACB O/G PAN	4
1600A	MCC (DF)	16
	DUMMY PAN	1

Name of the Board: AIR WASHER MCC#0SB

TYPE OF CONNECTION: CABLE ENTRY BOTTOM

DOUBLE FRONT D/O TYPE

RATING	FEEDER TYPE	ACTUAL
1000A	DAE IC	2
1000A	DAE BC	1
30.0-37.0KW	DK21	18
13.1-24KW	DK2	24
UP TO 5.5KW	DK2	6
UPTO 32A	E3	62
125A	E3	3
	G1(BUS PT)	2
2KVA	J4 (CONTROL SUPPLY)	2
630A	ACB PANELS	3
630A	MCC DF PANEL	11

SL NO	MODULE TYPE	ITEM DESCRIPTION	QTY.
1	DAET (I/C)	PMCC INCOMER OF 1600A, 2500A, 3000A, 3200A, 4000A SHALL COMPRISE OF:	
		ACB TP, ELECTRICALLY OPERATED D/O TYPE, WITHOUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 2NC contacts.	1
		CONTROL FUSE 6A	15
		CONTROL FUSE 16A	4
		FUSE BASE 32A	19
		Indicating Lamp	5
		CURRENT TRANSFORMER (PROTECTION) 10VA, CL-5P20	3
		CURRENT TRANSFORMER (PROTECTION) with VDR 10VA, CL-PS	3
		POTENTIAL TRANSFORMER -CAST RESIN, OVER VOLTAGE FACTOR 1.2 CONT./1.5 FOR 30 SEC . 415/110, 50 VA CL-0.5 INSL CL-E	1
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-STUD TYPE	As required
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A, 220 V DC	2
		2POLE 2POS1 SELECTOR SWITCH KEY LOCKABLE-10A, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (51) • EARTH FAULT PROTECTION (51N) • OVER LOAD PROTERCTION • RESTRICTED EARTRH FAULT PROTECTION • RESIDUAL EARTH FAULT PROTECTION • TRIP CIRCUIT SUPERVISION (95) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASUREMENT • SYNCHRONIZING FEATURE • No of DI/DO SHALL BE AS PER SCHEME REQUIREMNET • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC ,HOWEVER THE THERSHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%)	1

		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Breaker Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
2	DAE (I/C)	MCC INCOMER OF 400A, 630A, 800A, 1000A, 1250A, 1600A SHALL COMPRISE OF:	
		ACB TP, ELECTRICALLY OPERATED D/O TYPE, WITHOUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 2NC contacts.	1
		CONTROL FUSE 6A	15
		CONTROL FUSE 16A	4
		FUSE BASE 32A	19
		Indicating Lamp	5
		CURRENT TRANSFORMER (PROTECTION) 10VA, CL-5P20	3
		POTENTIAL TRANSFORMER -CAST RESIN, OVER VOLTAGE FACTOR 1.2 CONT./1.5 FOR 30 SEC . 415/110,50 VA CL-0.5 INSL CL-E	1
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-STUD TYPE	As required
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A, 220 V DC	2
		2POLE 2POS1 SELECTOR SWITCH KEY LOCKABLE-10A, 220VDC	1

		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (51) • EARTH FAULT PROTECTION (51N) • OVER LOAD PROTECTION • RESIDUAL EARTH FAULT PROTECTION • TRIP CIRCUIT SUPERVISION (95) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASUREMENT • SYNCHRONIZING FEATURE • No of DI/DO SHALL BE AS PER SCHEME REQUIREMENT • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC ,HOWEVER THE THRESHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%)	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Breaker Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
3	DAET/DAE (B/C)	PMCC/MCC BUSCOUPLER OF 400A, 630A, 800A, 1000A, 1250A, 1600A, 2500A, 3000A, 3200A,4000A SHALL COMPRISE OF:	
		ACB TP, ELECTRICALLY OPERATED D/O TYPE, WITHOUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC	1
		CONTROL FUSE 6A	9
		CONTROL FUSE 16A	6
		FUSE BASE 32A	15
		AUXILIARY CONTACTOR 2NO+2NC 220VDC	1
		BREAKER CONTACT MULTIPLICATION RELAY TYPE VAJC 11 OR EQVT	1
		Indicating Lamp	2
		CURRENT TRANSFORMER (PROTECTION) 10VA,CL-5P20	3
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-STUD TYPE	As required
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A,220 V DC	5

		2POLE 2POSI SELECTOR SWITCH KEY LOCKABLE-10A, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (51) • EARTH FAULT PROTECTION (51N) • OVER LOAD PROTECTION • RESTRICTED EARTH FAULT PROTECTION • RESIDUAL EARTH FAULT PROTECTION • TRIP CIRCUIT SUPERVISION (95) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASUREMENT • SYNCHRONIZING FEATURE • No of DI/DO SHALL BE AS PER SCHEME REQUIREMENT • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC ,HOWEVER THE THRESHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%)	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
		DC SOURCE SELECTION SWITCH	2
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Breaker Plate, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
	4 DAEG(-I/C)	EMERGENCY MCC INCOMER OF 800A, 1000A, 1250A, 1600A, 2000A, 2500A SHALL COMPRISE OF:	
		ACB TP, ELECTRICALLY OPERATED D/O TYPE, WITHOUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 2NC contacts.	1
		CONTROL FUSE 6A	15
		CONTROL FUSE 16A	4
		FUSE BASE 32A	19
		Indicating Lamp	5
		CURRENT TRANSFORMER (PROTECTION) 10VA, CL-5P20	3
		CURRENT TRANSFORMER (PROTECTION) with VDR 10VA, CL-PS	3

		POTENTIAL TRANSFORMER -CAST RESIN, OVER VOLTAGE FACTOR 1.2 CONT./1.5 FOR 30 SEC . 415/110,50 VA CL-0.5 INSL CL-E	1
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS(FIXED)	As required
		CT SHORTING TERMINAL-STUD TYPE	As required
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A,220 V DC	2
		2POLE 2POSI SELECTOR SWITCH KEY LOCKABLE-10A, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (51) • EARTH FAULT PROTECTION (51N) • OVER LOAD PROTERCTION • RESTRICTED EARTRH FAULT PROTECTION • RESIDUAL EARTH FAULT PROTECTION • TRIP CIRCUIT SUPERVISION (95) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASURENMET • SYNCHRONIZING FEATURE • No of DI/DO SHALL BE AS PER SCHEME REQUIREMNET • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC ,HOWEVER THE THERSHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%) • DIFFERENTIAL PROTECTION (HIGH IMPEDANCE) • REVERSE POWER PROTECTION • DG NEUTRAL DISPLACEMENT • DG MONITORING	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
5	DAE/DAE-TIE (O/G)	OUTGOING BREAKER FEEDER OF 630A, 800A, 1000A, 1250A, 1600A, 2500A SHALL COMPRISE OF:	

		ACB TP, ELECTRICALLY OPERATED D/O TYPE, WITHOUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 2NC contacts.	1
		CONTROL FUSE 6A	8
		CONTROL FUSE 16A	2
		FUSE BASE 32A	10
		Indicating Lamp	2
		CURRENT TRANSFORMER (PROTECTION) 10VA, CL-5P20	3
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS (FIXED)	As required
		CT SHORTING TERMINAL-STUD TYPE	As required
		POWER TERMINAL	As required
		DOUBLE POLE ON/OFF SWITCH-16 A, 220 V DC	1
		2POLE 2POS1 SELECTOR SWITCH KEY LOCKABLE-10A, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (51) • EARTH FAULT PROTECTION (51N) • OVER LOAD PROTECTION • RESIDUAL EARTH FAULT PROTECTION • TRIP CIRCUIT SUPERVISION (95) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASUREMENT • SYNCHRONIZING FEATURE • No of DI/DO SHALL BE AS PER SCHEME REQUIREMENT • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC, HOWEVER THE THRESHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%)	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Breaker Plate, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
6	DM / PM	BREAKER CONTROLLED MOTOR ABOVE 110KW & ABOVE SHALL COMPRISE OF:	

		ACB TP, ELECTRICALLY OPERATED D/O TYPE, WITHOUT RELEASES, CONTROL SUPPLY VOLTAGE 220V DC, 4NO + 4NC CONTACTS OF POSITION/ CELL SWITCH. SPRING CHARGE LIMIT SWITCH WITH minimum 2NO + 2NC contacts.	1
		CONTROL FUSE 6A	9
		CONTROL FUSE 16A	2
		FUSE BASE 32A	11
		Indicating Lamp	2
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		CURRENT TRANSFORMER (PROTECTION) 10VA, CL-5P20	3
		CURRENT TRANSDUCER (DC), 4-20mA, DUAL O/P, AUX.- 220V DC	1
		NEUTRAL LINK 32A	1
		CONTROL TERMINALS (FIXED)	As required
		CT SHORTING TERMINAL-STUD TYPE	As required
		POWER TERMINAL	As required
		SP ON/OFF SWITCH FOR MOTOR SPACE HTR. OF BREAKER MOTOR FDR-12A, 240VAC	1
		DOUBLE POLE ON/OFF SWITCH-16 A, 220 V DC	1
		2POLE 2POS SELECTOR SWITCH KEY LOCKABLE-10A, 220VDC	1
		NUMERICAL RELAY WITH COMMUNICATION FACILITY AS PER IEC-61850 FOR FOLLOWING FUNCTIONS: • SHORT CIRCUIT PROTECTION (51) • EARTH FAULT PROTECTION (51N) • OVER LOAD PROTECTION UNDER VOLTAGE • EARTH FAULT PROTECTION • TRIP CIRCUIT SUPERVISION (95) • CIRCUIT BREAKER MONITORING • PT FUSE FAILURE • ENERGY METERING • CURRENT, VOLTAGE & FREQUENCY MEASUREMENT • BLOCKED ROTOR PROTECTION CURRENT UNBALANCE PROTECTION • No of DI/DO SHALL BE AS PER SCHEME REQUIREMENT • ALL THE BINARY INPUTS SHALL BE CAPABLE OF TAKING THE 220V DC, HOWEVER THE THRESHOLD VALUE FOR BINARY INPUT SHALL BE 18V DC (+/- 5%)	1
		INTERPOSING RELAY REM302/EQVT. WITH BUILT IN LED, TEST KNOB & FREEWHEELING DIODE	2
		Materials Cost	
		Integration Cost	

		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
7	G1	BUS PT MODULE FOR PCC / PMCC SHALL COMPRISE OF:	
		CONTROL FUSE-6A	7
		FUSE BASE-32A	7
		POTENTIAL TRANSFORMER -415/ROOT3 /110/ROOT3, 50 VA CL-0.5 INSL CL-E	3
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS(FIXED)	As required
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
8	G2	BUS PT MODULE FOR DG PCC SHALL COMPRISE OF:	
		CONTROL FUSE-6A	7
		FUSE BASE-32A	7
		POTENTIAL TRANSFORMER -415/ROOT3 /110/ROOT3, 50 VA CL-0.5 INSL CL-E	3
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS(FIXED)	As required
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
9	VM	BUS PT MODULE FOR MCC/ACDB SHALL COMPRISE OF:	
		CONTROL FUSE-6A	3
		FUSE BASE-32A	3
		AUX. CONTACTOR 2NO+2NC CV. 415 V AC	1
		VOLTMETER (AC),96 X 96 mm2, SCALE-90, CL-1.5,0-500V DIRECT	1
		VOLTAGE TRANSDUCER (AC),4-20 m A DUAL O/P AUX. 220 V DC,0-500/4-20mA, 415V DIRECT	1
		VOLTMETER SELECTOR SWITCH-12 A,415 V AC	1
		RECTIFIER (AC TO DC),I/P-240V AC, O/P-220VDC	1
		Materials Cost	
		Integration Cost	

		Breaker Module Cost (Breaker Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
10	CS	EACH CONTROL SUPPLY OUTGOING SHALL COMPRISE OF:	
		CONTROL FUSE-6A	4
		CONTROL FUSE-25A	4
		FUSE BASE-32A	8
		AUX. CONTACTOR , 2NO+2NC,CV. 110 V AC	4
		NEUTRAL LINK-32A	6
		CONTROL TERMINALS(FIXED)	As required
		POWER TERMINALS	As required
		CONTROL TRANSFORMER,DRY TYPE, CAST RESIN,415/110 V, 2KVA	2
		4POLE,2POSI, SELECTOR SWITCH FOR CONTROL TRF.- 25A, 110V AC	2
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Breaker Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
11	DB	220V DC INCOMER FROM BATTERY SHALL COMPRISE OF:	
		DC AMMETER WITH SHUNT AND CENTER ZERO	1
12	DC	220V DC BUS COUPLER SHALL COMPRISE OF:	
		DOUBLE POLE 250V DC SWITCH/CIRCUIT BREAKER WITH 2NO+2NC AUXILIARY CONTACTS	1
13	CH	220V DC INCOMER OF DCDB FROM CHARGER SHALL COMPRISE OF:	
		Double pole, 250 V DC fuse -switch unit	1
		INDICATING LAMP	2
		VOLTMETER	1
		DC AMMETER WITH SHUNT	1
		CURRENT TRANSDUCER	1
14	HD	220V DC ISOLATING SWITCH/CIRCUIT BREAK MODULE SHALL COMPRISE OF:	
		DOUBLE POLE 250V DC SWITCH ISOLATOR/CIRCUIT BREAKER WITH REQUIRED AUXILIARY CONTACTS	1
15	S	220V DCDB BUS MODULE FOR METERING & PROTECTION SHALL COMPRISE OF:	
		UNDERVOLTAGE (INSTANTANEOUS WITH SETTING OF 95% OF 220VDC. THE RESETING OF RELAY SHOULD NOT BE MORE THAN 1.05)	1

		OVERVOLTAGE(INSTANEIOUS WHICH SHALL OPERATE AT 110% OF 220V DC. THE RESETTNGRATION SHOULD NOT BE LESS THAN .95)	1
		EARTHFAULT (CAEM21 OR EQV.)	1
		INDICATING LAMP	2
		CONTROL FUSE-6A	3
		FUSE BASE-32A	3
		NEUTRAL LINK	1
		DC VOLTAGE METER (0-300V)	1
		VOLTMETER SELECTOR SWITCH	1
		AUXILIARY CONTACTOR,2NO+2NC,CV 220AC	1
		PUSH BUTTON- SPRING RETURN WITH 1NO+1NC AUX, CONTACT	2
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
16	X	220V DC OUTGOING FEEDER SHALL COMPRISE OF:	
		DOUBLE POLE 225V DC FUSE SWITCH UNIT	1
		HRC FUSES	2
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
17	CC	ISOLATOR INCOMER WITH CONTACTOR UPTO 630A SHALL COMPRISE OF	
		TRI POLE LOAD BREAK ISOLATING SWITCH	2
		Power Fuse	3
		Auxiliary Switch	1
		INDICATING LAMP	2
		CONTROL FUSE-6A	5
		FUSE BASE-32A	5
		SERVICE POSITION LIMIT SWITCH	2
		TRIPLE POLE POWER CONTACTOR WITH COIL SUITABLE FOR 415V AC WITH 2NO+2NC AUX	2
		AUXILIARY CONTACTOR 2NO+2NC ,CV 415V AC	2
		TERMINAL BLOCKS	30
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	

		TOTAL	
18(a)	EM3 (I/C)	INCOMER MCCB FOR MCC / ACDB FOR RATING from 100A UPTO 630A	
		CONTROL FUSE-6A	1
		FUSE BASE-32A	1
		MCCB TP MICROPROCESSOR BASED ADJ. O/L,S/C & E/F RELEASE	1
		AUX. SWITCH FOR MCCB-2C/O	2
		ALARM SWITCH FOR MCCB-1C/O	1
		SHUNT TRIP COIL 220VAC	1
		EXTENDED ROTORY HANDLE	1
		INDICATION LAMP	3
		NEUTRAL LINK 32A	1
		NEUTRAL LINK AS PER MCCB RATING	1
		CONTROL TERMINALS (DRAWOUT)	AS REQUIRED
		CT SHORTING TERMINAL-STUD TYPE	AS REQUIRED
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
18(b)	EM3 (I/C)	INCOMER SFU FOR MCC / ACDB FOR RATING below 100A	
		CONTROL FUSE-6A	1
		FUSE BASE-32A	1
		SFU (3 POLE WITH AUX. CONTACT 1NO+1NC)	1
		INDICATION LAMP	3
		NEUTRAL LINK 32A	1
		NEUTRAL LINK AS PER MCCB RATING	1
		CONTROL TERMINALS (DRAWOUT)	AS REQUIRED
		CT SHORTING TERMINAL-STUD TYPE	AS REQUIRED
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
19(A)	EM3 (B/C)	BUSCOUPLER MCCB FOR MCC / ACDB FOR RATING UPTO 630A	
		MCCB TP MICROPROCESSOR BASED ADJ. O/L,S/C & E/F RELEASE	1
		EXTENDED ROTORY HANDLE	1
		AUXILARY CONTACTOR	2
		CONTROL FUSES-6A	2

