Jaipur Metro Rail Corporation Limited

NCB No. JP/EW/1B/E1

Addendum – 1 Summary

S.No	Part / Section / Volume	Document/Chapter	Addendum
	GENERAL POINTS		
1.	Section 4 Page 4-5	Bidding Forms	Footnote 1 added
2.	Section 8 Page 8-15	SCC	Clause 25 made applicable for AMC also
3.	Section 9 Page 9-3	Contract Agreement Clause 1.1 (c)	'BOQ' word added
4.	Section 9 Page 9-8	Contract Forms	Clause 'f' added
5.	Section 9 Page 9-11	Contract Forms	Key dates updated
6.	Appendix 7 Page 7-1 of 2, 7-2 of 2, 7-3 of 2, 7-4 of 2,	Engineer Accommodation for off site works	Details modified
	Drawings		
7.	E&M Drawing		General alignment drawing of Jaipur Metro provided
8.	TVS Drawing		Typical Nozzle arrangement drawing provided
9.	TVS Drawing		Typical schematic for compressed air system provided
	ECS TVS BMS Scope of work and Specifications		
10.	Scope of work TVS SCADA Page 9		- SCP removed
11.	ECS Specifications Page 18 to 27	Section A01 – AHU	- Plug fan specifications replaced with Centrifugal fan specifications at all places. - Clause A01.3.6.5 updated
12.	ECS Specifications Page 37 Page 55 Page 59	Section A03 – Chilling Water Units	- Screw Chiller Clause A03.3.3.2 updated - Winding temperature sensor removed - Footnote 9 updated

13.	ECS Specifications Page 71 Page 72 Page 80	Section A05 – Water Circulating Pumps	- Efficiency updated of various pumps (Clause A05.3.2) - Manual bypass removed in AFD (Point no 3) - 'Vertical' split added in datasheet
14.	ECS Specifications Page 89 Page 91 Page 94	Section A06 - Ductworks, dampers, diffusers and accessories	- Testing as per DW143 Class B accepted (Clause A06.3.4.3) - Clause A06.3.4.4 updated - Duct Accessories updated in Datasheet - Bearing Rating made Two Hour @ 250º C in Datasheet
15.	ECS Specifications Page 108 to 112	Section A08 – Cooling Towers	- Performance test allowed at site (Clause A08.2.1) - Clause A08.3.2.1 updated - Dynamic balancing of fan removed (Clause A08.3.3.1 and datasheet) - Cage type ladder allowed (Clause A08.3.4.1 and datasheet) - Counter flow added in datasheet - Cast iron hub added in datasheet - Bearing point updated in datasheet
16.	ECS Specifications Page 115	Section A09 - Pipework	- Clause A09.3.3.1 updated
17.	ECS Specifications Page 125	Section A10 – Pipeline Fittings	- Standards Updated
18.	ECS Specifications Page 141 Page 145	Section A12 - Fans	- Specific color requirement removed and mounting plate thickness made 1.2mm for propeller fans (Clause A12.3.2.4) - Tip speed criteria removed for propeller fans (Clause A12.3.2.6) - Noise criteria removed for axial flow fans (Datasheet)

19.	ECS Specifications Page 153,154	Section A13 – ECS Equipment Control	- Specifications for 'CO2 and air quality monitor sensors' updated. Air quality monitor requirement removed. (Clause A13.3.18)
20.	ECS Specifications Page 263 to 269	Section A25 – Chiller Plant Manager	- Specifications updated for CPM
21.	TVS Specifications Page 17	Section V01 : Tunnel Ventilation System – FanUnits	- Motor from single manufacturer requirement removed (Clause V01.3.1.4)
22.	TVS Specifications Page 18	Section V01 : Tunnel Ventilation System – FanUnits	- Efficiency of TEF made 70% (Clause V01.3.3.3) - Fan starting time and reversal time updated (Clause V01.3.3.4) - Pressure variation made plus minus 200 Pascal (Clause V01.3.3.7)
23.	TVS Specifications Page 19, 20	Section V01 : Tunnel Ventilation System – FanUnits	- Clause V01.3.4.7 updated - Clause V01.3.6.4 updated
24.	TVS Specifications Page 30	Section V01 : Tunnel Ventilation System – FanUnits	- 'IE-2' efficiency word added in datasheet
25.	TVS Specifications Page 41	Section V01 : Tunnel Ventilation System – FanUnits	- Clause V02.3.6.1 updated
26.	TVS Specifications Page 72	Section V05 : Tunnel Booster Fans	- 'IE-2' efficiency word added in datasheet
27.	BMS Specifications Page 20	BMS/2.01.30 B)	- Clause added: Service life of IT components
28.	BMS Specifications Page 31	BMS/5.01.13	- Details changed for processor's on-board memory
29.	BMS Specifications Page 32	BMS/5.01.13	- QMR System Architecture removed
30.	BMS Specifications Page 34,35	BMS/5.01.22	- Wire color requirements changed
31.	BMS Specifications Page 38,39	BMS/6.01.9	- Ethernet / RS232 port allowed - Communication routes updated
32.	BMS Specifications Page 91	BMS/23.00	- New chapter added for Energy Management System

33.	TVS SCADA Specifications Page 50	Historical Data Management	- Clause 4.20.2 updated
	ECS TVS BMS BOQ		
34.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.0 (xi) Page 4	- Pont (xi) added
35.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.1.01 A 1) 2) 3) Page 4,5	- Incomer ACB kA rating changed from 50kA to 65kA from and made from 3P to 4P - Incomer ACB quantity changed from 2 to 3 - Indication lamps quantity changed accordingly
36.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.1.02 B Page 5	- Busbar kA rating changed from 50kA to 65kA and made from 3P to 4P
37.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.1.02 C a) Page 5	- Bus coupler ACB kA rating changed from 50kA to 65kA from and made from TPN to 4P
38.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.1.10 8) Page 11	- MCCB quantity changed from 4 Nos to 3 Nos - Description removed for pump room panel