		FUSE BASE-32A	2
		NEUTRAL LINK	2
		INDICATING LAMP	2
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Breaker Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
19(B)	EM3 (B/C)	BUSCOUPLER SFU FOR MCC / ACDB FOR RATING below 100A	
		SFU (3 POLE WITH AUX. CONTACT 1NO+1NC)	1
		AUXILIARY CONTACTOR	2
		CONTROL FUSES-6A	2
		FUSE BASE-32A	2
		NEUTRAL LINK	2
		INDICATING LAMP	2
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Breaker Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
20(A)	E/E3	TPN AC OUTGOING MCCB OPERATED FEEDER FOR RATING 100A AND ABOVE	
		MCCB TP MICROPROCESSOR BASED ADJ. O/L,S/C & E/F RELEASE	1
		EXTENDED ROTARY HANDLE	1
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Breaker Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
20(B)	E/E3	TPN AC OUTGOING SFU OPERATED FEEDER FOR RATING below 100A	
		3 POLES SFU	1
		POWER FUSE	3
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
		Materials Cost	
		Integration Cost	

		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
21(A)	E2	DP AC OUTGOING MCCB OPERATED FEEDER FOR RATING 100A AND ABOVE	
		MCCB TP MICROPROCESSOR BASED ADJ. O/L,S/C	1
		EXTENDED ROTORY HANDLE	1
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
21(B)	E2	DP AC OUTGOING SFU OPERATED FEEDER FOR RATING below 100A	
		(DP)SWITCH FUSE UNIT	1
		HRC FUSE (POWER)	2
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
22(A)	E1	SP AC OUTGOING MCCB OPERATED FEEDER FOR RATING 100A AND ABOVE	
		(TP)SWITCH FUSE UNIT	1
		HRC FUSE (POWER)	1
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
22(B)	E1	SP AC OUTGOING SFU OPERATED FEEDER FOR RATING below 100A	
		(TP)SWITCH FUSE UNIT	1
		HRC FUSE (POWER)	1
		NETURAL LINK EQUIVALENT TO POWER FUSE RATING	1
		Materials Cost	
		Integration Cost	

		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
23	DK2/PK2/ AK2	UNIDIRECTIONAL MOTOR FEEDER BELOW 30KW (AU/BU/CU CONTROLLED FROM ATRS/DDCMIS/PLC SHALL COMPRISE OF:	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		CONTROL FUSE-6A	1
		FUSE BASE-32A	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2NO+2NC, CV. 110 V AC	2
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	1
		OVERLOAD RELAY,BUILT IN SPPR FEATURE 1NO+1NC AUX. & INDEPENDENT MOUNTING TYPE	1
		MOUNTING KIT FOR O/L RELAY	1
		RESET CORD ACTUATOR	1
		Indication lamp	3
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
		COUPLING RELAY WITH BUILT IN DIODE	2
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
24	EA1	1-PHASE SFU CONTACTOR CONTROLLED FEEDER SHALL COMPRISE OF:	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	2
		CONTROL FUSE-6A	1
		FUSE BASE-32A	1
		2P POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2NO+2NC, CV. 110 V AC	2
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	1
		Indication lamp	3
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
		COUPLING RELAY WITH BUILT IN DIODE	2
		Materials Cost	

		Integration Cost	
		Breaker Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
25	EA3	3-PHASE SFU CONTACTOR CONTROLLED FEEDER SHALL COMPRISE OF:	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		CONTROL FUSE-6A	1
		FUSE BASE-32A	1
		3P POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2NO+2NC, CV. 110 V AC	2
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	1
		Indication lamp	3
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	As required
		COUPLING RELAY WITH BUILT IN DIODE	2
26	DK21/PK21/ AK21	UNIDIRECTIONAL MOTOR FEEDER 30KW & ABOVE UPTO 110KW CONTROLLED FROM DDCMIS/PLC/ATRS SHALL COMPRISE OF:	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		CONTROL FUSE-6A	2
		FUSE BASE-32A	2
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2NO+2NC CV. 110 V AC	2
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	1
		OVERLOAD RELAY,BUILT IN SPPR FEATURE 1NO+1NC AUX. & INDEPENDENT MOUNTING TYPE	1
		RESET CORD ACTUATOR	1
		Indication lamp	3
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER CTSEC 1A (AC),96 X 96 mm2, SCALE-90, CL-1.5	1
		CURRENT TRANSDUCER (AC),4-20mA, DUAL O/P,AUX.-110V AC	1
		NEUTRAL LINK	1
		CONTROL TERMINALS (DRAWOUT)	50
		CT SHORTING TERMINAL-STUD TYPE	18

		SP ON/OFF SWITCH FOR MOTOR SPACE HTR. OF MOTOR FDR.,10A, 240VAC	1
		COUPLING RELAY WITH BUILT IN DIODE,24V DC 2C/O	2
		One (1) Digital Energy Meter with Analog output of Current (4-20 mA)	1
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
27	DKE2**	UNIDIRECTIONAL MOTOR FEEDER (ESSENTIAL) BELOW 30KW CONTROLLED FROM DDCMIS/PLC/ ATRS SHALL COMPRISE OF:	
		TRIPLE POLE SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		TRIPLE POLE POWER CONTACTOR	1
		THERMAL O/L RELAY OF SUITABLE RANGE	1
		Mounting Kit	1
		THERMAL O/L RELAY RESET PUSH BUTTON	1
		INDICATING LAMP	3
		CONTROL FUSE	4
		Contorl Fuse base	4
		NEUTRAL LINK	2
		AUXILIARY CONTACTOR	2
		CT FOR METERING	1
		AMMETER	1
		CURRENT TRANSDUCER (DUAL OUTPUT)	1
		INTERPOSING RELAY RE302 OR EQVT	2
		TIMER	1
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
28	DKE21**	UNIDIRECTIONAL MOTOR FEEDER (ESSENTIAL) 30KW & ABOVE UPTO 110KW CONTROLLED FROM ATRS/DDCMIS/PLC SHALL COMPRISE OF:	
		3P SFU	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		TRIPLE POLE POWER CONTACTOR	1
		THERMAL O/L RELAY OF SUITABLE RANGE	1
		THERMAL O/L RELAY RESET PUSH BUTTON	1
		INDICATING LAMP	3
		CONTROL FUSE	8

		Contorl Fuse base	8
		NEUTRAL LINK	2
		AUXILIARY CONTACTOR	2
		CT FOR METERING	1
		AMMETER SELECTOR SWITCH	1
		AMMETER	1
		CURRENT TRANSDUCER (DUAL OUTPUT)	1
		INTERPOSING RELAY RE302 OR EQVT	2
		TIMER	1
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
29	K3	UNIDIRECTIONAL MOTOR FEEDER BELOW 30KW CONTROLLED FROM LPBS SHALL COMPRISE OF:	
		3P SFU	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		TRIPLE POLE POWER CONTACTOR	1
		THERMAL O/L RELAY OF SUITABLE RANGE	1
		Mounting Kit	1
		THERMAL O/L RELAY RESET PUSH BUTTON	1
		INDICATING LAMP	3
		AUXILIARY CONTACTOR	1
		INTERPOSING RELAY RE302 OR EQVT	2
		CONTROL FUSE	1
		Control fuse base	1
		NEUTRAL LINK	1
		NO. OF TERMINALS	25
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
30	K31	UNIDIRECTIONAL MOTOR FEEDER 30KW & ABOVE UPTO 110KW CONTROLLED FROM LPBS SHALL COMPRISE OF:	
		3P SFU	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		TRIPLE POLE POWER CONTACTOR	1
		THERMAL O/L RELAY OF SUITABLE RANGE	1
		THERMAL O/L RELAY RESET PUSH BUTTON	1
		INDICATING LAMP	3
		AUXILIARY CONTACTOR	1
		AMMETER	1

		INTERPOSING RELAY RE302 OR EQVT	2
		CT FOR METERING	1
		CONTROL FUSE	1
		Control Fuse base	1
		NEUTRAL LINK	1
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
31	DK2**	HEATER FEEDER BELOW 30KW (AU/BU/CU CONTROLLED FROM ATRS/DDCMIS/PLC SHALL COMPRISE OF:	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		CONTROL FUSE-6A	1
		FUSE BASE-32A	1
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2NO+2NC, CV. 110 V AC	2
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	1
		Indication lamp	3
		NEUTRAL LINK-32A	1
		CONTROL TERMINALS (DRAWOUT)	30
		COUPLING RELAY WITH BUILT IN DIODE	2
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
32	DK21**	HEATER FEEDER 30KW & ABOVE UPTO 110KW CONTROLLED FROM DDCMIS/PLC/ATRS SHALL COMPRISE OF:	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		CONTROL FUSE-6A	2
		FUSE BASE-32A	2
		POWER CONTACTOR(AC) WITH 1NO AUX CONTACT COIL VOLTAGE 110V AC	1
		AUX. CONTACTOR,2NO+2NC CV. 110 V AC	2
		ADD ON AUX. CONTACTOR BLOCK 2NO+2NC	1
		Indication lamp	3
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1

		AMMETER CTSEC 1A (AC),96 X 96 mm2, SCALE-90, CL-1.5	1
		CURRENT TRANSDUCER (AC),4-20mA, DUAL O/P,AUX.-110V AC	1
		NEUTRAL LINK	1
		CONTROL TERMINALS (DRAWOUT)	60
		CT SHORTING TERMINAL-STUD TYPE	60
		SP ON/OFF SWITCH FOR MOTOR SPACE HTR. OF MOTOR FDR.,10A, 240VAC	1
		COUPLING RELAY WITH BUILT IN DIODE,24V DC 2C/O	2
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
33	DW	220V DC SOLENOID VALVE FEEDER SHALL COMPRISE OF:	
		DOUBLE POLE 250V DC ISOLATING SWITCH FUSE UNIT	1
		HRC FUSE	2
		220V DC POWER CONTACTOR	1
		AUXILIARY CONTACTOR	1
		NEUTRAL LINK	1
		DIODE WITH PEAK INVERSE VOLTAGE OF 440V	1
		COUPLING RELAY	1
		Control fuse	2
		Control fuse base	2
		Materials Cost	
		Integration Cost	
		Breaker Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
34	DN1	BIDIRECTIONAL MOTOR FEEDER	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		TRIPLE POLE POWER CONTACTOR	2
		THERMAL O/L RELAY OF SUITABLE RANGE	1
		MOUNTING Kit	1
		THERMAL O/L RELAY RESET PUSH BUTTON	1
		INDICATING LAMP	3
		CONTROL FUSE	4
		Control fuse base	4
		NEUTRAL LINK	1
		AUXILIARY CONTACTOR	2
		NO. OF TERMINALS (240V AC/24V DC)	60

		INTREPOSING RELAY	3
		TEST PUSH BUTTON	1
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
35	K1	UNIDIRECTIONAL MOTOR FEEDER BELOW 30KW CONTROLLED FROM MCC SHALL COMPRISE OF:	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		TRIPLE POLE POWER CONTACTOR	1
		THERMAL O/L RELAY OF SUITABLE RANGE	1
		MOUNTING Kit	
		THERMAL O/L RELAY RESET PUSH BUTTON	1
		INDICATING LAMP	3
		CONTROL FUSE	1
		CONTROL FUSE BASE	1
		NEUTRAL LINK	1
		NO. OF TERMINALS	30
		Materials Cost	
		Integration Cost	
		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	
36	K11	UNIDIRECTIONAL MOTOR FEEDER RATED FROM 30KW to 110KW CONTROLLED FROM MCC SHALL COMPRISE OF:	
		(TP)SWITCH FUSE UNIT	1
		AUX. CONTACT FOR SFU (1NO+1NC)	1
		HRC FUSE (POWER)	3
		TRIPLE POLE POWER CONTACTOR	1
		THERMAL O/L RELAY OF SUITABLE RANGE	1
		THERMAL O/L RELAY RESET PUSH BUTTON	1
		INDICATING LAMP	3
		CURRENT TRANSFORMER (METERING) 10VA, CL-1	1
		AMMETER	1
		CURRENT TRANSDUCER (AC),4-20mA, DUAL O/P,AUX.-110V AC	
		CONTROL FUSE	1
		CONTROL FUSE base	
		NEUTRAL LINK	1
		NO. OF TERMINALS	50
		Single Phase switch for motor Space Heater	1
		Materials Cost	
		Integration Cost	

		Breakar Module Cost (Beakar Plat, Support, Paint & Class-C items wire, lugs, Cable gland etc.)	
		TOTAL	

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
1	BOUGHT OUT ITEMS (ELECTRICAL COMPONENTS)				M	T / C							
1.1	AIR CIRCUIT BREAKER	VERIFICATION OF MAKE, TYPE RATING	MAJOR	VISUAL	100%		IS 13947 , TECH SPEC AND APPROVED DRG	IS 13947 , TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		ROUTINE TEST	CRITIC AL	ELECT	100%				SUPPLIER TC	V	V	V	
1.2	MCCB	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	10% OF EACH TYPE		IS 13947 , SPEC AND APPROVED DRG	IS 13947 , SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		FUCHIONL CHECK		FUCNTI ONAL	10% OF EACH TYPE				LOG BOOK	P	V	V	
1.3	ROTARY SWITCHES (CONTROL AND SELECTOR)	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	5 SAMPLE OF EACH TYPE		TECH SPEC AND APPROVED DRG	TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK			FUNCTI ONAL	10%					P	V	V
1.4	DOOR , TOGGLE & TNC SWITCH	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	10% OF EACH TYPE		TECH SPEC AND APPROVED DRG	TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
1.5	SWITCH FUSE UNITS	VERIFICATION OF MAKE, TYPE, RATING	MAJOR	VISUAL	10%		IS 13947, TECH SPEC AND APPROVED DRG	IS 13947 , TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		CONTINUITY TEST	MAJOR	FUNCTI ONAL	10% OF EACH RATING					P	V	V	

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION								
								APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
1.6	ETHERNET SWITCH	MAKE, TYPE , RATING MODEL	MAJOR	VISUAL	100%		TECH SPEC AND APPROVED DRG	TECH SPEC AND APPROVED DRG	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK		ELECT	100%				SUPPLIER TC	V	V	V	
1.7	CONTROL TRANSFORMER	MAKE, TYPE, RATING VOLTAGE RATIO & CLASS	MAJOR	VISUAL NAME PLATE	10% OF EACH RATING		IS 121021 (81)	IS 121021(87)	LOG BOOK	P	V	V	
		VOLTAGE RATIO			100% OF EACH RATING				LOG BOOK	P	V	V	
		ROUTINE TEST		ELEC	100%				SUPPLIER TC	V	V	V	
1.8	CURRENT TRANSFORMER CTS	MAKE, TYPE, RATING VOLTAGE RATIO	MAJOR	VISUAL NAME PLATE	10% OF EACH RATING		IS 2705 (92)	IS 2705(92)	LOG BOOK	P	V	V	
		ROUTINE TEST		ELECT	100%				SUPPLIER TC	V	V	V	
1.9	VOLTAGE/ POTENTIAL/ TRANSFORMER PTS	MAKE, TYPE, RATING VOLTAGE RATIO	MAJOR	VISUAL NAME PLATE	10% OF EACH RATING		IS 2705 (92) APPROVED DRG/TECH SPEC	IS 2705(92) APPROVED DRG	LOG BOOK	P	V	V	
		ROUTINE TEST		ELECT	100%				SUPPLIER TC	V	V	V	
		TRANSDUCERS CURRENT AND VOLTAGE	MAKE, TYPE, RATING	MAJOR	VISUAL	10% OF EACH RATING		IS 14570 /IEC 16088 APPROVED DRG /TECH SPEC/	IS 14570 /IEC 16088 APPROVED DRG /TECH SPEC	LOG BOOK	P	V	V

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION								
								APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
	(CTD & VTD)	ROUTINE TEST INCLUDING CALIBRATION AND ACCURACY TEST		ELECT	100%				SUPPLIER TC	V	V	V	
1.10	HRC FUSE, FUSE BASE,	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		IS 13703 P-2 TECH SPEC AND APPROVED DRG/ MANFR CATLOGUE	IS 13703 P-2 TECH SPEC AND APPROVED DRG/ MANFR CATLOGUE	LOG BOOK	P	V	V	
		CONTINUITY TEST		ELECT						P	V	V	
1.11	NEUTRAL LINK	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		TECH SPEC AND APPROVED DRG/ MANFR CATLOGUE	TECH SPEC AND APPROVED DRG/ MANFR CATLOGUE	LOG BOOK	P	V	V	
1.12	NEUMERICAL RELAY	MAKE, TYPE, RATING	MAJOR	VISUAL	100%		APPROVED DRG/ TECH SPEC	APPROVED DRG/TECH SPEC	LOG BOOK	P	V	V	
		ROUTINE TEST		ELECT	100%				SUPPLIER TC	V	V	V	
		RELAY TESTING		ELECT	10% OF EACH TYPE		IEC 60255	IEC 60255		P	W	W	
1.13	OVERLOAD RELAY	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		IS 3231(86) / APPROVED DRG/TECH SPEC	IS 3231(86) / APPROVED DRG/TECH SPEC	LOG BOOK	P	V	V	
1.14	INTERPOSING RELAY	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MNFR CAT	APPROVED DRG/TECH SPEC/MNFR CAT	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK		ELECT	5% OF EACH TYPE				P	V	V		
1.15		MAKE, TYPE, RATING		VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH	APPROVED DRG/TECH	LOG BOOK	P	V	V	

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								APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN				CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS					
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
	TIMERS	CONTACT CONFIGURATION	MAJOR	ELECT	5% OF EACH TYPE		TECH SPEC/ MNFR CAT	TECH SPEC/ MNFR CAT	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK		ELECT	5% OF EACH TYPE				LOG BOOK	P	V	V	
1.16	THERMOSTAT	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MNFR CAT	APPROVED DRG/TECH SPEC/MNFR CAT	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK		ELECT	5% OF EACH TYPE				LOG BOOK	P	V	V	
1.17	SPACE HEATER	MAKE TYPE RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		FUNCTIONAL CHECK	MAJOR	ELECT	5% OF EACH TYPE				LOG BOOK	P	V	V	
1.18	INDICATING INSTRUMENTS AMMETER, VOLTMETER	MAKE, TYPE, RANGE & CLASS	MAJOR	VISUAL	5% OF EACH TYPE		IS 1248(93) APPROVED	IS 1248(93) /APPROVED	LOG BOOK	P	V	V	
		ROUTINE TEST		ELECT	5% OF EACH TYPE				SUPPLIER TC	P	V	V	
1.19	INDICATING LAMPS	MAKE, TYPE, RATING AND COLOR	MAJOR	VISUAL	5% OF EACH TYPE		IS 1901/APPROVED DRG	IS 1901 /APPROVED DRG	LOG BOOK	P	V	V	

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		APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
1.20	PUSH BUTTON SWITCHES	MAKE, TYPE, RATING AND COLOR	MAJOR	VISUAL	5% OF EACH TYPE		IS 4794/APPROVED DRG	IS 4794 /APPROVED DRG	LOG BOOK	P	V	V	
1.21	2/3 PIN SOCKET/LAMP HOLDER/ HOOTER	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
1.22	TERMINAL BLOCK FOR POWER AND CONTROL CKT	MAKE, TYPE, RATING	MAJOR	VISUAL	5% OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
1.23	AC/ DC POWER AND AUX CONTACTORS	MAKE, TYPE, RATING	MAJOR	VISUAL	100%		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		FUCTIONAL		ELECT	5 % OF EACH TYPE				LOG BOOK	P	V	V	
1.24	BUSBAR SUPPORT INSULAOR	MAKE, TYPE, RATING, DIM.	MAJOR	VISUAL AND PHY	5 % OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		IR/ HV TEST	MAJOR	ELECT	-DO-		-DO-	-DO-	SUPPLIER TC/ LOG BOOK	P	V	V	
1.25	SHROUDS (FIRE RESISTANT TYPE)	MAKE, TYPE	MAJOR	VISUAL	ONE SAMPLE OF EACH TYPE		APPROVED DRG/TECH SPEC/MANFR CAT	APPROVED DRG/TECH SPEC/MANFR CAT	LOG BOOK	P	V	V	
		HV TEST	MAJOR	ELECT	-DO-		2.5 KV FOR 1 MIN WITHSTAND	2.5 KV FOR 1 MIN WITHSTAND	SUPPLIER TC/ LOG BOOK	P	V	V	

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			APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
		FLAME RESISTANCE TEST	MAJOR	FLAME TEST	SAMPLING AS PER MNFT STD		MNFR STDQ	MNFR STD	SUPPLIER TC	V	V	V	
1.26	POWER AND CONTROL CABLES	MAKE, TYPE, RATING	MAJOR	VISUAL	5 SAMPLES OF EACH TYPE		IS 694(90)	IS 694(90)	LOG BOOK	P	V	V	
1.27	CABLE LUGS	MAKE, TYPE, SIZE	MAJOR	VISUAL/ MEASUR	5% SAMPLES OF EACH TYPE		APPROVED DRG/MANFR CAT	APPROVED DRG/MANFR CAT	LOG BOOK	P	V	V	
1.28	PVC WIRE	SIZE, COLOUR, BIS MARKING	MAJOR	VISUAL	100%		PO SPEC, DRG IS 694	PO SPEC, DRG IS 694	LOG BOOK	P	V	V	
2	BOUGHT OUT ITEMS (MECHANICAL COMPONENTS)												
2.1	ENCLOSURE	SIZE, TYPE	MAJOR	VISUAL/ MEASUR	100%		APPROVED DRG, IS 8623	APPROVED DRG, IS 8623	LOG BOOK	P	V	V	
		COLOUR (PAINT SHADE), SURFACE FINISH	MAJOR	VISUAL	100%		APPROVED DRG/SHADE CARD	APPROVED DRG/IS/SHADE CARD	LOG BOOK	P	V	V	
		PAINT THICKNESS AND ADHESION TEST.	MAJOR	TEST	RANDOM		APPROVED DRG/	IS 6005/ APPROVED DRG.	LOG BOOK	P	V	V	
2.2	ENCLOSURE ANGLES, CHANNELS AND SHEET(CR)/ GLAND PLATE	DIMENSION/THICKNESS	MAJOR	MEASUR	5% OF EACH TYLPE		APPROVED DRG	APPROVED DRG	SUPPLIER TC	V	V	V	
		SURFACE FINISH, CHCEK FOR WAVINESS AND FLATNESS	MAJOR	VISUAL	5% OF EACH TYLPE		APPROVED DRG	APPROVED DRG	SUPPLIER TC	V	V	V	
		LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION											
MANUFACTURER/ SIGNATURE													
									APPROVED BY			APPROVAL SEAL	

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
		TENSILE / BENDING STRENGTH	MAJOR	MECH	AS PER IS		IS 513/ IS 1079/ IS 2062	IS 513/ IS 1079/ IS 2062	SUPPLIER TC	V	V	V	
2.3	BUSBAR: AL & CU	SIZE	MAJOR	MEASUR	1 SAMPLE OF EACH TYPE		IS 5082(FOR AL)/ IS 1897 (FOR CU)/ APPROVED DRG/ TECH SPEC	IS 5082(FOR AL)/ IS 1897 (FOR CU)/ APPROVED DRG/ TECH SPEC	LOG BOOK	P	V	V	
		SURFACE FINISH	MAJOR	VISUAL	-DO-		IS 5082 & IS 1897	IS 5082 & IS 1897	LOG BOOK	P	V	V	
		CONDUCTIVITY	MAJOR	ELECT	AS PER IS		IS 5082 & IS 1897	IS 5082 & IS 1897	SUPPLIER TC	P	V	V	
		CHEMICAL / MECH PROPERTY	MAJOR	CHEM & MECH	AS PER IS		-DO-	-DO-	SUPPLIER TC	P	V	V	
2.4	EARTH BUS BAR	SIZE, MATERIAL	MAJOR	PHYSIC AL/ MEASUR	1 SAMPLE /LOT		IS 3043	IS 4043	LOG BOOK/ SUPPLIER TC	V	V	V	
2.5	CABLE GLAND	MAKE, TYPE, SIZE	MAJOR	VISUAL/ MEASUR	5 SAMPLES / LOT		APPROVED DRG/MANFR CAT	APPROVED DRG/MANFR CAT	LOG BOOK	P	V	V	
2.6	GASKET	MATERIAL TYPE	MAJOR	VISUAL	1 SAMPLE OF EACH TYPE AND SIZE		IS 11149 TECH SPEC / APPROVED DRG	IS 11149 TECH SPEC / APPROVED DRG	LOG BOOK	P	V	V	
		DIMENSION, SHORE HARDNESS, FLAME TEST	MAJOR	MEASUR /PHY	-DO-		-DO-	-DO-	LOG BOOK	P	V	V	
		COMPRESSION , ELONGATION AT BREAK AND AGING, TEST,OZONE RESISTANCE	MAJOR	TEST	-DO-		-DO-	-DO-	SUPPLIER TC	V	V	V	
MANUFACTURER/ SIGNATURE		LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION											
									APPROVED BY			APPROVAL SEAL	

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN				CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS					
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
3.0	IN-PROCESS										V	V	
3.1	PRE TREATMENT AND PAINTING (POWDER COATING)	1. CHEMICAL CONCETRATIONIN CHECK OF ALL TANIKS FOR PRE TREATMENT OF SHEET STEEL (7 TANK PROCESS)	MAJOR	CHEMIC AL	MANFR STD		MANFR STD/ IS 6005	MANFR STD/ IS 6005	SUPPLIER TC	V	V	V	
		2. PAINT SHADE	MAJOR	VISUAL	1 SAMPLE PER LOT		TECH. SPEC./ APPROVED DRAWING	TECH. SPEC./ APPROVED DRAWING	SUPPLIER TC/ LOG BOOK	V	V	V	
		3. PAINT THICKNESS AND ADHESION	MAJOR	MEASUR / TEST	MANUF. PRACTICE		TECH. SPEC./ APPROVED DRAWING	TECH. SPEC./ APPROVED DRAWING	SUPPLIER TC/ LOG BOOK	V	V	V	
3.2	DRAWOUTS	SIZE/ TYPE	MAJOR	MEASUR	1 NO OF EACH TYPE		APPROVED DRG	APPROVED DRG	SUPPLIER TC/ LOG BOOK	V	V	V	
		TYPE OF COATING FOR BASE AND FRAME	MAJOR	VISUAL	1 NO OF EACH TYPE		-DO-	-DO-	SUPPLIER TC/ LOG BOOK	V	V	V	
		COATING THICKNESS	MAJOR	MEASUR	-DO-		-DO-	-DO-	SUPPLIER TC/ LOG BOOK	V	V	V	
3.3	ASSEMBLY OF ELECTRICAL COMPONENTS	LOCATION OF COMPONENTS, ACCESSIBILITY FOR ATTENDING / WIRE TIGHTENING	MAJOR	VISUAL	100%		PO SPEC, DRG, IS 8623	PO SPEC, DRG, IS 8623	LOG BOOK	P	V	V	
		CLEARANCE OF BUS BARS OF DIFFERENT PHASES AND EARTH	MAJOR	MESH	100%		PO SPEC, DRG, IS 8623	PO SPEC, DRG, IS 8623	LOG BOOK	P	V	V	

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		APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
		SHROUDING OF POWER TERMINALS	CRITIC AL	VISUAL	100%		PO SPEC, DRG, IS 8623	PO SPEC, DRG, IS 8623	LOG BOOK	P	V	V	
4.0 FINAL INSPECTION													
4.1	VERIFICATION OF DEMENSION OF VERTICALS, SHEET. VISUAL CHECK FOR VERTICALITY, ALLIGNMENT OF PANELS.		MAJOR	VISUAL & MEASUR	100%		AS PER APPROVED DRG.GA	AS PER APPROVED GA DRG.	LOG BOOK	P	W	W	
4.2	VERIFICATION OF PAINT FINISH, SHADE, THICKNESS & ADHESIION TEST		MAJOR	VISUAL AND MEASUR	100% FOR SHADE AND FINISH 2-3 SAMPLES FOR THICKNESS AND ADHESION 2-3 SAMPLES/ BOARD		AS PER IS/ APPROVED DRG GN	AS PER IS/ APPROVED DRG GN	INSPECTIO N REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.3	VERIFICATION OF BUSBAR (MAIN, CONTROL AND AUX). MATERIAL, COLOR CODING, PHASE SEQUENCE IDENTIFICATION, PROVISION OF COLOR (R-Y-B) / BLACK HEAT SHRINKING SLEEVE. & EARTH BUSBAR		CRITICA L	VISUAL AND MEASUR	10%		APPROVED DRG GA	APPROVED DRG GA	INSPECTIO N REPORT	P	W	W	

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION			
			APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
4.4	MEASUREMENT OF TIGHTENING TORQUE OF BUSBAR JOINTS BY TROQUE WRENTCH		CRITICAL	MECH	10%		M6 = 0.30- 0.7KGFM M8 = 1.25- 2.5KGFM M10= 2.50- 4.0KGFM M12= 4.30- 7.0KGFM	M6 = 0.30- 0.7KGFM M8 = 1.25- 2.5KGFM M10= 2.50- 4.0KGFM M12= 4.30- 7.0KGFM	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.5	BUS BAR SUPPORT ARRANGEMENT, CENTRE TO CENTRE DISTANCE (CREEPAGE DISTANCE)		MAJOR	VISUAL AND MEASUR	10%		APPROVED DRG GA	APPROVED DRG GA	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.6	MOUNTING ARRANGEMENT OF COMPONENTS AND COMPONENT IDENTIFICATION FOR MAKE, TYPE, RATING AND LAYOUT		MAJOR	VISUAL	100% FOR EACH TYPE OF MODULE		APPROVED DRG/MANFR STD	APPROVED DRG/MANFR STD	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.7	VERIFICATION OF CONTROL WIRING, TERMINAL ARRANGEMENT AND FERRULING		MAJOR	VISUAL	100%		APPROVED DRG/MANFR STD	APPROVED DRG/MANFR STD	INSPECTION REPORT	P	W	W	
4.8	VERIFICATION OF SINGLE LINE DIAGRAM COMPONENTS AND LEGENDS		MAJOR	VISUAL	100%		APPROVED DRG SLD	APPROVED DRG SLD	INSPECTION REPORT	P	W	W	
4.9	VERIFICATION OF MOUNTING ARRANGEMENT OF COMPONENT , IDENTIFICATION OF COMPONENT AND VERIFICATION OF MAKE, TYPE & RATING (AS PER BOM)		MAJOR	VISUAL	100%		AS PER APPROVED DRG(SCHEME) AND APPROVED BOM	AS PER APPROVED DRG(SCHEME) AND APPROVED BOM	INSPECTION REPORT	P	W	W	

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION								
								APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
4.10	VERIFICATION OF DOOR INTERLOCK AND DEFEAT INTERLOCK		MAJOR	PHYSICAL	100%		APPROVED GN	APPROVED GN	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.11	VERIFICATION OF DEGREE OF PROTECTION AND FIXING OF GASKETS		MAJOR	PHYSICAL	2-5 SAMPLES AT GASKETED JOINTS PER BOARD		APPROVED GN	NO INSERTION POSSIBLE FROM OPENINGS AND GASKETTED JOINTS	INSPECTION REPORT	P	W	W	PAPER INSERTION METHOD FOR IP5X COMPARTMENT AND WIRE INSERTION METHOD FOR IP 4X COMPARTMENT RANDOM CHECK
4.12	ACB OPERATION TEST AT SERVICE, TEST AND ISOLATION POSITION & CHECK OF MECHANICAL INTERLOCK AND ANTI PUNPING AND TRIP FREE FEATURE		CRITICAL	ELECT	100%		APPROVED DRG/TECH SPEC	APPROVED DRG/TECH SPEC	INSPECTION REPORT	P	W	W	10% RANDOM SAMPLE BY CUSTOMER
4.13	VERIFICATION OF INTER CHANGEABILITY OF SIMILAR MODULES AND CHECK FOR ALIGNMENT OF POWER AND CONTROL CONTACTS.		MAJOR	VISUAL & MECH	RANDOM		APPROVED TECH SPEC	APPROVED TECH SPEC	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER
4.14	FUNCTIONAL CHECK / LOGIC CHECK (1. Operation of Instrument & Relays 2. Functional Check of Control Function & Interlock in test & service Position. 3. Relay calibration Tests.)		MAJOR	ELECT	100%		AS PER APPROVED SCHEME	AS PER APPROVED SCHEME	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.15	IR TEST BEFORE HV TEST ON POWER CKT AND CONTROL CKT		CRITICAL	ELECT	100%		IS 8623	IS 8623	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION								
								APPROVED BY	APPROVAL SEAL

		MANUFACTURER: BHARAT HEAVY ELECTRICALS LTD.- ELECTROPORCELAINS DIVISION BANGALORE 560012		MANUFACTURING QUALITY PLAN			CUSTOMER:NTPC PROJECT: 3X660 MW NORTH KARANPURA SCTPS						
				ITEM : L V SWITCH BOARDS/ LPBS/ LOCAL MOTOR STARTERS									
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CATSS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
										M	T	C	
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.
4.16	HV TEST ON POWER CKT AND CONTROL CKT		CRITICAL	ELCECT	100%		IS 8623	IS8623	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.17	IR TEST AFTER HV TEST ON POWER CKT AND CONTROL CKT		CRITICAL	ELECT	100%		IS 8623	IS 8623	INSPECTION REPORT	P	W	W	RANDOM SAMPLES BY CUSTOMER.
4.18	TYPE TEST		CRITICAL	ELECT	1/ ITEM		PO SPEC, DRG IS 60529 IS 8623	PO SPEC, DRG IS 60529 IS 8623	INSPECTION REPORT	P	V	V	AS PER BELOW NOTE
4.19	CHECK SHROUDING OF ACCECABLE LIVE PARTS		MAJOR	VISUAL	10%		AS PER TECH SPEC	AS PER TECH SPECH	INSPECTION REPORT	P	W	W	
4.20	PROVISION OF ADDITIONAL TAPPED HOLES AND FASTENERS FOR EARTH CONNECTION AND EARTH SYMBOL		MAJOR	VISUAL	100%		AS PER TECH SPEC	AS PER TECH SPECH	INSPECTION REPORT	P	V	V	

NOTE:

- A. ONLY APPROVED MAKE OF COMPONENTS USED.
- B. TYPE TESTS WILL INCLUDE
1. DEGREE OF ENCLOSURE PROTECTION (AS PER IEC 60529)
 2. TEMPERATURE RISE TEST (AS PER IS 8623)
 3. SHORT CIRCUIT TEST (AS PER IS 8623)
- C. FUNCTIONAL/ PERFORMANCE CHECKS TO BE CONDUCTED ON ENTIRE BOARD WHILE ALL POWER SUPPLIES SWITCHED ON.