39.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.4.01 A 1 Page 17	- ATS kA rating changed from 50kA to 65kA
40.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.4.02 B Page 18	- Busbar kA rating changed from 50kA to 65kA
41.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.9.01 A a Page 34	- Incomer changed from 3P to 4P
42.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.10 Page 35	- Industrial socket description changed
43.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.11 Page 35,41	- DB 140/240 quantity changed from 0 to 1 for Chhoti Chaupar
44.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.11.01 A 1 Page 36	- ATS rating changed from 1600A to 1000A and kA rating changed from 50kA to 65kA
45.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.11.02 B	- Busbar rating changed from 1600A to 1000A and

		Page 37	kA rating changed from 50kA to 65kA
46.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.11.03a Page 38,39,40	- Item removed
47.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.11.04 2) Page 40	- MCB feeder decreased from 11 to 3
48.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.12 Page 41,45	- Quantity changed from 2 to 1 for Chhoti Chaupar and from 1 to 0 for Badi Chaupar
49.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.12.01 A 1 Page 42	- ACB rating changed from 1600A to 1250A
50.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.12.01 A 1 d ii) iii) Page 43	- CT rating changed from 1600A to 1250A
51.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.12.02 B Page 43	- Busbar rating changed from 1600A to 1250A
52.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 1.12.A Page 45 to 50	- Item added DB-140/240 (Type-III). Quantity 1 Nos at Badi Chaupar
53.	Section 4 Vol 2 Part I Part A	ECS Electrical BOQ S.No 2.10 Page 62	- Item description changed
54.	Section 4 Vol 2 Part I Part B	ECS BOQ Pg 10 of 28 Sr. no. 5	- Plug fan details removed and AHU description changed as per centrifugal fan requirements
55.	Section 4 Vol 2 Part I Part B	ECS BOQ Pg 21 of 28 Sr. no. 17.2 (f)	- Chemicals removed for water treatment plant
56.	Section 4 Vol 2 Part I Part B	ECS BOQ Pg 27 of 28 Sr. no. 23.1 (k)	- 550 Pa added in SPF description
57.	Section 4 Vol 2 Part I Part B	ECS BOQ Pg 27 of 28 Sr. no. 23.2	- For attenuator the Unit of Measurement changed from No. to SQM and quantity modified accordingly
58.	Section 4 Vol 2 Part I Part B	ECS BOQ Pg 28 of 28 Sr. no. 26.1	- 'Air quality monitor' requirements removed and sensor description made only for 'CO2 Sensor'

59.	Section 4 Vol 2 Part I Part B	ECS BOQ Pg 28 of 28 Sr. no. 26.2	- Quantity of flow meter changed from 0 to 4
60.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 2 of 10 Sr. no. 1.1.2	- Quantity decreased from 4 to 2 for Chhoti Chaupar and from 2 to 0 for Badi Chaupar (TVF)
61.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 3 of 10 Sr. no. 1.1.3	- Item added: Total 4 nos. Reversible axial flow fans (TVF)
62.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 3 of 10 Sr. no. 1.2.1	- Quantity decreased from 1 to 0 for Badi Chaupar (TBF)
63.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 3 of 10 Sr. no. 1.2.2	- Capacity changed from 1600 N to 1450 N (TBF) - Quantity increased from 4 to 8 for Badi Chaupar (TBF)
64.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 5 of 10 Sr. no. 2.1	- Quantity decreased from 4 to 2 for Chhoti Chaupar and from 4 to 2 for Badi Chaupar (Fan Isolation Damper)
65.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 6 of 10 Sr. no. 2.3	- Quantity decreased from 4 to 2 for Chhoti Chaupar and from 9 to 5 for Badi Chaupar (TVD)
66.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 6 of 10 Sr. no. 2.6	- Item added: Total 4 Nos. Fan isolation dampers 3.2m x 3.2m
67.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 7 of 10 Sr. no. 2.7	- Item added: Total 4 nos. Tunnel ventilation dampers, 2.5m x 4m
68.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 7 of 10 Sr. no. 3.1.1	- Quantity decreased from 8 to 4 for Chhoti Chaupar and from 8 to 4 for Badi Chaupar (TVS Sound Attenuator)
69.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 7 of 10 Sr. no. 3.3.1	- Item added: Total 8 nos. Sound attenuators for TVF, 3.2m x 3.2m
70.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 8 of 10 Sr. no. 4.1	- Quantity decreased from 2 to 0 for Badi Chaupar (TVF Nozzle)

71.	Section 4 Vol 2 Part I Part C	TVS BOQ Pg 8 of 10 Sr. no. 4.2	- Quantity increased from 0 to 2 for Chhoti Chaupar and from 0 to 2 for Badi Chaupar (TVF Nozzle)
72.	Section 4 Vol 2 Part I Part D	ECS BMS BOQ Pg 8 of 17 Sr. no. 8.01	- Description modified
73.	Section 4 Vol 2 Part I Appendix C1 Annexure 1	Spares	- Water Treatment Chemical changed from 1 year to 2 years
	E&M Specifications		
74.	E&M Specifications Page 1 Page 260 to 263	Chapter E24 : Battery	- Specifications for battery have been added as Chapter E24 in the index and at the end
75.	E&M Specifications Page 198	Chapter E17 : Pipework for fire fighting system	- 'GI' word added (Clause E17.3.4.5.1 updated)
	E&M BOQ		
76.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 4 of 86	E&M BOQ Item no. 1 ab	Point 1 ab introduced, it says wherever MFM is asked 3 No. CTs to be provided.