MANUFACTURER/ SIGNATURE	LEGEND: M: MANUFACTURER : VENDOR, T: CONSULTANT : TCE & BHEL, C: CUSTOMR: RRVUNL P: PERFORM, W: WITNESS, V: VERIFICATION		
		APPROVED BY	APPROVAL SEAL



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LIST OF CODES & STANDARDS

Notes:

1 Equipment , accessories , components , material and tests shall confirm , to the specifications of latest revision of applicable standards.

2 Equipment , accessories , components , material and tests shall confirm , in general , to the Specifications of
☒ S ☐ BS ☐ IEC

Unless marked other wise in the list below. Applicable standards are to be ticked ☐

LV Switch gear :-

1	Switchgear General Requirements	☒ IS : 4237	☐ BS : 162	☐ IEC :
2	Factory built assemblies of LV Switchgear control gear	☒ IS : 8623	☐ BS:5486	☐ IEC : 439
3	Selection , installation and maintenance of switchgear and control gear	☒ IS : 10118	☐ :	☐ IEC :
4	Busbar main connections and accessories	☒ IS: 5578	☐ BS : 159	☐ IEC :
5	Rail mounting in switchgear and control gear installation	☒ IS :11039	☐ BS :	☐ IEC : 715
6	Marking and identification of conductor and appartatus terminal	☒ IS:11053	☐ BS :	☐ IEC :
7	Marking of insulated conductors	☒ IS: 5578	☐ BS :	☐ IEC : 391
8	Item designation	☒ IS :8270	☐ BS :	☐ IEC :
9	Climate proofing of electrical equipment	☒ IS: 3202	☐ BS : CP 1014	☐ IEC :
10	Degree of protection (enclosure)	☒ IS:13947	☐ BS :	☐ IEC : 144
11	Wrought aluminium & Al. alloys	☒ IS:5082	☐ BS: 2898	☐ IEC : 114
12	Copper of busbars	☒ IS :	☐ BS :	☐ IEC : 28
13	LV circuit breakers	☒ IS :2516 Pt. I& II	☐ BS: 4752 ☐ BS:3871 SEC 1	☐ IEC : 157 -1
14	Starters	☒ IS : 8544	☐ BS: 4941	☐ IEC : 292-1
15	Identification of terminals of contractors and associated overload	☒ IS :10705	☐ BS:	☐ IEC : 158-1C
16	Air break switch	☒ IS :4064	☐ BS: 5419	☐ IEC : 408
17	Contactors	☒ IS:2959	☐ BS: 775	☐ IEC : 158-1
18	HRC catridge fuses	☒ IS:13703	☐ BS: 88	☐ IEC : 269-1



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19	Indicating instruments	[v] IS:1248	[] BS: 89	[] IEC : 51
20	Dimensions for panel mounted indicating instruments	[v] IS:2419	[] BS:	[] IEC :
21	AC electricity meters	[v] IS:722	[] BS: 5685	[] IEC : 521
22	Relays	[v] IS:3231	[] BS:142	[] IEC : 255
23	Static protective relays	[v] IS :8686	[] BS:	[] IEC :
24	Current transformers	[v] IS :2705	[] BS: 3938	[] IEC : 185
25	Voltage tranformers	[v] IS: 3941	[] BS: 3941	[] IEC :
26	LV Control Transformers	[v] IS: 12021	[] BS :	[] IEC :
27	Miniature circuit breakers	[v] IS: 8828	[] BS : 3871	[] IEC :
28	Control switches & push button	[v] IS: 13947	[] BS:	[] IEC :
29	Thermostatic Bimetals	[v] IS: 8588	[] BS:	[] IEC :
30	Phosphating of iron & steel	[v] IS: 6005	[] BS: 3189	[] IEC :
31	"Colours for ready mixed paints and enamels"	[v] IS: 5	[] BS:	[] IEC :
32	Environmental tests	[v] IS: 2106	[] BS:	[] IEC :
33	Maintenance & field testing of relays	[v] IS:9124	[] BS:	[] IEC :
34	Specification for PVC insulated cables for working voltage upto & including 1100volts	[v] IS: 694	[] BS:	[] IEC :



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LPB & Local Starters:-

1	Factory built assemblies of LV Switchgear and control gear	☒ IS: 8623 PART -II	☐ BS :5486	☐ IEC : 439
2	Degree of protection	☒ IS: 13947	☐ BS :5420	☐ IEC : 144
3	Push button	☒ IS: 13947	☐ BS :	☐ IEC : 337
4	Climatic proofing of electrical equipment	☒ IS: 3202	☐ BS :CP1014	☐ IEC :
5	AC motors starters for voltage not exceeding 1000 V	☒ IS: 8544	☐ BS : 4941	☐ IEC : 292
6	Code of practice for phosphating iron & steel	☒ IS: 6005	☐ BS :3189	☐ IEC :
7	Colour for ready mixed paints & enamels	☒ IS: 5	☐ :	☐ IEC :

2X660 MW SURATGARH TPS BOM PRICE SCHEDULE FOR LV SWITCHGEAR

Sr.No.	ITEM NO.	ITEM NAME	UOM	TOTAL QTY.	RATING(A)	UNIT PRICE	TOTAL PRICE
1	ELNKSCTS190101	EMERGENCY MCC #1DG,2DG & 3DG	EA	3	3200A		
2	ELNKSCTS190102	BOILER SERVICE PMCC #1DA,2DA & 3DA	EA	3	3200A		
3	ELNKSCTS190103	BLR VALVE & DAMPER ACDB #1HA,2HA & 3HA	EA	3	250A		
4	ELNKSCTS190104	BOILER ACDB #1HB,2HB & 3HA	EA	3	630A		
5	ELNKSCTS190105	TURBINE SERVICE PMCC #1DB,2DB & 3DB	EA	3	400A		
6	ELNKSCTS190106	SERVICE ACDB #1QA,2QA & 3QA	EA	3	630A		
7	ELNKSCTS190107	TURBINE VALVE DB #1KA,2KA & 3KA	EA	3	250A		
8	ELNKSCTS190108	STATION SERVICE PMCC #0DA,0DB & 0DC	EA	3	4000A		
9	ELNKSCTS190109	AIR CONDITIONING MCC #OTA	EA	1	400A		
10	ELNKSCTS190110	VENTILATION MCC #1TA,2TA & 3TA	EA	3	630A		
11	ELNKSCTS190111	MISC SERVICES MCC #0QA,0QB & 0QC	EA	3	400A		
12	ELNKSCTS190112	AIR WASHER MCC #0SA & 0SC	EA	2	630A		
13	ELNKSCTS190113	220V MAIN DCDB #1FA,2FA & 3FA	EA	3			
14	ELNKSCTS190114	ESP & ID FAN AREA MCC #1HD,2HD & 3HD	EA	3	400A		
15	ELNKSCTS190115	ESP AC & VENT MCC #1TB,2TB & 3TB	EA	3	400A		
16	ELNKSCTS190116	AIR CONDITIONING MCC #0TB (UNIT-2&3)	EA	1	630A		
17	ELNKSCTS190117	SERVICE BUILDING MCC	EA	1	1000A		
18	ELNKSCTS190118	WATER SYSTEM PMCC	EA	1	2500A		
19	ELNKSCTS190119	DM PLANT MCC	EA	1	250A		
20	ELNKSCTS190120	CPU MCC	EA	1	250A		
21	ELNKSCTS190121	FW WATER PMCC	EA	1	2500A		
22	ELNKSCTS190122	PTP MCC	EA	1	400A		
23	ELNKSCTS190123	ETP/STP MCC	EA	1	400A		
24	ELNKSCTS190124	FUEL OIL SERVICE PMCC	EA	1	2500A		
25	ELNKSCTS190125	AUX. BOILER MCC	EA	1	630A		
26	ELNKSCTS190126	WORKSHOP MCC	EA	1	400A		
27	ELNKSCTS190127	ADMIN PMCC	EA	1	1600A		
28	ELNKSCTS190128	CT, CW TREATMENT PMCC	EA	1	1600A		
29	ELNKSCTS190155	AIR WASHER MCC #0SB	EA	1	1000A		
30	ELNKSCTS190150	MANDATORY SPARE	LOT	1			
31	ELNKSCTS190151	SITE MODIFICATION CHARGE	LOT	1			
32	ELNKSCTS190152	COMMISSIONING CHARGE FOR NUMERICAL RELAY	LOT	550			
33	ELNKSCTS190153	E&C SPARES	LOT	1			
34	ELNKSCTS190154	TOOLS & TACKELS	LOT	1			
35	ELNKSCTS190155	SITE MODIFICATION MATERIAL @1% OF TOTAL COST	LOT	1			
		TOTAL					

NOTES:

1. SUMMATION OF ALL UNIT RATES OF MODULES SHALL BE EQUIVALENT TO TOTAL BOARD COST QUOTED, VARIANCE OF +/- 5% IS ACCEPTABLE. BEYOND 5% OFFER WILL NOT BE CONSIDER AS VALID OFFER. IN UNIT ADDITION-DELETION PRICES, PRICES QUOTED FOR COMPONENTS SHALL BE AS PER LIST PRICE OF CONCERNED MANUFACTURES. IF ANY ABNORMAL PRICES ON HIGHER SIDE OBSERVED OFFER MAY BE REJECTED.

2. ALL LT PCC/ MCC/ DBs SHALL BE SUPPLIED ALONGWITH THE INTEGRAL BASE FRAMES, FOUNDATION BOLTS, CABLE GLANDS & LUGS AND TOOLS & TACKLES AS MENTIONED IN DIFFERENT SECTIONS. ALSO SEPARATE BASE FRAMES OF ISMC-75 FOR SWITCHGEAR ERECTION (IN ADDITION TO INTEGRAL BASE FRAMES) SHALL BE SUPPLIED LOOSE BY THE BIDDER. ALL FIXING NUTS & BOLTS TOGETHER WITH FOUNDATION BOLTS SHALL ALSO BE SUPPLIED. PRICES FOR THE BASE FRAME SHALL BE BUILT IN THE SWITCHBOARD PRICE.

3. ITEM WISE PRICES WITH DESCRIPTION AND RATING OF EACH ITEM COMPLYING TO LIST FURNISHED IN THE SCHEDULE OF UNIT PRICES SHALL BE FURNISHED IN SCHEDULE OF UNIT PRICE.

4. FOR DETAILED BOARD WISE BOM, REFER ANNEXURE-B.

5. FOR DETAILED MODULE WISE BOM, REFER ANNEXURE-A.

6. LIST OF RECOMMENDED O&M SPARES FOR 3 YEARS (OPTIONAL) WITH ITEM WISE PRICE & QUANTITY OF EACH ITEM AS RECOMMENDED BY MANUFACTURER SHALL BE FURNISHED IN SCHEDULE OF PRICES.

7. ADDITION/DELETION OF QUANTITIES SHALL BE APPLICABLE AT THE QUOTED PRICE. THE UNIT RATE OF SUPPLY OF ALL EQUIPMENTS & SERVICES QUOTED BY THE BIDDER SHALL BE FIRM FOR A VARIATION OF QUANTITIES, WHICH MAY BE TO THE EXTENT OF ±30% OF THE TOTAL CONTRACT VALUE DERIVED ON THE BASIS OF ORDERED QUANTITY. SUM OF INDIVIDUAL MODULE SHALL EQUAL TO BOARD PRICE.

8. Price of components for Panels, Busduct, E&C spres, Tools and Tackles are to be quoted in Unit Price Schedule given in specification.

a. COMPLETE DIMENSIONS OF ALL THE BOARDS INCLUDING NO OF ACB, MCC. GA DRAWING SHALL BE DULY SUBMITTED FOR ALL BOARDS.

b. DIMENSIONS OF EACH TYPE OF PANEL.

c. MODULE SIZE OF EACH TYPE OF FEEDER.

d. MINIMUM CLEARANCES REQUIRED ON ALL SIDES FOR EACH TYPE OF PANEL.

e. NO. of VERTICAL (including PCC, MCC etc.) of EACH PANLES TO BE GIVEN, ELSE YOUR OFFER WILL BE REJECTED..

9. DOUBLE COMPRESSION, NICKLE PLATED BRASS CABLE GLANDS & HEAVY DUTY LUGS OF NTPC APPROVED MAKE FOR EXTERNAL POWER, CONTROL & EARTHING CONNECTIONS AT SUPPLIED EQUIPMENT END AND FOUNDATION BOLT ARE IN THE SCOPE OF BIDDER. BIDDER TO QUOTE ALL EQUIPMENT WITH CABLE GLANDS, LUGS AND FOUNDATION BOLTS.

10. COMMISSIONING CHARGES OF NUMERICAL RELAYS, TVM & ENERGY METERS SHALL BE INCLUDED IN THE PRICE QUOTED FOR SWGR & NO EXTRA CHARGESWILL BE GIVEN FOR THE SAME.

3 X 660 MW NORTH KARANPURA TPS
LV SWITCHGEAR
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
1	INCOMING FEEDER UNIT		
a)	ACB Incomer to PCC/PMCC from Trafo. - Module Type DAET (I/C)		
	630A		
	1000A		
	1600A		
	2000A		
	2500A		
	3000A		
	4000A		
b)	ACB Incomer to MCC - Module Type DAE/ DAEN/ AE (I/C)		
	630A		
	800A		
	1000A		
	1600A		
c)	MCCB Incomer for MCC / ACDB – Module Type EM3 (I/C)		
	200A – Fixed Type		
	125A – Fixed Type		
	200A – Fixed Type		
	250A – Fixed Type		
	400A – Fixed Type		
	630A – Fixed Type		
	125A – Drawout Type		
	200A – Drawout Type		
	200A – Drawout Type		
	250A – Drawout Type		
	400A – Drawout Type		
	630A – Drawout Type		
d)	SFU Incomer for MCC / ACDB – Module Type E3 (I/C)		
	Upto 63A – Fixed Type		
	Upto 63A – Drawout Type		
e)	220V DCDB Incomer from charger - Module type CH (I/C)		
	150A – CH Fixed Type		
	200A – CH Fixed Type		
	400A – CH Fixed Type		
	630A – CH Fixed Type		
	1250A – CH Fixed Type		
	150A – CH Drawout Type		
	200A – CH Drawout Type		
	400A – CH Drawout Type		
	630A – CH Drawout Type		
f)	220V DC Fuse DB Incomer from DCDB - Module type H2		
	32A		
	50A		
	63A		
g)	AC MCCB DB Incomer– Module Type H3		
	32A		
	63A		
	125A		
h)	ACB Incomer to Emergency Board - Module Type DAEG/ DAEGN (I/C)		
	3000A		
2	BUSCOUPLER UNIT		
a)	ACB Buscoupler to PCC/PMCC/MCC from Trafo. - Module Type DAET/ DAE (B/C)		
	400A		
	630A		
	800A		

3 X 660 MW NORTH KARANPURA TPS
LV SWITCHGEAR
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	1000A		
	1600A		
	2000A		
	2500A		
	3000A		
	4000A		
b)	MCCB Buscoupler for MCC / ACDB – Module Type EM3 (B/C)		
	125A – Fixed Type		
	200A – Fixed Type		
	200A – Fixed Type		
	250A – Fixed Type		
	400A – Fixed Type		
	630A – Fixed Type		
	125A – Drawout Type		
	200A – Drawout Type		
	200A – Drawout Type		
	250A – Drawout Type		
	400A – Drawout Type		
	630A – Drawout Type		
c)	SFU Buscoupler for MCC / ACDB – Module Type E3 (B/C)		
	Upto 63A – Fixed Type		
	Upto 63A – Drawout Type		
d)	220V DCDB Buscoupler from charger - Module type CH (B/C & DCDB-TIE)		
	150A – CH Fixed Type		
	200A – CH Fixed Type		
	400A – CH Fixed Type		
	630A – CH Fixed Type		
	1250A – CH Fixed Type		
	150A – CH Drawout Type		
	200A – CH Drawout Type		
	400A – CH Drawout Type		
	630A – CH Drawout Type		
	1250A – CH Drawout Type		
e)	ACB Incomer to Emergency Board - Module Type DAEG (B/C)		
	3000A		
3	Outgoing ACB supply feeder - Module Type DAE/DAE-TIE (O/G)		
	630A		
	800A		
	1000A		
	1600A		
	3000A		
4	Outgoing ACB motor feeder - Module Type DM/PM (controlled from DDCMIS/PLC)		
	90.1- 200KW		
5	DOL Motor Starter - Unidirectional Drive - Drawout Type		
a)	Module Type K2 (Controlled from LPBS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 13KW		
	13.1 - 24KW		
	24.1 - 29.9KW		
b)	Module Type K21 (Controlled from LPBS)		

3 X 660 MW NORTH KARANPURA TPS
LV SWITCHGEAR
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	30.0 - 37.0KW		
	37.1 - 40KW		
	40.1 - 50.0KW		
	50.1 - 75KW		
	75 - 90KW		
c)	Module Type K3 (Controlled from LCP)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 13KW		
	13.1 - 24KW		
	24.1 - 29.9KW		
d)	Module Type K31 (Controlled from LCP)		
	30.0 - 37.0KW		
	37.1 - 40KW		
	40.1 - 50.0KW		
	50.1 - 75KW		
	75 - 90KW		
e)	Module Type DK2/PK2/AK2 (Controlled from DDCMIS/PLC/ATRS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 13KW		
	13.1 - 24KW		
	24.1 - 29.9KW		
f)	Module Type DK21/PK21/AK21 (Controlled from DDCMIS/PLC/ATRS)		
	30.0 - 37.0KW		
	37.1 - 40KW		
	40.1 - 50.0KW		
	50.1 - 75KW		
	75 - 90KW		
g)	Module Type DK2E/PK2E/AK2E (Controlled from DDCMIS/PLC/ATRS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 13KW		
	13.1 - 24KW		
	24.1 - 29.9KW		
h)	Module Type DK21E/PK21E/AK21E (Controlled from DDCMIS/PLC/ATRS)		
	30.0 - 37.0KW		
	37.1 - 40KW		
	40.1 - 49.9KW		
	50 - 75KW		
	75 - 90KW		
	6 RDOL Motor Starter – Bidirectional Drive Drawout Type		
a)	Module Type DN1/ PN1/ AN1 (Controlled from DDCMIS/PLC/ATRS)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 13KW		
	13.1 - 24KW		
	24.1 - 29.9KW		

3 X 660 MW NORTH KARANPURA TPS
LV SWITCHGEAR
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
7	Outgoing MCCB/ SFU controlled feeders		
a)	Outgoing SFU controlled supply feeder - Module Type E3 (O/G)		
	upto 10A - Fixed type		
	16A - Fixed type		
	25A - Fixed type		
	32A - Fixed type		
	63A - Fixed type		
	upto 10A - Drawout type		
	16A - Drawout type		
	25A - Drawout type		
	32A - Drawout type		
	63A - Drawout type		
b)	Outgoing MCCB controlled supply feeder - Module Type E3 (O/G)		
	125A - Fixed type		
	160A - Fixed type		
	200A - Fixed type		
	250A - Fixed type		
	400A - Fixed type		
	600A - Fixed type		
	125A - Drawout type		
	160A - Drawout type		
	200A - Drawout type		
	250A - Drawout type		
	400A - Drawout type		
	600A - Drawout type		
c)	Double pole SFU controlled 1-ph feeder - E1 (O/G)		
	10A - Fixed type		
	16A - Fixed type		
	25A - Fixed type		
	32A - Fixed type		
	63A - Fixed type		
	10A - Drawout type		
	16A - Drawout type		
	25A - Drawout type		
	32A - Drawout type		
	63A - Drawout type		
d)	1-Ph SFU controlled outgoing contactor feeder (EA1)		
	10A - Fixed type		
	16A - Fixed type		
	25A - Fixed type		
	32A - Fixed type		
	63A - Fixed type		
	10A - Drawout type		
	16A - Drawout type		
	25A - Drawout type		
	32A - Drawout type		
	63A - Drawout type		
e)	3-Ph SFU controlled outgoing contactor feeder (EA3)		
	10A - Fixed type		
	16A - Fixed type		
	25A - Fixed type		
	32A - Fixed type		
	63A - Fixed type		
	125A - Fixed type		
	10A - Drawout type		
	16A - Drawout type		
	25A - Drawout type		
	32A - Drawout type		

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LV SWITCHGEAR
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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	63A - Drawout type		
	125A - Drawout type		
f)	3-Ph MCCB controlled outgoing contactor feeder (EA3)		
	200A - Fixed type		
	250A - Fixed type		
	400A - Fixed type		
	600A - Fixed type		
	200A - Drawout type		
	250A - Drawout type		
	400A - Drawout type		
	600A - Drawout type		
g)	220V DC Solenoid Valve feeder - (DW)		
	Upto 5.5KW		
	5.6 - 7.0KW		
	7.1 - 13KW		
	13.1 - 24KW		
	24.1 – 29.9KW		
8	1-Ph MCB controlled outgoing feeder (H1) from AC MCCB DB		
	10A		
	16A		
9	Outgoing Switch-fuse feeders		
a)	220V DC Outgoing SFU feeder (X)		
	2A - Fixed type		
	4A - Fixed type		
	6A - Fixed type		
	10A - Fixed type		
	16A - Fixed type		
	25A - Fixed type		
	32A - Fixed type		
	50A - Fixed type		
	63A - Fixed type		
	100A - Fixed type		
	125A - Fixed type		
	200A - Fixed type		
	250A - Fixed type		
	400A - Fixed type		
	500A - Fixed type		
	630A - Fixed type		
	2A - Drawout type		
	4A - Drawout type		
	6A - Drawout type		
	10A - Drawout type		
	16A - Drawout type		
	25A - Drawout type		
	32A - Drawout type		
	50A - Drawout type		
	63A - Drawout type		
	100A - Drawout type		
	125A - Drawout type		
	200A - Drawout type		
	250A - Drawout type		
	400A - Drawout type		
	500A - Drawout type		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	630A - Drawout type		
10	Common Auxiliary Module		
a)	PT module		
i	Bus PT module for PCC/PMCC-G1 Type		
ii	Bus PT module for Emergency MCC-G2 Type		
iii	Bus PT DCDB-S Type		
b)	Space heater and Power Socket - TT		
c.1)	110V AC control supply module – Type CS (consisting of 415/110V control Trafo.)		
	1KVA		
	2KVA		
	2.5KVA		
	3KVA		
	5KVA		
	7.5KVA		
	10KVA		
c.2)	240 V AC control supply module – type CS (consisting of 415/240V control Trafo.)		
	1KVA		
	2KVA		
	2.5KVA		
	3KVA		
	5KVA		
	7.5KVA		
	10KVA		
d.1)	110V AC control supply module – Type CS-A (consisting of 415/110V control Trafo.)		
	1KVA		
	2KVA		
	2.5KVA		
	3KVA		
	5KVA		
	7.5KVA		
	10KVA		
d.2)	240 V AC control supply module – type CS-A (consisting of 415/240V control Trafo.)		
	1KVA		
	2KVA		
	2.5KVA		
	3KVA		
	5KVA		
	7.5KVA		
	10KVA		
e)	240V AC motor space heater module		
f)	220V DC supply module (for receiving 220V DC supply)		
g)	24 V winding heating module		
h)	Alarm module		
i)	Test supply module		
J.1)	240 V AC Panel Space heating supply module – type SH (consisting of 415/240V control Trafo.)		
	1KVA		
	2KVA		
	2.5KVA		
	3KVA		
	5KVA		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	7.5KVA		
	10KVA		
J.2)	240 V AC Panel Space hetaing supply module – type SH-A (consisting of 415/240V control Trafo.)		
	1KVA		
	2KVA		
	2.5KVA		
	3KVA		
	5KVA		
	7.5KVA		
	10KVA		
11	Empty Panel with Horizontal & Vertical Busbar, Support & Auxiliary Busbar		
a)	MCC Panel (Double Front Drawout Type)		
	250 / 250A		
	400 / 400A		
	630 / 630A		
	800 / 630A		
	1000 / 630A		
	1600 / 630A		
	2000 / 630A		
	2500 / 630A		
	3000 / 630A		
	4000 / 630A		
b)	MCC Panel (Double Front Fixed Type)		
	250 / 250A		
	400 / 400A		
	630 / 630A		
	800 / 630A		
	1000 / 630A		
	1600 / 630A		
	2000 / 630A		
	2500 / 630A		
	3000 / 630A		
	4000 / 630A		
c)	220V DCDB Panel (Double Front Fixed type)		
	UPTO 630A (with 630A VBB)		
	1000A (with 630A VBB)		
	1600A (with 630A VBB)		
d)	220V DCDB Panel (Double Front Drawout type)		
	UPTO 630A (with 630A VBB)		
	1000A (with 630A VBB)		
	1600A (with 630A VBB)		
12	Empty Panel With Horizontal & Vertical Busbar, Support & Auxiliary Busbar		
a)	PCC Panel (Single Front Drawout Type)		
	1600 / 1600A		
	2000 / 2000A		
	2500 / 2500A		
	3000 / 3000A		
	4000 / 4000A		
b)	MCC Panel (Single Front Drawout Type)		
	250 / 250A		
	400 / 400A		
	630 / 630A		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	800 / 630A		
	1000 / 630A		
	1600 / 630A		
	2000 / 630A		
	2500 / 630A		
	3000 / 630A		
	4000 / 630A		
c)	MCC Panel (Single Front Fixed Type)		
	250 / 250A		
	400 / 400A		
	630 / 630A		
	800 / 630A		
	1000 / 630A		
	1600 / 630A		
	2000 / 630A		
	2500 / 630A		
	3000 / 630A		
	4000 / 630A		
d)	220V DCDB Panel (Single Front Fixed Type)		
	UPTO 630A (with 630A VBB)		
	1000A (with 630A VBB)		
	1600A (with 630A VBB)		
e)	220V DCDB Panel (Single Front Fixed Type)		
	UPTO 630A (with 630A VBB)		
	1000A (with 630A VBB)		
	1600A (with 630A VBB)		
13	ACB Panel with Horizontal & Vertical Busbar, Support & Auxiliary Busbar		
	630 / 630A		
	800 / 630A		
	800 / 800A		
	1000 / 630A		
	1000 / 800A		
	1000 / 1000A		
	1600 / 630A		
	1600 / 800A		
	1600 / 1000A		
	1600 / 1600A		
	2000 / 630A		
	2000 / 800A		
	2000 / 1000A		
	2000 / 1600A		
	2000 / 2000A		
	2500 / 630A		
	2500 / 800A		
	2500 / 1000A		
	2500 / 1600A		
	2500 / 2000A		
	2500 / 2500A		
	3000 / 630A		
	3000 / 800A		
	3000 / 1000A		
	3000 / 1600A		
	3000 / 2000A		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	3000 / 2500A		
	3000 / 3000A		
	4000 / 630A		
	4000 / 800A		
	4000 / 1000A		
	4000 / 1600A		
	4000 / 2000A		
	4000 / 2500A		
	4000 / 3000A		
	4000 / 4000A		
14	Dummy Panel		
	UPTO 630A		
	800A		
	1000A		
	1600A		
	2000A		
	2500A		
	3000A		
	4000A		
15	Unit Prices For Circuit Components		
	a) Air Circuit Breaker without releases		
	630A MDO		
	800A MDO		
	1000A MDO		
	630A ACB, 3P, EDO, AC		
	800A ACB, 3P, EDO, AC		
	1000A ACB, 3P, EDO, AC		
	4000A ACB, 3P, EDO, AC		
	3200A ACB, 3P, EDO, AC		
	2500A ACB, 3P, EDO, AC		
	2000A ACB, 3P, EDO, AC		
	1600A ACB, 3P, EDO, AC		
	1250A ACB, 3P, EDO, AC		
	1250A ACB, 2P, MDO, DC		
	b) MCCB, 2NO+2NC AUX, FSC		
	16A		
	25A		
	32A		
	63A		
	80A		
	115A		
	150A		
	185A		
	265A		
	315A		
	400A		
	630A		
	c) MCCB, 2NO+2NC AUX, ASC		
	16A		
	25A		
	32A		
	63A		
	80A		
	115A		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	150A		
	185A		
	265A		
	315A		
	400A		
	630A		
d)	MCCB with LSIG release		
	200A		
	250A		
	300A		
	350A		
	400A		
	630A		
e)	MCCB - Motorized with LSIG release		
	200A		
	250A		
	300A		
	350A		
	400A		
	630A		
f)	POWER FUSE LINK FOR SFU (AC) - TPN		
	Upto 16A		
	25A		
	32A		
	63A		
	125A		
	250A		
	400A		
	630A		
g)	POWER FUSE LINK FOR SFU (DC) - DP		
	Upto 16A		
	25A		
	40A		
	50A		
	60A		
	80A		
	100A		
	200A		
	300A		
	400A		
	630A		
h)	SFU WITHOUT POWER FUSE LINK (AC) - TPN		
	Upto 16A		
	25A		
	32A		
	63A		
	125A		
	250A		
	400A		
	630A		
i)	SFU WITHOUT POWER FUSE LINK (DC) - DP		
	Upto 16A		
	25A		
	40A		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	50A		
	60A		
	80A		
	100A		
	200A		
	300A		
	400A		
	630A		
j)	HRC Fuse Links (Offset tag Type)		
	Upto 10A		
	16A		
	25A		
	32A		
	50A		
	63A		
k)	HRC Fuse DIN Type (Blade Contact)		
	Upto 10A		
	16A		
	20A		
	32A		
	36A		
	50A		
	63A		
	80A		
	100A		
	125A		
	160A		
	200A		
	250A		
	315A		
	400A		
	Control Fuse Link		
l)	Power contactor (AC)		
	16A		
	25A		
	32A		
	63A		
	80A		
	115A		
	150A		
	185A		
	265A		
	315A		
	400A		
m)	Power contactor (DC)		
	16A		
	25A		
	32A		
	63A		
	80A		
	115A		
	150A		
	185A		
	265A		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	400A		
n)	Fuse Base		
	UPTO 20A		
	32A		
	50/63A		
	100A		
	250A		
	400A		
	630A		
o)	Auxiliary contactor AC/DC		
i)	AC Aux. contactor		
	2NO + 2NC		
	3NO + 3NC		
	4NO + 4NC		
	6NO + 6NC		
ii)	DC Aux. contactor		
	2NO + 2NC		
	3NO + 3NC		
	4NO + 4NC		
	6NO + 6NC		
p)	Protection Relay		
	VAGM 23		
	CTU 12		
	CTU 32		
	VTT 11		
	VAG 11		
	VAA 11		
	VAJHM 13		
	VAJHM 23		
	CDGM-12		
	CAG 12		
	CAG 34		
	CCUM 21		
	CDG 11		
	CDG 31		
	CDG 61		
	VDG 14		
	CDV 62		
	CAG 14		
	VAX 31		
	CAG 37		
	CAEM-21		
	VAG-21		
	VAJC-11		
	CTMM-501		
	MOTPRO		
	VAA21		
	VTT12		
	VTIG		
	VTU21		
	NUMERICAL RELAY FOR PROTECTION, T/C SUPERVISION, LOGIC, METERING FUNCTION & WITH CHECK SYNCHRONIZATION, REF PROTECTION, FUSE FAILURE, ENERGY METERING, OVER LOAD PROTECTION. 50. 50N. 51. 51N. 27. 98. 86. 25. 95. 30A. 30B. 64R		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	SEF NUMERICAL RELAY		
	NUMERICAL RELAY FOR PROTECTION, T/C SUPERVISION, LOGIC, METERING FUNCTION & WITH CHECK SYNCHRONIZATION, FUSE FAILURE, ENERGY METERING, OVER LOAD PROTECTION 50, 50N,51, 51N, 27, 98, 86, 25, 95, 30A, 30B		
	NUMERICAL RELAY FOR PROTECTION, T/C SUPERVISION, LOGIC, METERING FUNCTION & WITH CHECK SYNCHRONIZATION, FUSE FAILURE, 50, 50N,51, 51N, 27, 98, 86, 25, 95, 30A, 30B		
	NUMERICAL RELAY FOR PROTECTION, T/C SUPERVISION, LOGIC, METERING FUNCTION & WITH CHECK SYNCHRONIZATION, FUSE FAILURE, ENERGY METERING, OVER LOAD PROTECTION 50, 50N,51, 51N, 27, 98, 86, 25, 95, 30A, 30B, DG PROTECTION (Like Neutral Under-voltage-27N, Power Direction / Reverse Power (Islanding)-32, Negative Phase Sequence Over-current (Phase unbalance, reverse phase sequence) -46, , Negative Sequence Voltage -47, Ground Over-voltage trip or ground over-current trip-51G, Instantaneous Over-voltage trip (ferro-resonance)-59, Over-voltage trip-59T, Neutral over-voltage-59N, Over/Under Frequency trip-81O/ 81U etc.)		
	NUMERICAL RELAY FOR PROTECTION, T/C SUPERVISION, LOGIC, METERING FUNCTION & FUSE FAILURE, OVER LOAD PROTECTION 50, 50N,51, 51N, 27, 98, 86, 95, 30A, 30B		
	NUMERICAL RELAY FOR PROTECTION, T/C SUPERVISION-95, LOGIC, METERING FUNCTION & FUSE FAILURE-98, OVER LOAD PROTECTION, LOCKED ROTOR PROTECTION-14, RESTART INHIBIT PROTECTION-49, NEGATIVE SEQUENCE PROTECTION-46, 50, 50N, 51, 51N, 27, 86, 30A, 30B		
	Communicable type Numerical relay for O/C, E/F, TC Supervision on IEC-61850 protocol		
	Communicable type Numerical relay for O/C, E/F, Check Synchronization, TC Supervision on IEC-61850 protocol		
	Communicable type Numerical relay for Voltage control O/C, 3Phase O/C, Reverse power, Differential, Neutral Displacement, E/F, U/V, O/V protection, Check Synchronization, TC Supervision on IEC-61850 protocol		
	Communicable type Numerical relay for Under voltage, Over voltage etc. on IEC-61850 protocol		
	Communicable type Numerical relay for E/F protection for DCDB on IEC-61850 protocol		
	Communicable type Numerical relay for composite motor protection including TC Supervision on IEC-61850 protocol		
	Communicable type Numerical relay for Neutral Displacement on IEC-61850 protocol		
	Communicable type Numerical relay for O/C, E/F, TC Supervision on Modbus protocol		
	Communicable type Numerical relay for O/C, E/F, Check Synchronization, TC Supervision on Modbus protocol		
	Communicable type Numerical relay for Voltage control O/C, 3Phase O/C, Reverse power, Differential, Neutral Displacement, E/F, U/V, O/V protection, Check Synchronization, TC Supervision on Modbus protocol		
	Communicable type Numerical relay for Under voltage, Over voltage etc. on Modbus protocol		
	Communicable type Numerical relay for E/F protection for DCDB on Modbus protocol		
	Communicable type Numerical relay for composite motor protection including TC Supervision on Modbus protocol		
	Communicable type Numerical relay for Neutral Displacement on Modbus protocol		
	Numerical Check synchronising Relay		
	Check synchronising Relay Type-SKE11 or better		
	Guard Relay		
	NUMERICAL RELAY Over current and Earth fault		
	BATTERY EARTH FAULT RELAY, 1-7mA, NOMINAL VOLTAGE-220V DC, 1DV, 2NO S/R, FLUSH		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	OVERLOAD RELAY, NOMINAL VOLTAGE-220V DC, O/V VLTAGE SETTING-110%, 1/4NV, 1NO+1NC S/R		
	UNDER VOLTAGE RELAY, NOMINAL VOLTAGE-220V DC, U/V SETTING-80%, AUX.-240V AC, 1/2NH, 1NO+2NC S/R		
	JAMING RELAY - CAG17		
q)	Bimetal Thermal O/L Relays		
i)	Thermal O/L relay with SPP - OLR		
	Upto 5.5KW		
	5.6 to 11KW		
	11.1 to 22KW		
	22.1 to 45KW		
	45.1 to 75KW		
	75 to 110KW		
ii)	Heavy Duty Thermal O/L relay with SPP - OLR		
	Upto 5.5KW		
	5.6 to 11KW		
	11.1 to 22KW		
	22.1 to 45KW		
	45.1 to 75KW		
	75 to 110KW		
r)	Timer (DC)		
	ON DELAY TIMER, 0.5-5SEC., 220V DC, 2NO+2NC		
	ON DELAY TIMER, 1.0-10SEC. 220V DC, 2NO+2NC		
	240VAC MTR RESTART CONTROL TIMER (.2-60SECS)		
	240VAC ON DELAY TIMER(1-10SECNS)WITH 1NO		
	220VDC ON DELAY TIMER(.5-5SECS) WITH 1NO		
	220VDC ON DELAY TIMER(0.5-5SECS)WITH 3NO		
	220VDC ON DELAY TIMER(1-10SECS) WITH 3NO		
s)	Meter		
	AC ammeter (Digital)		
	AC ammeter (Analog) linear scale		
	AC ammeter (Analog) compressed scale		
	DC ammeter (Digital)		
	DC ammeter (Analog)		
	AC voltmeter (Digital)		
	DC voltmeter (Analog)		
	Wattmeter (3 Phase)		
	Wattmeter (1 Phase)		
	TVM meter		
	DIGITAL ENERGY METER		
	Frequency meter		
	Synchroscope		
	Differential Voltmeter		
	Differential Frequency meter		
	Multifunction digital Energy meter with RS485 Port (0.2 Acc. Class)		
	Multifunction digital Energy meter with RS485 Port (0.5 Acc. Class)		
	Multifunction digital Energy meter with RS485 Port (1.0 Acc. Class)		
t)	Single Phase Preventor Relay		
u)	MCB		
	6A, 4P 415V AC		
	6A DP, 240V AC		
	10A DP, 240V AC		
	16A DP, 240V AC		
	32A DP, 240V AC		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	6A DP, 110V AC		
	10A DP, 110V AC		
	16A DP, 110V AC		
	32A DP, 110V AC		
	16A DP, 220V DC		
	6A DP, 220V DC		
	6A DP, 240V AC		
	10A SP, 240V AC		
	16A SP, 240V AC		
	32A SP, 240V AC		
	6A SP, 110V AC		
	10A SP, 110V AC		
	16A SP, 110V AC		
	32A SP, 110V AC		
	16A SP, 220V DC		
	6A SP, 220V DC		
v)	SWITCH & PUSH BUTTON		
	BREAKER CONTROL SWITCH, 16A,220V DC, 2CLOSE+2TRIP		
	DC ISOLATING SWITCH 16A,220V DC, DP, BASE MTG.		
	16A,240V AC SELECTOR SWITCH 3WAY, 4POLE, FLUSH MTG		
	25A,240V AC SELECTOR SWITCH 3WAY, 4POLE, FLUSH MTG		
	16A,240V AC SELECTOR SWITCH 2WAY, 2POLE, FLUSH MTG		
	NORMAL/ TRIAL SEL. SWITCH, 2POLE , 2WAY, 10A 240V AC, FLUSH MTG,		
	MCC/ NORMAL/ TRIAL SEL. SWITCH, 2POLE ,3WAY, 10A 240V AC, FLUSH MTG		
	SWGR/ REMOTE SEL. SWITCH 3POLE 2WAY,16A 220V DC, FLUSH MTG		
	SWGR/ NORMAL/ TRIAL SEL. SWITCH, 3POLE, 3WAY, 16A 220V DC, FLUSH MTG.		
	NORMAL/ TRIAL SEL. SWITCH, 2POLE , 2WAY, 10A 240V AC, FLUSH MTG, LOCKABEL TYPE		
	MCC/ NORMAL/ TRIAL SEL. SWITCH, 2POLE ,3WAY, 10A 240V AC, FLUSH MTG, LOCKABEL TYPE		
	SWGR/ REMOTE SEL. SWITCH 3POLE 2WAY,16A 220V DC, FLUSH MTG.LOCKABLE TYPE		
	SWGR/ NORMAL/ TRIAL SEL. SWITCH, 3POLE, 3WAY, 16A 220V DC, FLUSH MTG., LOCKABLE TYPE		
	AMMETER SELECTOR SWITCH		
	VOLTMETER SELECTOR SWITCH		
	TOGGLE SWITCH 5A, 240V AC		
	AC SWITCH SPST-5A,240V AC		
	10A, 220V DC SWITCH		
	Door Limit switch		
	Ammeter selector switch		
	Voltmeter selector switch		
	Synchronisation selector switch		
	Trip selector switch		
	Push Button		
	2NO + 2NC Shrouded		
	1NO + 1NC Shrouded		
	2NO + 2NC Mushroom head stayput		
	2NO + 2NC Lockable type		
w)	Indicating Lamp Assembly (LED Type)		
	240V AC-GREEN		
	240V AC-RED		
	240V AC- AMBER		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	110V AC-GREEN		
	110V AC-RED		
	110V AC- AMBER		
	220V DC-WHITE		
	220V DC-RED		
	220V DC-GREEN		
	220V DC-BLUE		
	220V DC- AMBER		
	63.5V AC-RED		
	63.5V AC-YELLOW		
	63.5V AC-BLUE		
x)	CT		
i)	Metering CT		
	Upto 75/1A		
	100/1A		
	125/1A		
	150/1A		
	200/1A		
	250/1A		
	300/1A		
	400/1A		
	500/1A		
	630/1A		
	800/1A		
	1000/1A		
	1250/1A		
	1600/1A		
	2000/1A		
	2500/1A		
	3000/1A		
	4000/1A		
ii)	Protection CT (5P20)		
	Upto 75/1A		
	100/1A		
	125/1A		
	150/1A		
	200/1A		
	250/1A		
	300/1A		
	400/1A		
	500/1A		
	630/1A		
	800/1A		
	1000/1A		
	1250/1A		
	1600/1A		
	2000/1A		
	2500/1A		
	3000/1A		
	4000/1A		
	630/5A		
	800/5A		
	1000/5A		
	1250/5A		