77.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 4 of 86	E&M BOQ Item no. 1.01 A.e)	Number of CTs reduced to 3, also tapping at 2500A added
78.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 5 of 86	E&M BOQ Item no. 1.01 B.a)	FP ACB in place of 3P ACB and deletion of 1 neutral CT updated in BOQ
79.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 7 of 86	E&M BOQ Item no. 1.01 E.3.a)	1 no. 1600A ACB & 1 no. 2000A ACB in place of 2 no. 1600A ACB updated in BOQ
80.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 9 of 86	E&M BOQ Item no. 1.01 E.6.e)	MFM in place of Ammeter updated in BOQ
81.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 10 of 86	E&M BOQ Item no. 1.01 and Item no. 1.01.1	Different rates for Supply, Installation and Testing & Commissioning updated. Also, transducers and wiring made separate item.
82.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 11 of 86	E&M BOQ Item no. 1.02 A.e)	Number of CTs reduced to 3, also tapping at 2500A added
83.	BOQ PART-2 PART A: ELECTRICAL WORKS	E&M BOQ Item no. 1.02 B.a)	FP ACB in place of 3P ACB and deletion of 1 neutral CT

	Pg 12 of 86		and addition of emergency push button updated in BOQ
84.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 14 of 86	E&M BOQ Item no. 1.02 E.3.a)	1 no. 1600A ACB & 1 no. 2000A ACB in place of 2 no. 1600A ACB updated in BOQ
85.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 15 of 86	E&M BOQ Item no. 1.01 E.4.e)	MFM in place of Ammeter updated in BOQ
86.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 17 of 86	E&M BOQ Item no. 1.04 A.a)	FP MCCB in place of 3P MCCB and deletion of neutral CT updated in BOQ
87.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 17 of 86	E&M BOQ Item no. 1.02 and Item no. 1.02.1	Different rates for Supply, Installation and Testing & Commissioning updated. Also, transducers and wiring made separate item.
88.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 18 of 86	E&M BOQ Item no. 1.05 A.a)	FP MCCB in place of 3P MCCB and deletion of neutral CT updated in BOQ
89.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 19 of 86	E&M BOQ Item no. 1.06 A.a)	Deletion of neutral CT updated in BOQ
90.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 22 of 86	E&M BOQ Item no. 1.09 A.a)	FP MCCB in place of 3P MCCB and deletion of neutral CT and communication facility in APFCR updated in BOQ
91.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 24 of 86	E&M BOQ Item no. 1.10 & 1.11	35KAs fault level updated in BOQ
92.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 25 of 86	E&M BOQ Item no. 1.11 .1.e)	MFM added in BOQ
93.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 27 of 86	E&M BOQ Item no. 1.17 A.a)	FP MCCB in place of 3P MCCB updated in BOQ
94.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 31 of 86	E&M BOQ Item no. 1.18 C.4	2 No. 250/160A 3P MCCB added in BOQ
95.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 31 of 86	E&M BOQ Item no. 1.19 A a)	1 No. 250/160A 3P MCCB incomer deleted from BOQ
96.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 33 of 86	E&M BOQ Item no. 1.20	DB-111 & 211 changed to DB-111/211 in BOQ

97.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 37 of 86	E&M BOQ Item no. 2	FS wiring replaced with LSZH
98.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 44 of 86	E&M BOQ Item no. 2.6.1	Motorized MCCB in place of normal MCCB added in BOQ
99.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 59 to 67 of 86	E&M BOQ Item no. 5	Quantity of Conventional lights reduced to half and Applicable LED lights added
100.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 70 of 86	E&M BOQ Item no. 6.8	25 mm diameter in place of 20 mm updated in BOQ
101.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 71 of 86	E&M BOQ Item no. 7.1.a	30 minute backup capacity in place of 120 minute for UPS updated in BOQ
102.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 73 to 77 of 86	E&M BOQ Item no. 9	Various rating of breakers changed and added in BOQ
103.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 77,78 of 86	E&M BOQ Item no. 9A.1.a)	FP ACB in place of 3P ACB and deletion of 1 neutral CT updated in BOQ
104.	BOQ PART-2 PART A: ELECTRICAL WORKS Pg 81 of 86	E&M BOQ Item no. 9A.2	Interlocking PLC deleted and rate split into supply, installation and testing & commissioning in BOQ
105.	BOQ PART-2 PART B: PLUMBING WORKS Page 5 of 7	E&M BOQ Item no. 11.2 (6)	In OBR, '13 hrs' deleted
106.	BOQ PART-2 PART C: FIRE PROTECTION WORKS Page 1,2,3 of 15	E&M BOQ Item no. 12	RPM in pumps changed to 2950/2900 and single stage single outlet updated in diesel engine pump
107.	General	Check list for bid submission	Checklist to be attached with Technical bid and Checklist to be attached with Financial bid are enclosed

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
ab	**All feeders with MFM shall be provided the 3Nos. CT.**									
	Description of Various panels/boards covered under this BOQ is as given below:									
1.01										
I	**Main Distribution Board DB-100 as per Technical Specifications and as per following details:**									
I										
A	**INCOMER**									
	TRANSFORMER - I INCOMING each comprising of following									
a)	1 No. 5000 A / 5000 A, 415V, 70kA, 4 Pole, Electrically operated Draw Out type ACB, complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of V, A, W, VAR, VA, Wh, VARh, Hz, power factor etc shall be as per I/O Schedule (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous, over and under voltage, minimum and maximum frequency, voltage and current imbalance, phase sequence, load shedding and reconnection (4) Measurement of inturrepted currents, differenciated fault indications, maintenance indicators (5) Last few trippings and event histories and time stamping with facility for consulting the history file, maintenance indicator register etc (6) Communication options to remotely read and set parameters for the protection functions, transmission of all the calculated indicators and measurements (7) Signailing of the cause of tripping and alarms (8) NO/NC contacts for interlocks and indications (9) 1No.Lockable Emergency Push Button with contact.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for the following-									
	ON, OFF, TRIP, spring charged & phase indication (R-Y-B).									
e)	Metering									
i)	1 No. Multifunction energy meter for measurement of voltage, line current, power factor, power & energy.									
ii)	~~4~~ **3**Nos. CTs 5000**-2500**/**5-**5A, 15VA, CL-0.5S for metering (Dual Ratio).									
iii)	1 Nos. CTs 5000/5A, 15VA, CL-1 for APFCR relay.									
f)	Protection									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
i)	4 Nos. CTs, 5000/1A, CL-PS, in the MDB. Contractor carry out interface, to ensure that these CT's are matching with the CT provided in the neutral section of the Transformer by the Power Supply Contractor. In case any changes are required in the Specifications given above due to interface, including the rating of the CT's, same shall be done at no extra cost to the Employer.									
g)	Front Display Module(FDM)									
B	**ASS-1 to ASS-2 (TIE BREAKER for connecting DB-100 to DB-200**									
a	1 No. 2500A/2500A, 415V, 65KA, ~~3~~ **4**Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) ~~1 No. CT in the neutral to connect with the trip unit.~~(9) 1No.Lockable Emergency Push Button with contact									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
f)	3 Nos. CTs, 2500/5A, 15VA, CL-1 for metering.									
C	**Interconnector Bus-Section Circuit Breaker (Bus Coupler comprising of following)**									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
f)	3 Nos. CTs, 2500/5A, 15VA, CL-1 for metering.									
2)	Outgoing feeder - (Total 1 Nos) -One No.CAP-100 of the above feeders consisting of the following:									
a)	1 No. 630A/630A, 415V, 65KA, 3 Pole motorised MCCB with 240V AC shunt trip coil and having electronics releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against Overload (with base setting and fine adjustment), Short Circuit and earth fault (all with adjustable time delays) + Instantaneous (4) Communication options to remotely read parameters for the protection functions transmission of ammeter measurements, signaling of cause of tripping, maximeter reset etc. (5) NO / NC contacts for interlocks and indications (6) 1 No.CT in Neutral for earth fault protection.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
f)	3 Nos. CTs, 630/5A, 15VA, CL-1 for metering.									
3	Outgoing feeders - (Total 2 Nos) - One No. for DB-140 ,One No. for DB-240 (BU)with each of the above feeders consisting of the following:									
a)	1 No. 1600A/1600A, **for DB140 & 1 No. 2000/2000A for DB240,** 415V, 65KA, 3 Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. 1000A/1000A, 415V, 65KA, 3 Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
f)	3 Nos. CTs, 1000/5A, 15VA, CL-1 for metering.									
6	Outgoing feeders - (Total 2 Nos) - One No. for DB-110 & One No. for Spare with each of the above feeders consisting of the following:									
a)	1 No. 630A/630A, 415V, 65KA, 3 Pole motorised MCCB with 240V AC shunt trip coil and having electronics releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against Overload (with base setting and fine adjustment), Short Circuit and earth fault (all with adjustable time delays) + Instantaneous (4) Communication options to remotely read parameters for the protection functions transmission of ammeter measurements, signaling of cause of tripping, maximeter reset etc. (5) NO / NC contacts for interlocks and indications (6) 1 No.CT in Neutral for earth fault protection.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	~~Digital Ammeter with Inbuilt Selector Switch~~ **1 No.Multifunction energy meter for measurement of voltage, line current, power factor**									
f)	3 Nos. CTs, 630/5A, 15VA, CL-1 for metering.									
7	Outgoing feeders - (Total 2 Nos) - One No. for DB-120,One no Spare with each of the above feeders consisting of the following:									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. 250A/200A, 415V, 65KA, 3 Pole motorised MCCB with 240V AC shunt trip coil and having electronics releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against Overload (with base setting and fine adjustment), Short Circuit and earth fault (all with adjustable time delays) + Instantaneous (4) Communication options to remotely read parameters for the protection functions transmission of ammeter measurements, signaling of cause of tripping, maximeter reset etc. (5) NO / NC contacts for interlocks and indications (6) 1 No.CT in Neutral for earth fault protection.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
f)	3 Nos. CTs, 200/5A, 15VA, CL-1 for metering.									
F	**INTERLOCKING ARRANGEMENT**									
	PLC unit, suitable for interlocking 16 Nos Circuit Breakers, complete with all hardware and software as per interlocking schedule.									
G	**SCADA CONNECTIVITY**									
	All the breakers should be provided with communication facilities & contractor should provide single point to the marshelling box to communicate with BMS/SCADA for all system parameters of the panel. DC source & other accessories including software and hardware required for this is in the scope of contractor.									