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ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	1600/5A		
	2000/5A		
	2500/5A		
	3000/5A		
	4000/5A		
iii)	PS Class CT		
	1600/1A		
	2500/1A		
	3000/1A		
	4000/1A		
	1600/5A		
	2500/5A		
	3000/5A		
	4000/5A		
y)	Voltage Transformer		
i)	415/√3 : 110/√3V, 1ph, 50VA		
ii)	415/√3 : 110/√3V, 1ph, 100VA		
iii)	415/√3 : 240/√3V, 1ph, 50VA		
iv)	415/√3 : 240/√3V, 1ph, 100VA		
z)	Toggle switch (16A)		
aa)	Secondary Isolating Contact Block		
ab)	Control Terminal (Fixed)		
ac)	Thermostat		
ad)	CONTROL TRANSFORMER		
	415/240V,CL-E, 1 KVA		
	415/240V,CL-E, 2KVA		
	415/240V,CL-E, 2.5KVA		
	415/240V,CL-E, 3KVA		
	415/240V,CL-E, 5KVA		
	415/240V,CL-E, 10KVA		
	415/110V,CL-E, 1 KVA		
	415/110V,CL-E, 2KVA		
	415/110V,CL-E, 2.5KVA		
	415/110V,CL-E, 3KVA		
	415/110V,CL-E, 5KVA		
	415/110V,CL-E, 10KVA		
ac)	4-20mA Dual o/p, Aux sup 220V DC, 1A, Current Transducer		
	4-20mA Dual o/p, Aux sup 240V AC, 1A, Current Transducer		
	4-20mA Dual o/p, Aux sup 110V AC, 1A, Current Transducer		
	4-20mA Dual o/p, Aux sup 220V DC, VoltageTransducer, PTR 415/110V		
	4-20mA Dual o/p, Aux sup 240V AC, VoltageTransducer, PTR 415/110V		
	4-20mA Dual o/p, Aux sup 110V AC, VoltageTransducer, PTR 415/110V		
	4-20mA Dual o/p, Aux sup 220V DC, FrequencyTransducer, PTR 415/110V		
	4-20mA Dual o/p, Aux sup 220V DC, Input 0-75mV DC, Current Transducer-DC		
	4-20mA Dual o/p, Aux sup 240V AC, Input Voltage 0-220V DC, Voltage Transducer-DC		
ad)	4-20mA Dual Output kW transducer		
ae)	4-20mA Dual Output kVA transducer		
af)	4-20mA Dual Output PF transducer		
ag)	4-20mA Dual Output Frequency transducer		
ah)	Interposing relay RE 302 or Eqvt with freewheeling diode & LED		

3 X 660 MW NORTH KARANPURA TPS
LV SWITCHGEAR
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
ai)	Laptop PC alongwith software & hardware		
aj)	3 PIN SOCKET - 5A, 110V AC, 3PIN		
ak)	THERMOSTATE, DIAL TYPE		
am)	SPACE HEATER		
an)	CFL WITH HOLDER		
ao)	NEUTRAL LINK		
	20A FOR CONTROL CKT. & POWER CKT. UPTO 25A MCCB RATING		
	32A FOR 50A MCCB RATING		
	63A FOR 100A & 125A MCCB RATING		
	125A FOR 250A MCCB RATING		
	250A FOR 400A & 500A MCCB RATING		
ap)	CASTLE KEY INTERLOCK FOR MCCB - 3LOCK+2KEY		
aq)	MECHANICAL INTERLOCK FOR POWER CONTACTOR		
	16A		
	25A		
	32A		
	63A		
	80A		
	115A		
	150A		
	185A		
	265A		
	315A		
	400A		
ar)	AUX. CONTACTOR		
	2NO+2NC, CV-220V DC		
	4NO, CV-220V DC		
	2NO+2NC, CV-240V AC		
	3NO+1NC, CV-240V AC		
	2NO+2NC, CV-110V AC		
	3NO+1NC, CV-110V AC		
	1NO + 1NC 240V AC		
	1NO + 1NC 110V AC		
	1NO + 1NC 220V DC		
	1NO 240V AC		
	1NO 110V AC		
	1NO 220V DC		
as)	ISOLATING TRANSFORMER-15kVA		
	ISOLATING TRANSFORMER-20kVA		
	ISOLATING TRANSFORMER-25kVA		
	ISOLATING TRANSFORMER-30kVA		
16	Foundation Frame		
a)	MCC panel		
	upto 1600A (SF)		
	2500A (SF)		
	3000A (SF)		
	4000A (SF)		
	upto 1600A (DF)		
	2500A (DF)		
	3000A (DF)		
	4000A (DF)		
b)	220V DCDB panel		
	SF		

3 X 660 MW NORTH KARANPURA TPS
LV SWITCHGEAR
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	DF		
c)	PCC / PMCC panel		
	upto 1600A		
	2500A		
	3000A		
	4000A		
17	Connection from PMCC/MCC panel to PMCC/MCC panel		
	250A		
	400A		
	630A		
	800A		
	1000A		
	1600A		
	2500A		
	3000A		
	4000A		
18	Cable Glands & Lugs:		
a)	Single Compression Cable Glands for cable sizes:		
	2C X 2.5 Sq. mm.		
	3C X 2.5 Sq. mm.		
	5C X 2.5 Sq. mm.		
	7C X 2.5 Sq. mm.		
	12C X 2.5 Sq. mm.		
	16C X 2.5 Sq. mm.		
	2C X 10 Sq. mm.		
	2C X 16 Sq. mm.		
	2C X 25 Sq. mm.		
	2C X 35 Sq. mm.		
	2C X 50 Sq. mm.		
	2C X 70 Sq. mm.		
	2C X 95 Sq. mm.		
	3C X 2.5 Sq. mm.		
	3C X 10 Sq. mm.		
	3C X 16 Sq. mm.		
	3C X 25 Sq. mm.		
	3C X 35 Sq. mm.		
	3C X 50 Sq. mm.		
	3C X 70 Sq. mm.		
	3C X 95 Sq. mm.		
	3C X 150 Sq. mm.		
	3C X 185 Sq. mm.		
	3C X 240 Sq. mm.		
	3.5C X 25 Sq. mm.		
	3.5C X 50 Sq. mm.		
	3.5C X 70 Sq. mm.		
	3.5C X 300 Sq. mm.		
	3.5C X 240 Sq. mm.		
	3.5C X 185 Sq. mm.		
	3.5C X 95 Sq. mm.		
	4C X 16 Sq. mm.		
	4C X 35 Sq. mm.		
	1C X 400 Sq. mm.		
	1C X 630 Sq. mm.		
b)	Double Compression Cable Glands for cable sizes:		

**3 X 660 MW NORTH KARANPURA TPS
LV SWITCHGEAR
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	2C X 2.5 Sq. mm.		
	3C X 2.5 Sq. mm.		
	5C X 2.5 Sq. mm.		
	7C X 2.5 Sq. mm.		
	12C X 2.5 Sq. mm.		
	16C X 2.5 Sq. mm.		
	2C X 10 Sq. mm.		
	2C X 16 Sq. mm.		
	2C X 25 Sq. mm.		
	2C X 35 Sq. mm.		
	2C X 50 Sq. mm.		
	2C X 70 Sq. mm.		
	2C X 95 Sq. mm.		
	3C X 2.5 Sq. mm.		
	3C X 10 Sq. mm.		
	3C X 16 Sq. mm.		
	3C X 25 Sq. mm.		
	3C X 35 Sq. mm.		
	3C X 50 Sq. mm.		
	3C X 70 Sq. mm.		
	3C X 95 Sq. mm.		
	3C X 150 Sq. mm.		
	3C X 185 Sq. mm.		
	3C X 240 Sq. mm.		
	3.5C X 25 Sq. mm.		
	3.5C X 50 Sq. mm.		