	Supply of above item	**Sets**		1	1	2				
	Insallation of above item	**Sets**		1	1	2				
	Testing and Commissioning of above item	**Sets**		1	1	2				
1.01.1	Transducer and wiring upto marshalling box for all relevant I/O points for panels for SCADA/BMS Connectivity ~~in the scope of contractor~~.	**Sets**		1	1	2				
1.02										
I	**Main Distribution Board DB-200 as per Technical Specifications and as per following details:**									
A	**INCOMER**									
	TRANSFORMER -II INCOMING each comprising of following									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. 5000 A / 5000 A, 415V, 70kA, 4 Pole, Electrically operated Draw Out type ACB, complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of V, A, W, VAR, VA, Wh, VARh, Hz, power factor etc shall be as per I/O Schedule (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous, over and under voltage, minimum and maximum frequency, voltage and current imbalance, phase sequence, load shedding and reconnection (4) Measurement of inturrepted currents, differenciated fault indications, maintenance indicators (5) Last few trippings and event histories and time stamping with facility for consulting the history file, maintenance indicator register etc (6) Communication options to remotely read and set parameters for the protection functions, transmission of all the calculated indicators and measurements (7) Signailing of the cause of tripping and alarms (8) NO/NC contacts for interlocks and indications.(9) 1No.Lockable Emergency Push Button with contact.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for the following-									
	ON, OFF, TRIP, spring charged & phase indication (R-Y-B).									
e)	Metering									
i)	1 No. Multifunction energy meter for measurement of voltage, line current, power factor, power & energy.									
ii)	~~4~~ **3**Nos. CTs 5000**-2500**/**5-**5A, 15VA, CL-0.5S for metering (Dual Ratio).									
iii)	1 Nos. CTs 5000/5A, 15VA, CL-1 for APFCR relay.									
f)	Protection									
i)	4 Nos. CTs, 5000/1A, CL-PS, in the MDB. Contractor carry out interface, to ensure that these CT's are matching with the CT provided in the neutral section of the Transformer by the Power Supply Contractor. In case any changes are required in the Specifications given above due to interface, including the rating of the CT's, same shall be done at no extra cost to the Employer.									
g)	1 No. Front Display Module(FDM)									
B	**ASS-1 to ASS-2 (TIE BREAKER for connecting DB-100 to DB-200**									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a	1 No. 2500A/2500A, 415V, 65KA, ~~3~~ **4**Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) ~~1 No. CT in the neutral to connect with the trip unit.~~**(9) 1No.Lockable Emergency Push Button with contact**									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
f)	3 Nos. CTs, 2500/5A, 15VA, CL-1 for metering.									
C	**Interconnector Bus-Section Circuit Breaker (Bus Coupler comprising of following)**									
a)	1 No. 3200A/3200A, 415V, 70kA, 4 Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase and neutral current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications. (8) Status Indication ON, OFF, TRIP									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
D	**BUS-BARS**									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
f)	3 Nos. CTs, 630/5A, 15VA, CL-1 for metering.									
3	Outgoing feeders - (Total 2 Nos) - One No. for DB-240 , One No. for DB-140(BU), with each of the above feeders consisting of the following:									
a)	1 No. 1600A/1600A, **for DB140 & 1 No. 2000/2000A for DB240,** 415V, 65KA, 3 Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
f)	3 Nos. CTs, ~~1600~~ **As Per Bearker rating**/5A, 15VA, CL-1 for metering.									
4	Outgoing feeders - (Total 2 Nos) - One No. for DB-250 & One No.Spare with each of the above feeders consisting of the following:									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. 1250A/1250A, 415V, 65KA, 3 Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	~~Digital Ammeter with Inbuilt Selector Switch~~**1 No.Multifunction energy meter for measurement of voltage, line current, power factor**									
f)	3 Nos. CTs, 1250/5A, 15VA, CL-1 for metering.									
5	Outgoing feeders - (Total 2 Nos) - One No. for DB-130 & One No. for DB-230 with each of the above feeders consisting of the following:									
a)	1 No. 1000A/1000A, 415V, 65KA, 3 Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
f)	3 Nos. CTs, 1000/5A, 15VA, CL-1 for metering.									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
F	**INTERLOCKING ARRANGEMENT**									
	PLC unit, suitable for interlocking **16** Nos Circuit Breakers, complete with all hardware and software as per interlocking schedule.									
G	**SCADA CONNECTIVITY**									
	All the breakers should be provided with communication facilities & contractor should provide single point to the marshelling box to communicate with BMS/SCADA for all system parameters of the panel. DC source & other accessories including software and hardware required for this is in the scope of contractor.									
	Supply of above item	**Sets**		1	1	2				
	Insallation of above item	**Sets**		1	1	2				
	Testing and Commissioning of above item	**Sets**		1	1	2				
1.02.1	Transducer and wiring upto marshalling box for all relevant I/O points for panels for SCADA/BMS Connectivity ~~in the scope of contractor~~.	**Sets**		1	1	2				
1.04	**Small power distribution panels (DB-110 & DB-210) as per Technical Specifications and as per the following details.**	**Sets**		2	2	4				
A	**INCOMING**									
a)	1 No. 630 A / 630 A, 415V, 65kA, ~~3~~ **4**P motorised MCCB having (1) Electronic Trip Unit with adjustable Overload, adjustable Short Circuit and adjustable Earth Fault (All with adjustable time delays) protection; (2) Provision for remote tripping of MCCB; (3) NO/NC contacts for operation and ~~(4) 1 No.CT in Neutral for earth fault protection.~~									
b)	TNC switch									
c)	LED indication lamp for ON, OFF & TRIP.									