3 X 660 MW NORTH KARANPURA TPS
LV SWITCHGEAR
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION

ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	3.5C X 70 Sq. mm.		
	3.5C X 300 Sq. mm.		
	3.5C X 240 Sq. mm.		
	3.5C X 185 Sq. mm.		
	3.5C X 95 Sq. mm.		
	4C X 16 Sq. mm.		
	4C X 35 Sq. mm.		
	1C X 400 Sq. mm.		
	1C X 630 Sq. mm.		
c)	Cable Lugs for sizes:		
	2.5 Sq. mm.		
	10 Sq. mm.		
	16 Sq. mm.		
	25 Sq. mm.		
	35 Sq. mm.		
	50 Sq. mm.		
	70 Sq. mm.		
	95 Sq. mm.		
	120 Sq. mm.		
	150 Sq. mm.		
	185 Sq. mm.		
	240 Sq. mm.		
	300 Sq. mm.		
	400 Sq. mm.		
	630 Sq. mm.		
19	Daily 8 hour rate deployed at site:		
	Engineer : (per day)		
20	Module Name plate		
21	Wires for Secondary wiring:		
a)	1.5 Sq. mm. per meter		
b)	2.5 Sq. mm. per meter		
c)	4.0 Sq. mm. per meter		
22	Control Terminal for Secondary wiring suitable for cable size:		
a)	0.5 Sq. mm.		
b)	1.5 Sq. mm.		
c)	2.5 Sq. mm.		
23	Unit price for following tests:		
a)	Local Push Button Station - Degree of protection test		
b)	Local motor Starter - Degree of protection test		
24	Electrical Junction Boxes (for termination of 0.5 sqmm screened control cables)		
a)	48 ways		
b)	64 ways		
c)	72 ways		
a)	96 ways		
25	ISMC channels		
a)	ISMC 75 channel per meter		
a)	ISMC 100 channel per meter		
26	ANY OTHER ITEM WHICH MAY BE REQUIRED FOR ADDITION / DELETION DURING DETAILED ENGINEERING		
27	SBMCC		
	WALL BLOWER FEEDER-0.56 KW		
	WALL BLOWER FEEDER-0.09 KW		
	LR BLOWER FEEDER-0.56 KW		
	LR BLOWER FEEDER-0.736 KW		
	AH BLOWER FEEDER-0.18 KW		

**3 X 660 MW NORTH KARANPURA TPS
LV SWITCHGEAR
SCHEDULE OF UNIT PRICES FOR ADDITION / DELETION**

ANNEXURE-F-1

SL.NO.	ITEM DESCRIPTION	MODEL NO./ ITEM DESCRIPTION	UNIT PRICE (Rs.)
	ISOLATION BLOWER VALVE-4 KW		



**3X660MW NORTH KARANPURA SUPER
CRITICAL TEHRMAL POWER PLANT**

**TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR
(ANNEXURE-G)**

SPECIFICATION NO.

VOLUME III

SECTION

REV NO. 00 DATE

SHEET 1 OF 1

ANNEXURE-G

SITE MODIFICATION CHARGES

(SL No. 60 of Main Price list)

SL.NO.	DETAILS	QUANTITY	UNIT PRICE	TOTAL PRICE
1	LUMP SUM ALL INCLUSIVE CHARGES PER VISIT FOR SKILLED TECHNICIAN (EXCEPT DAILY CHARGES)	10 VISITS		
2	LUMP SUM ALL INCLUSIVE DAILY CHARGES FOR SKILLED TECHNICIAN	30 DAYS		
3	LUMP SUM ALL INCLUSIVE CHARGES PER VISIT FOR SERVICE ENGINEER (EXCEPT DAILY CHARGES)	15 VISITS		
4	LUMP SUM ALL INCLUSIVE DAILY CHARGES FOR SERVICE ENGINEER	60 DAYS		
			TOTAL	

NOTES:

- 1) AMOUNT PAYABLE FOR SKILLED TECHNICIAN PER VISIT TO SITE = VISIT CHARGES AS PER SL. NO. 1 ABOVE + (DAILY CHARGES AS PER SL. NO. 2 ABOVE X NO. OF DAYS AT SITE) (TO BE CERTIFIED BY BHEL SITE)
- 2) AMOUNT PAYABLE FOR SERVICE ENGINEER PER VISIT TO SITE = VISIT CHARGES AS PER SL. NO. 3 ABOVE + (DAILY CHARGES AS PER SL. NO. 4 ABOVE X NO. OF DAYS AT SITE) (TO BE CERTIFIED BY BHEL SITE)



**3X660MW NORTH KARANPURA SUPER
CRITICAL TEHRMAL POWER PLANT**

**TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR
(ANNEXURE-G)**

SPECIFICATION NO.

VOLUME III

SECTION

REV NO. 00 DATE

SHEET 2 OF 1



**3X660MW NORTH KARANPURA SUPER
CRITICAL TEHRMAL POWER PLANT
TECHNICAL SPECIFICATION
FOR
LOW VOLTAGE SWITCHGEAR**

SPECIFICATION NO.
VOLUME NO. :
SECTION :
REV NO. : **00**
SHEET : Page 1 of 1

COMMISSIONING CHARGES FOR NUMERICAL RELAYS
AT SITE (SL No. 59 of Main Price list)

SNO	DETAILS	QUANTITY	UNIT PRICE	TOTAL PRICE
1	LUMP SUM ALL INCLUSIVE CHARGES PER NUMERICAL RELAY COMMISSIONING (INCLUDING CONVENIENCE TO SITE, BOARDING AND LOADING)	550		

NOTE:

AMOUNT PAYABLE FOR NUMERICAL RELAY COMMISSIONING = UNIT PRICE FOR
COMMISSIONING CHARGES AS PER SL.NO.1 ABOVE x NO. OF RELAYS COMMISSIONED
(SAME TO BE CERTIFIED BY BHEL)

**3X660MW NORTH KARANPURA SCTPS
LIST OF E & C SPARES**

S.No.	ITEM / COMPONENT	UNIT	QUANTITY		UNIT PRICE (EX WORKS)	TOTAL PRICE
1	FACTORY BUILT ASSEMBLIES (PCC/MCC/DB)					
1.1	Busbar supports (Horizontal)	1 set of 3	1SET	1		
1.2	Primary isolating contacts (Bus side)	1 set of 3	1SET			
	100A	1 set of 3		1		
	250A	1 set of 3		1		
	400A	1 set of 3		1		
1.3	Primary isolating contacts (Load side)	1 set of 3	1SET			
	100A	1 set of 3		1		
	250A	1 set of 3		1		
	400A	1 set of 3		1		
1.4	Secondary isolating contacts	1 set of 3	1SET			
	100A	1 set of 3		1		
	250A	1 set of 3		1		
	400A	1 set of 3		1		
1.5	Gaskets (each size)	Meter	10	10		
1.6	Fixed Terminal (1way)	Nos.	20	20		
1.7	Shrouds (for outgoing modules)	Nos. (of each physical size of module)	one for each physical size of module	1		
1.8	Wire (for secondary wiring)					
a.	2.5 mm ²	Metres	100	100		
b.	1.5mm ²	Metres	100	100		
1.9	Lugs (for secondary wiring)	Nos.	100	100		
2	Air Circuit Breaker					
2.1	Shunt trip coil	Nos	1	1		
	630A	No		1		
	800A	No		1		
	1000A	No		1		
	2000A	No		1		
	2500A	No		1		
	3200A	No		1		
2.2	spring charging motor	Nos.	1 motor of each rating	1 motor of each rating		
	630A-1600A	No		3		
	2000A-4000A	No		3		
2.3	closing coil	Nos.	1	1		
	630A	No.		1		
	800A	No.		1		
	1000A	No.		1		
	2000A	No.		1		
	2500A	No.		1		
	3200A	No.		1		
2.4	Auxiliary switch	Nos.	1	1		
3	ISOLATING SWITCH					
3.1	Main contact kit for each rating		1	1 set of 3 poles		
	32A	No		1		
	63A	No		1		
	125A	No		1		
	400A	No		1		
4	POWER CONTACTORS					
4.1	Contactor coil (110V AC)		1			
	16A	No.		1		
	32A	No.		1		
	63A	No.		1		

3X660MW NORTH KARANPURA SCTPS
LIST OF E & C SPARES

	80A	No.		1		
	115A	No.		1		
	185A	No.		1		
	265A	No.		1		
	400A	No.		1		
4.2	Contacts kit (main)		1	1 set of 3 poles		
	16A	No.		1		
	32A	No.		1		
	63A	No.		1		
	80A	No.		1		
	115A	No.		1		
	185A	No.		1		
	265A	No.		1		
	400A	No.		1		
5	AUXILIARY CONTACTORS					
5.1	Complete unit with 2NO + 2NC contacts		1 no. of each rating/type	1 no. of each rating / type		
	2NO + 2NC AC	No		1		
	2NO + 2NC DC	No		1		
5.2	Contactor coils					
a.	110V AC	No	1	1		
b.	220 V DC	No	1	1		
6	HRC FUSE					
6.1	Fuse base (each rating)	No	1	1		
6.2	Fuse link:					
a.	UPTO 40A	Nos.	10	10		
b.	63A TO 200A	Nos.	10	10		
c.	250A TO 400A	Nos.	5	5		
7	PUSH BUTTONS					
6.1	Actuator contacts	Nos.	5	5		
6.2	Element	Nos.	5	5		
8	INDICATING CLUSTER LED					
8.1	Complete unit	Nos.	10	10		
9	OTHERS					
9.1	Selector & control switch (each type)	Nos	1	1		
	ASS	No		1		
	VSS	No.		1		
	Breaker Control Switch	No.		1		
	Local Remote	No.		1		
	2P 2A ON/OFF	No.		1		
9.2	AC Voltmeter (0-500V)	No.	1	1		
9.3	DC Voltmeter (0-300 or 0-150 V)	No.	1	1		
10	LT BUSDUCT					
10.1	Busduct support insulators - TPN set for each rating of busduct	No.	1	1		
10.2	Gaskets for each rating of busduct - set consisting of 10 mts or 2 nos of each type of gasket used	No.	1	1		



TITLE :
**3X600MW NORTH KARANPURA SCTPS
TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR
PRICE SCHEDULE FOR TOOLS & TACKLES**

SPECIFICATION NO.
EPD-TS-CPBG-14015
VOLUME NO. : **II-B**
SECTION : **C**
REV NO. : **00** DATE 01/07/2015
SHEET : 1 OF 1

ANNEXURE-D

TOOLS & TACKLES AND ACCESSORIES

SL. NO.	ITEM DESCRIPTION	QUANTITY	UNIT PRICE (EX. WORKS)	TOTAL PRICE (EX. WORKS)
1	BREAKER LIFTING AND HANDLING TROLLEY	6		
2	MODULE RACKING HANDLE FOR BREAKERS	12		
3	MODULE RACKING HANDLE FOR MCC MODULES	20		
4	TEST CABINET WITH COUPLING CABLES FOR TESTING BREAKER IN WITHDRAWN POSITION	4		



**3X660 MW NORTH KARANPURA SC TPS,
NTPC
TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR
(ANNEXURE-K)**

SPECIFICATION NO. EPD-TS-CPBG-14015

VOLUME NO. : **II-B**

SECTION :

REV NO. : **00** DATE: 01.07.2015

SHEET : 1 OF 1

ANNEXURE-K

DRAWINGS AND DOCUMENTS DISTRIBUTION SCHEDULE



3X660 MW NORTH KARANPURA SCTPS,

NTPC

**TECHNICAL SPECIFICATION FOR
LOW VOLTAGE SWITCHGEAR
(ANNEXURE-K)**

SPECIFICATION NO. EPD-TS-CPBG-14015

VOLUME II B

SECTION

REV NO. 00 DATE 01/07/2015

SHEET 1 OF 1

ANNEXURE-K

NO. OF DRAWINGS/DOCUMENTS REQUIRED FROM VENDOR

SL.NO.	DESCRIPTION	PRINTS	CD-ROM	MANUALS
1	DRAWING /DOCUMENTS –FIRST SUBMISSION	3		
2	DRAWING /DOCUMENTS-SUBSEQUENT REVISED SUBMISSION	5		
3	DRAWING /DOCUMENTS-FINAL (AFTER CATEGORY –I APPROVAL)	15	5	
4	DRAWING AS BUILT	15	5	
5	O/M MANUAL-DRAFT			3
6	O/M MANUAL-FINAL		3	15
7	TYPE TEST CERTIFICATES	5		

ALL DRAWINGS SHALL BE SUBMITTED IN BOTH PDF AND AUTOCAD (.DWG 2004) FORMATS

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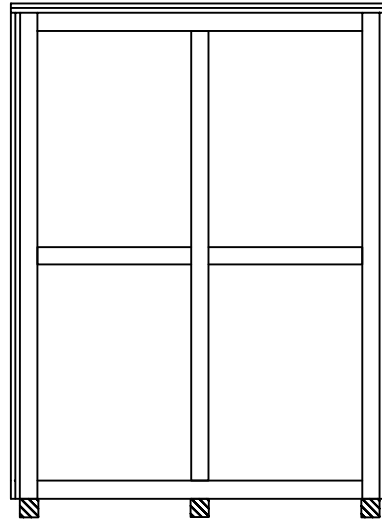
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REV. DATE : ALTERED :

INVENTORY NO. :
REV. 01 DATE : 04.04.08 ALTERED : SUNIL
REVISED AS BUILT

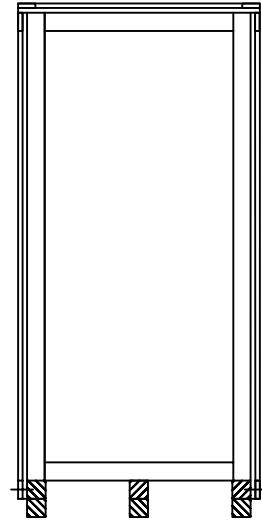
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FRONT VIEW

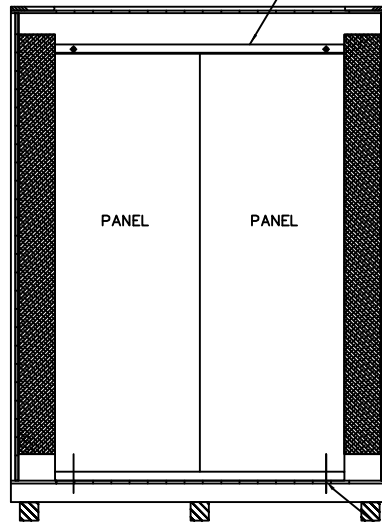
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A →



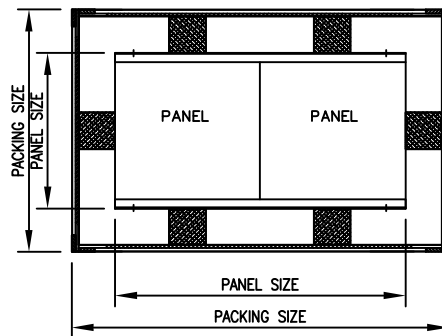
SIDE VIEW
A →

PANEL LIFTING ANGLE



SECTION-AA

PANEL FIXING TO THE BASE
USING PANEL FOUNDATION HOLES



SECTION-BB

BITUMINISED
KRAFT PAPER LINING
ON ALL INNER SURFACE OF COVERS
RUBBERISED COIR
(NON HYGROSCOPIC
CRUSHING MATERIAL)

JOB NO.:

QUALITY



BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPROCELAIN DIVISION BANGALORE

	NAME	SIGN.	DATE	DEPT.	CODE
DEGND.	TRINATH	<i>S. Trinath</i>	11.11.13		
DRN.					
CHKD.	TRINATH	<i>S. Trinath</i>	11.11.13		
APPD.	KS BALA	<i>M. Bala</i>	11.11.13		

TITLE :

PANEL PACKING CASE

DRG.
NO. : EP-4-PP-001-001

REV.
NO. : 00

SCALE : N.T.S.