	Phase Indication for R, Y and B									
d)	Metering									
i)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor, power & energy.									
ii)	3 Nos. CTs, 630/5A, 10VA, CL-1 for metering.									
B	**BUS-BARS**									
	Electrolytic high conductivity T P & N (full size) copper conductor bus-bars rated 630 Amps, suitable to withstand symetrical fault level of **65KA** for 1 second at 415 volts.									
C	**OUTGOING**									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1	25 Nos. Feeders with 100A/63A, 3 pole, 50kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit									
	Scada/BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & Transducers mounting prewired upto marshelling box terminal boards from the factory itself and audited in factory from the BMS provider									
1.05	**Lighting distribution panels (DB-120 & DB-220) as per Technical Specifications and as per the following details.**	**Sets**	**2**	2	2	4				
A	**INCOMING**									
a)	1 No. 250 A/200 A, 415V, 65kA, ~~3~~ **4**P motorised MCCB having (1) Electronic Trip Unit with adjustable Overload, adjustable Short Circuit and adjustable Earth Fault (All with adjustable time delays) protection; (2) Provision for remote tripping of MCCB; (3) NO/NC contacts for operation and ~~(4)~~ ~~1~~ ~~No.CT in Neutral for earth fault protection.~~									
b)	TNC switch									
c)	LED indication lamp for ON, OFF & TRIP.									
	Phase Indication for R, Y and B									
d)	Metering									
i)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor, power & energy.									
ii)	3 Nos. CTs, 200/5A, 10VA, CL-1 for metering.									
B	**BUS-BARS**									
	Electrolytic high conductivity T P & N (full size) copper conductor bus-bars rated 250 Amps, suitable to withstand symetrical fault level of 65KA for 1 second at 415 volts.									
C	**OUTGOINGS**									
1	14 Nos. Feeders with 100A/63 A, 3 pole, 50kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit.									
	Scada/BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & Transducers mounting prewired upto marshelling box terminal boards from the factory itself and audited in factory from the BMS provider									
1.06	**Escalator & lift panels (DB-150 & DB-250) as per Technical Specifications and as per the following details.**	**Sets**		2	2	4				

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
A	**INCOMING**									
a)	1 No. 1250A/1250A, 415V, 65kA, 4 Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications ~~(8) 1 No. CT in the neutral to connect with the trip unit.~~									
b)	TNC switch									
c)	LED indication lamp for ON, OFF & TRIP.									
	Phase Indication for R, Y and B									
d)	Metering									
i)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor, power & energy.									
ii)	3 Nos. CTs, 1250/5A, 10VA, CL-1 for metering.									
B	**BUS-BARS**									
	Electrolytic high conductivity T P & N (full size) copper conductor bus-bars rated 1250 Amps, suitable to withstand symetrical fault level of **65 KA** for 1 second at 415 volts.									
C	**OUTGOINGS**									
1	**2** Nos. Feeder with 400A/400A, 3 pole, 50 kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit.									
2	**8** Nos. Feeder with 400A/250A, 3 pole, 50 kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit.									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
3	2 Nos. Feeders with 100/40 A, 3 pole, 35kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit.									
4	1 No. Feeders with 160/100 A, 3 pole, 35kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit.									
	Scada/BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & Transducers mounting prewired upto marshelling box terminal boards from the factory itself and audited in factory from the BMS provider									
1.09	Capacitor Panel/Power Factor Correction Panel of 250 KVAR as per Technical specifications and as per the following details.	**Sets**		2	2	4				
A	**INCOMER**									
a)	1 No. 630 A / 630 A, 415V, 65kA,~~3~~ **4**P motorised MCCB having (1) Electronic Trip Unit with adjustable Overload, adjustable Short Circuit and adjustable Earth Fault (All with adjustable time delays) protection; (2) Provision for remote tripping of MCCB; (3) NO/NC contacts for operation and ~~(4) 1 No.CT in Neutral for earth fault protection.~~									
b)	LED indication lamp for the following-									
	ON, OFF, TRIP									
c)	LED phase indication lamp for R-Y-B.									
d)	12 Step APFCR relay **with communication facility**.									
e)	1 No Auto / manual Selector Switch.									
	Metering									
i)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor, power & energy.									
ii)	3 Nos. CTs, 630/5A, 10VA, CL-1 for metering.									
B	**BUS-BARS**									
	Electrolytic high conductivity T P & N (full size) copper conductor bus-bars rated 630 Amps, suitable to withstand symetrical fault level of **65 KA** for 1 second at 415 volts.									
C	**OUTGOINGS**									
	8 Nos. feeders with each feeder containing the following-									
a)	1 No. 100 A, 3 pole, 50kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit									
b)	Capacitor Duty, 3 - Pole Contactor suitable for 25 kVAR capacitor , with Auxiliary Contacts.									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1	Automatic Transfer Switch (ATS) with 2 Nos. 400A/250A, **35kA,** 4 pole, motorised MCCBs, electrically and mechanically interlocked with base frame and controller having selector switch for automatic & forced operation on normal and emergency sources. ATS must have monitoring of normal source, automatic changeover, test facility, circuit breaker status indication (On, Off & Trip), 3 phase Under - voltage protection and Phase Sequence Protection inbuilt in the controller or separately provided. The controller should have communication capability with BMS/SCADA. The MCCB's must have Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit, shunt trip coil, auxiliary contacts for ON, OFF, TRIP indication etc. as per drawing and specifications.									
b)	LED indication lamp for the following-									
	ON, OFF, TRIP (each for both the supplies)									
c)	LED phase indication lamp for R-Y-B.									