SHEET NO. : 01

NO. OF SHEETS : 05

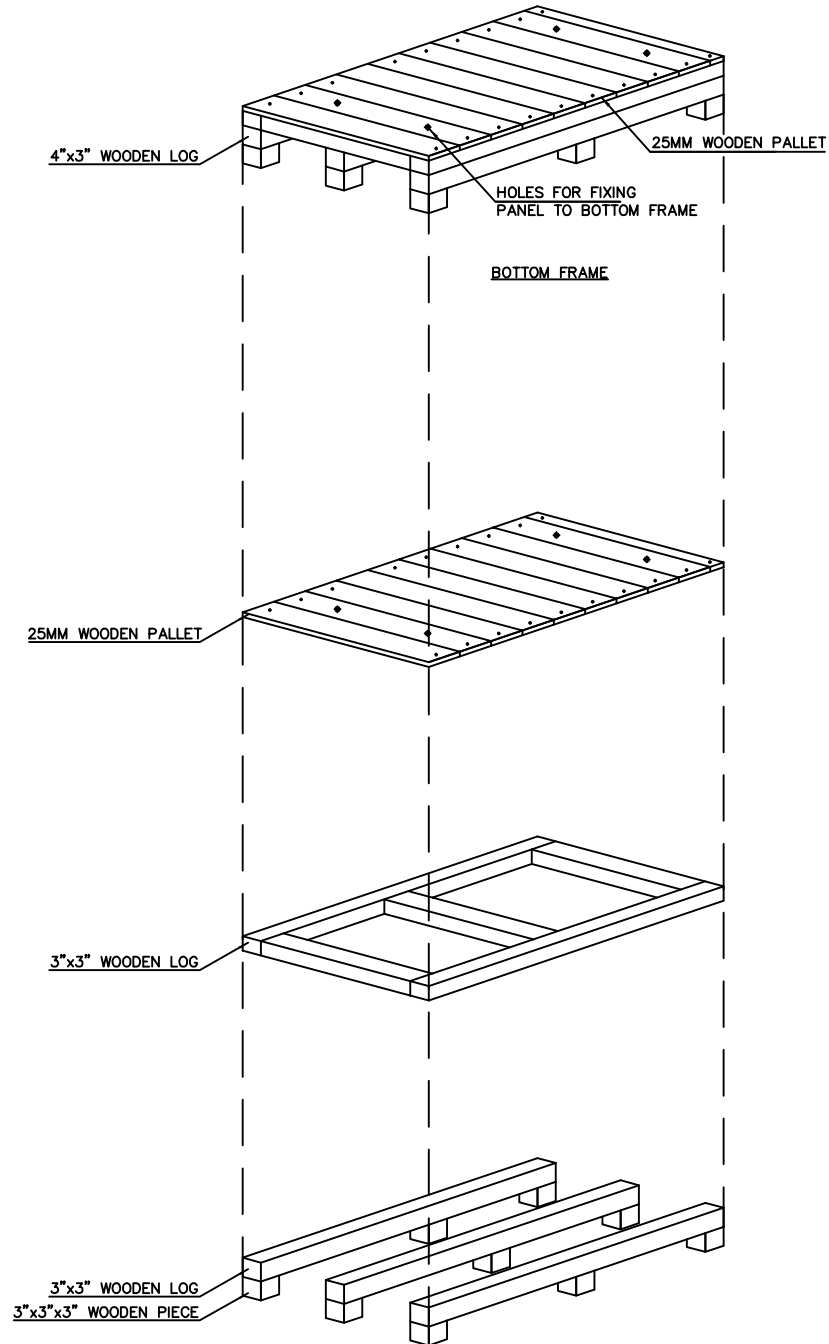
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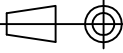
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SIGN. & DATE :
REV. DATE :
ALTERED :

INVENTORY NO. :
REV. 01 DATE : 04.04.08
ALTERED : SUNIL
REVISED AS BUILT



JOB NO.:						BHARAT HEAVY ELECTRICALS LIMITED ELECTROPROCELAIN DIVISION BANGALORE	
QUALITY						TITLE :	
	NAME	SIGN.	DATE	DEPT.	CODE	BOTTOM FRAME	
DEGND.	TRINATH	<i>T. Trinath</i>	21.01.14				
DRN.							
CHKD.	TRINATH	<i>T. Trinath</i>	21.01.14				
APPD.	KSB	<i>K. S. B.</i>	21.01.14			DRG. NO. : EP-4-PP-001-001	REV. NO. : 00
				SCALE : N.T.S.		SHEET NO. : 02	NO. OF SHEETS : 05

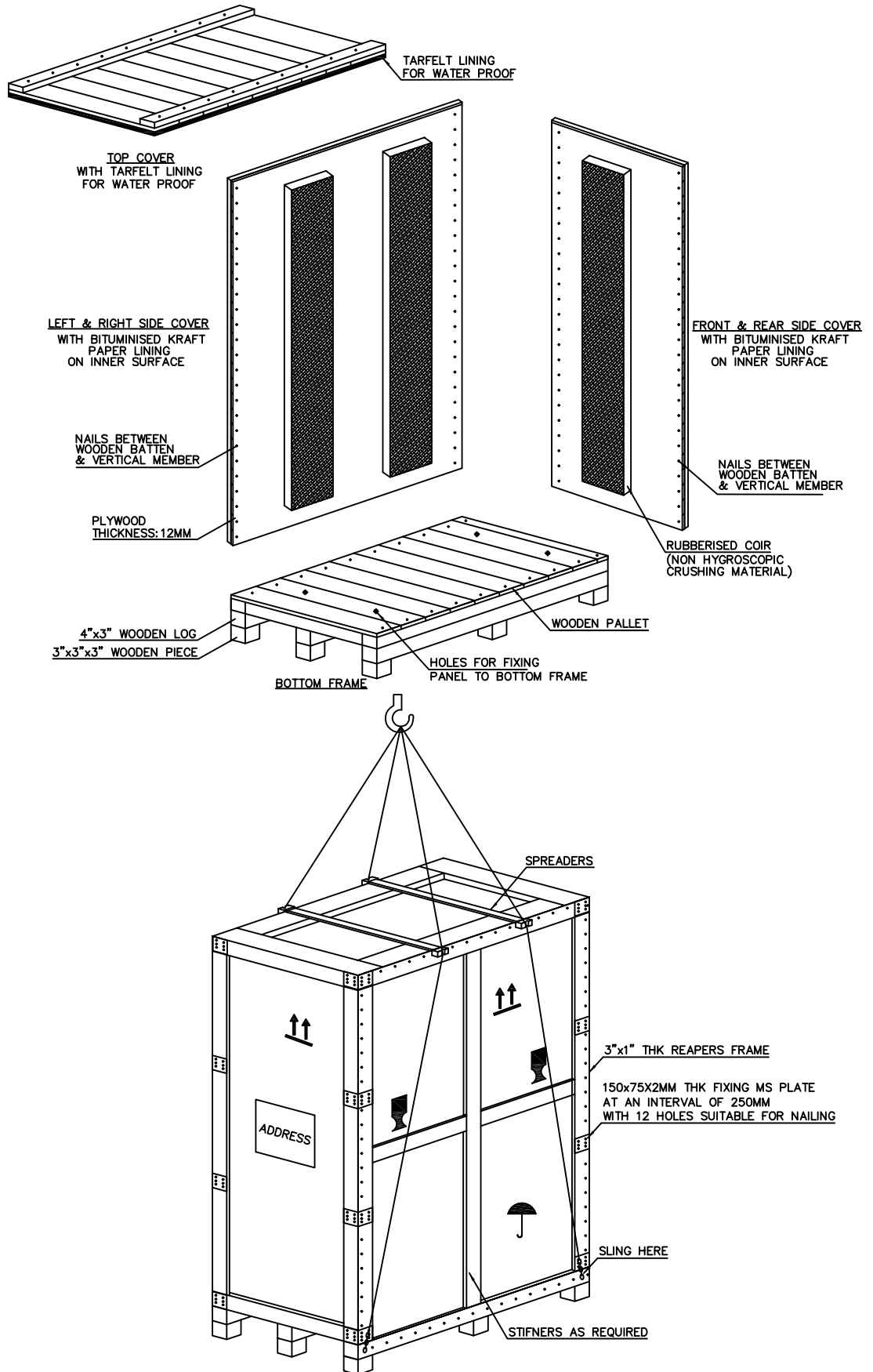
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REV. : DATE : ALTERED :

INVENTORY NO. :
REV. 01 DATE : 04.04.08 ALTERED : SUNIL
REVISED AS BUILT



JOB NO.:

QUALITY



BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPROCELAIN DIVISION BANGALORE

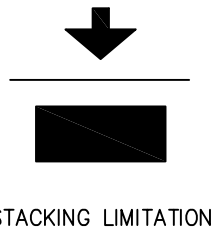
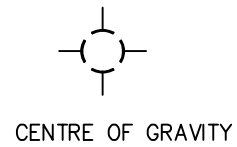
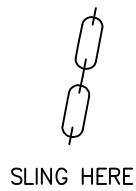
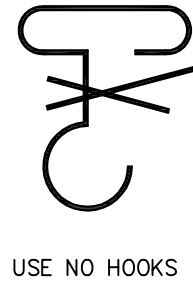
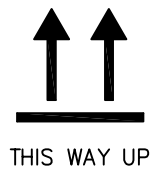
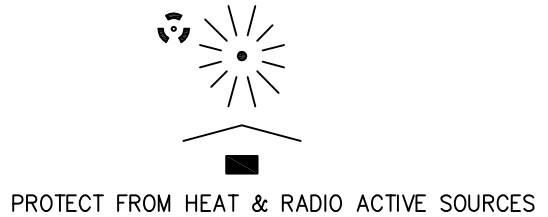
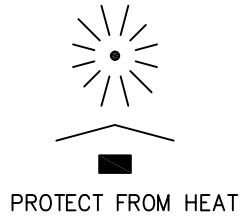
	NAME	SIGN.	DATE	DEPT.	CODE
DEGND.	TRINATH	<i>S. Trinath</i>	11.11.13		
DRN.					
CHKD.	TRINATH	<i>S. Trinath</i>	11.11.13		
APPD.	KS BALA	<i>M. Bala</i>	11.11.13		

TITLE :	
PANEL PACKING CASE	
DRG. NO. :	EP-4-PP-001-001
REV. NO. :	00
SCALE :	N.T.S.
SHEET NO. :	03
NO. OF SHEETS :	05

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INVENTORY NO. : REV. 01	DATE : 04.04.08	ALTERED : SUNIL	SIGN. & DATE :		REF. DRG. NO. :	
			REV. DATE :	ALTERED :	REV. DATE :	ALTERED :
REVISED AS BUILT						



JOB NO.:						BHARAT HEAVY ELECTRICALS LIMITED ELECTROPROCELAIN DIVISION BANGALORE			
QUALITY						TITLE :			
DEGND.	TRINATH	g. Trinath	11.11.13	DEPT.	CODE	PANEL PACKING CASE (MARKINGS)			
DRN.									
CHKD.	TRINATH	g. Trinath	11.11.13			DRG. NO. : EP-4-PP-001-001			REV. NO. : 00
APPD.	KS BALA	M. Bala	11.11.13			SCALE : N.T.S.			SHEET NO. : 04

REF. DRG. NO. :
REV. : DATE : ALTERED :SIGN. & DATE :
REV. : DATE : ALTERED :INVENTORY NO. :
REV. 01 DATE : 04.04.08 ALTERED : SUNIL
REVISED AS BUILTSPECIFICATION: -

1.0. SCOPE

THIS PROCEDURE GIVES MINIMUM GUIDLINES TO BE COMPILED WITH FOR PACKING OF ELECTRICAL, ELECTRONICS AND INSTRUMENTATION PANELS
THIS PACKING WILL BE SUITABLE FOR DIFFERENT HANDLING OPERATIONS AND FOR THE ADVERSE CONDITIONS DURING TRANSPORTATION AND DURING INDOOR/OUTDOOR STORAGE FOR PERIODS MORE THAN ONE YEAR

2.0. WOOD

- 2.1. SEASONED AND TREATED RUBBER WOOD FOR INLAND PACKING
2.2. SILVER OAK WOOD AS PER PROCEDURE PR: CHEM:017 OR AS PER RELEVANT STANDARD FOR EXPORT PACKING

3.0. PACKING

- 3.1. WOOD SHALL BE FREE FROM KNOTS ETC. AND ANY KIND OF DECAY CAUSED BY INSECTS AND FUNGUS
3.2. CASE SHALL BE MADE OUT OF INDIVIDUAL PLANKS OF SINGLE LENGTH AND NO JOINT IS PERMITTED
3.3. SUFFICIENT NUMBERS OF HORIZONTAL, VERTICAL AND DIAGONAL PLANKS SHALL BE USED FOR BINDING AND STRENGTHENING.
RUNNERS ARE TO BE PROVIDED WITH METALLIC SLING PLATES FOR HANDLING
3.4. SUPPORT PLANKS ARE TO BE SUCH THAT, NO FORCE IS ACTING ON THE PART OF EQUIPMENT OR IT PART
3.5. PANELS ABOVE 1.5 METER SHALL BE BOLTED AT THE BOTTOM USING FOUNDATION BOLT HOLES OF PANEL
3.5. EQUIPMENT COVERED WITH A POLYTHENE SHEET SHALL BE KEPT INSIDE THE CASE FOLLOWED BY COIR WOOD BOTTOMS, THERMO COAL ETC. TO PREVENT VIBRATION EFFECT DURING LOADING, TRANSPORTATION ETC.
3.6. GAP BETWEEN JOB AND THE CASE SHALL BE FILLED WITH MATERIALS LIKE JUTE, COIR, THERMO COAL ETC.
3.6. ALL INNER SIDES OF THE CASE SHALL BE NAILED WITH BLACK POLYTHENE SHEET
3.7. LOOSE ITEMS IF ANY PACKED SEPARATELY
3.8. DELICATE ITEMS SHALL BE COVERED INDIVIDUALLY IN ANTI STATIC BAGS AND PACKED IN CARTOONS FILLED WITH THERMO COAL, PAPER CUTTINGS ETC. THEN RAPPED WITH POLYTHENE AND THEN PACKED IN WOOD CASE.
THESE CASES ARE TO BE MARKED PROMINENTLY 'DELICATE COMPONENTS HANDLE WITH CARE'
3.9. SILICA GEL COTTON CLOTH BAGS SHALL BE KEPT AT DIFFERENT PLACES IN SUFFICIENT QUANTITY
SILICA GEL COTTON CLOTH BAGS SHALL HAVE THE FOLLOWING MARKING ON IT:-
SILICA GEL ACTIVATOR TYPE: BLUE: ACTIVE, ROSE: REDUCED ACTIVE, WHITE: NO ACTIVITY

4.0. MARKING

- 4.1. AFTER COMPLETING PACKING, CASES SHALL BE MARKED USING STENCIL AND PAINT AS PER THE DISPATCH INSTRUCTIONS & PRECAUTIONARY SYMBOLS

5.0. PACKING SLIP

- 5.1. ONE COPY OF PACKING SLIP IN A POLYTHENE COVER SHALL BE KEPT INSIDE THE BOX
ANOTHER COPY OF PACKING SLIP IN A POLYTHENE COVER SHALL BE FIXED OUTSIDE CASE AND COVER WITH METALLIC PLATE

6.0. CAUTION

- 6.1. DO NOT PACK ANY OTHER MECHANICAL ITEMS IN THIS CASE

7.0. GENERAL

- 7.1. THESE PACKING PROCEDURES ARE THE MINIMUM REQUIREMENTS, IN ADDITION TO THE STANDARD INSTRUCTIONS MENTIONED IN PURCHASE ORDER & SPECIFICATION.
7.2. DEVIATION TO MEET THE PACKING PROCEDURE REQUIREMENTS/NON CLARITY IN PACKING APPROACH IN ANY QUOTATION WILL BE LIABLE FOR REJECTION OF OFFER

JOB NO.:

QUALITY



BHARAT HEAVY ELECTRICALS LIMITED
ELECTROPROCELAIN DIVISION BANGALORE

	NAME	SIGN.	DATE	DEPT.	CODE
DEGND.	TRINATH	<i>S. Trinath</i>	11.11.13		
DRN.					
CHKD.	TRINATH	<i>S. Trinath</i>	11.11.13		
APPD.	KS BALA	<i>M. K. Bala</i>	11.11.13		

TITLE :

PANEL PACKING CASE
(PROCEDURES)

DRG. NO. : EP-4-PP-001-001

REV. NO. : 00

SCALE : N.T.S. SHEET NO. : 05 NO. OF SHEETS : 05