	Out going terminals for cable collection to be provided.									
	Scada/BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & Transducers mounting prewired upto marshelling box terminal boards from the factory itself and audited in factory from the BMS provider									
1.11	**Auto Transfer Switch for Lifts ATS as per Technical Specifications and as per the following details.**	**Sets**		3	3	6				
1	Automatic Transfer Switch (ATS) with 2 Nos. 160/100A, **35kA,** 4 pole, motorised MCCBs, electrically and mechanically interlocked with base frame and controller having selector switch for automatic & forced operation on normal and emergency sources. ATS must have monitoring of normal source, automatic changeover, test facility, circuit breaker status indication (On, Off & Trip), 3 phase Under - voltage protection and Phase Sequence Protection inbuilt in the controller or separately provided. The controller should have communication capability with BMS/SCADA. The MCCB's must have Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit, shunt trip coil, auxiliary contacts for ON, OFF, TRIP indication etc. as per drawing and specifications.									
b)	LED indication lamp for the following-									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
	ON, OFF, TRIP (each for both the supplies)									
c)	LED phase indication lamp for R-Y-B.									
d)	1 No 6A, DP, MCB (B curve) for Lift control supply (UPS supply) local isolation.									
e)	**1 No MFM with 3 No. CT as per breaker rating.**									
	Out going terminals for cable connection to be provided.									
	Scada/BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & Transducers mounting prewired upto marshelling box terminal boards from the factory itself and audited in factory from the BMS provider									
1.16	**Local Motor Control Panel for Seepage Pumps, DB - 155 & DB-255 as per as per technical Specifications & as per the following details.**	**Sets**		2	2	4				
A.	Incomer									
a)	Automatic Transfer Switch (ATS) with 2 Nos. 250A/160 A, 4 pole, 35kA motorised MCCBs, electrically and mechanically interlocked with base frame and controller having selector switch for automatic & forced operation on normal and emergency sources. ATS must have monitoring of normal source, automatic changeover, test facility, circuit breaker status indication (On, Off & Trip), 3 phase Under - voltage protection and Phase Sequence Protection inbuilt in the controller or separately provided. The controller should have communication capability with BMS/SCADA. The MCCB's must have Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit, shunt trip coil, auxiliary contacts for ON, OFF, TRIP indication etc. as per drawing and specifications.									
b)	LED indication lamp for the following-									
	ON, OFF, TRIP (each for both the supplies)									
c)	LED phase indication lamp for R-Y-B.									
d)	Flow meter with BMS Interfacing									
e)	METERING									
i)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor, power & energy.									
ii)	3 Nos. CTs, 160/5A, 10VA, CL-1 for metering.									
B.	BUS BAR									
	Electrolytic high conductivity T P & N (full size) copper conductor bus-bars rated 160 Amps, suitable to withstand symetrical fault level of 35 kA for 1 second at 415 volts.									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
ii)	1 No Digital Ammeter with Inbuilt Selector Switch.									
iii)	3 Nos. CTs, 40/5A, 10VA, CL-1 for metering.									
	Scada/BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & Transducers mounting prewired upto marshelling box terminal boards from the factory itself and audited in factory from the BMS provider									
1.17	**Local Motor Control Panel for Mid tunnel Pumps as per technical Specifications & as per the following details.**	**Sets**		2	2	4				
A.	**INCOMER**									
a)	100A/40 A, ~~3~~ **4**pole, 35kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit .									
b)	LED phase indication lamp for R-Y-B.									
c)	Flow meter with BMS Interfacing									
d)	METERING									
i)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
ii)	3 Nos. CTs, 40/5A, 10VA, CL-1 for metering.									
B.	**BUS BAR**									
	Electrolytic high conductivity T P & N (full size) copper conductor bus-bars rated 40 Amps, suitable to withstand symetrical fault level of 35kA for 1 second at 415 volts.									
C.	**OUTGOING**									
1	2 Sets of Star Delta starter unit for Sump Pumps (upto 3.7 KW each) with one Pump as Working and One as Standby. Each Starter Unit shall be equipped with the following.									
a	1 No. 3 Pole suitable rating of MPCB (with Inbuilt Single Phasing Preventor) with suitable rating of Over - load release and having contacts for indications - On, Off, Trip.									
b	1 No. 4 pole, **RCBO** with 40A rating and 100 mA sensitivity.									
c	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
d	1.No. CT, 10/5A, 10VA, class - I for metering.									
e	Auto / Local / Remote Selector Switch key operated.									
f	Door mounted push buttons for Start and Stop functions.									
g	Emergency Stop push button lockable type.									
h	LED indication lamp for ON, OFF, Trip.									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	3 No. 40A, AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 240 V AC.									
i)	One No. Star Delta Timer.									
j)	Auxiliary Contactors for Auto/Local/Remote Operation.									
k)	Triple pole saturable C.T. operated electronic over Current relays (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.).									
l)	Power & Control terminals for cable connections.									
4	**2 Nos. Feeders with 250A/160A, 3 pole, 50kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit(1 No. for WTP Panel and 1 No. Spare)**									
	Scada/BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & Transducers mounting prewired upto marshelling box terminal boards from the factory itself and audited in factory from the BMS provider									
1.19	**Local Motor Control Panel for Water Treatment System, DB - WT as per technical Specifications & as per the following details.**	**Sets**		1	1	2				
A.	**Incomer**									
a)	~~2~~ **1**Nos. 250 A/160 A, 415V, 35 kA, 4P MCCB having Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit and having NO/NC contacts for operation. ~~The MCCB's must be mechanically and electrically interlocked such that it is possible to manually close one of them at a time.~~									
b)	LED phase indication lamp for R-Y-B.									
c)	LED indication lamp for the following-									
	ON, OFF, TRIP									
d)	Flow meter with BMS Interfacing									
B.	**BUS BAR**									
	Electrolytic high conductivity T P & N (full size) copper conductor bus-bars rated 160 Amps, suitable to withstand symetrical fault level of **35KA** for 1 second at 415 volts.									
C.	**Outgoing**									
1	3 Sets (Bore well) of Star - Delta Starter Unit of 5.5kW. Each Starter Unit shall be equipped with the following:									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a	1 No. 3 pole, 6.3 A, MPCB (with inbuilt Single Phasing Preventor) having 4 - 6.3 A Over - load release and having Auxiliary contacts for indications for On, Off and Trip.									
b	1 No. 4 pole, RCBO with 40A rating and 100 mA sensitivity.									
c	1 No.Multifunction energy meter for measurement of voltage, line current, power factor									
d	1 No. CT, 10/5A, 10VA, class - I for metering.									
e	Auto / Local / Remote Selector Switch key operated.									
f	Door mounted push buttons for Start and Stop functions.									
g	Emergency Stop push button lockable type.									
h	LED indication lamp for ON, OFF, Trip.									
i	1 No. 10 A, AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 240 V AC.									
j	One No. timer with Instantaneous and Time Delay Contact (for programming in case selected pump is not operative then next shall be switched on automatically)									
k	Running hour meter.									
l	Auxiliary Contactors for Auto/Local/Remote Operation.									
m	Power & Control terminals for cable connections.									
	Scada/BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & Transducers mounting prewired upto marshelling box terminal boards from the factory itself and audited in factory from the BMS provider									
1.20	**Local Motor Control Panels for Sewage Pumps, DB - 111 & /211 as per technical Specifications & as per the following details.**	**Sets**		1	1	2				
A.	**Incomer**									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
	All the items / parts mentioned in relevant clauses of the technical specifications and not specifically mentioned in BOQ shall be deemed to be included in the quoted rates, unless specifically excluded.									
	Supply, Installation, Testing & Commissioning of front operated, indoor, front access cubicle type, dead rear, wall / recess / surface mounted Distribution Boards, (confirming to specifications given in technical Specifications). The Distribution Boards must have Ingress Protection Classification of IP 54,Current Rating of 100A and must be suitable suitable to withstand symetrical fault current level of 10 KA for 1 sec at 415 volts, with the configurations detailed below. Distribution boards must be provided with electrolytic, high conductivity, TPN copper bus-bars as specified in technical specifications (with full sized Neutral busbar), gland plates at both ends, blanking plates etc. as required. All internal wiring within the Distribution boards must be with Copper Conductor, LSZH wires (conforming to BS 7211 and technical Specifications) for ~~Normal~~ ~~Lighting~~ ~~and~~ ~~Socket~~ Distribution Boards ~~and with Fire Resistant / Survival wires (conforming to BS 6387 and technical Specifications) for Emergency Lighting Distribution Boards.~~ All distribution-boards shall be provided with 20% future space provision as required.									
2.1	**SMALL POWER TPN DISTRIBUTION BOARDS**									
2.1.1	**UNDERCROFT & PLATFORM B.O.H.**									
2.1.1.1	INCOMER (Type-1)	NOS		1	1	2				
1)	1 No. 63A, 4P, On - Load Manual Change - over Switch with 2 No. auxiliary contacts for position signalling.									
2)	1 No. 50A, TPN MCB									
3)	3 Nos. 40A, DP RCBO (30 mA Sensitivity)									
4)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor with suitable CT rating									
	OUTGOING									
1)	24 Nos. 25A, SP MCB									
2)	6 Nos. 32A, 4P, RCBO (30 mA Sensitivity)									
	Terminals blocks for power & control cables.									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
	OUTGOING									
1)	10 Nos. Of 10A DP RCBO (30 mA Sensitivity)									
	Terminals blocks for power & control cables.									
2.4	**SPN EMERGENCY DISTRIBUTION BOARD FOR SCADA**	Nos		4	4	8				
	INCOMER									
a)	1 No. 32A, TPN MCB									
b)	3 Nos. 32A, DP MCB with 3 Nos. 32A, DP RCBO/ RCCB (100 mA Sensitivity)									
c)	LED indication lamp for ON, OFF, Trip.									
d)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor with suitable CT rating									
	OUTGOING									
a)	8 Nos. Of 10A DP RCBO (30 mA Sensitivity)									
b)	Terminals blocks for power & control cables.									
2.5	Supply, installation, testing and commissioning of isolator box for S&T UPS	Nos		2	2	4				
	250 A 4 pole MCCB with indication lamp IP-52									
2.6	**TUNNEL LIGHTING**	Nos		2	2	4				
1	INCOMER									
a)	1 No. 63A, TPN, **motorised** MCCB with 2No. auixillary Contacts, **MCCB shall be suitable for remote ON, OFF and auxilary ON and OFF contacts should be provided for remote monitoring.**									
b)	LED indication lamp for ON, OFF, Trip.									
c)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor with suitable CT rating									
2	OUTGOING									
a)	30 Nos. Of 10A DP RCBO (30 mA Sensitivity)									
b)	Terminals blocks for power & control cables.									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
5.1	Supply, Installation, Testing and Commissioning of the following Luminaires including all accessories like H.F electronic ballast, holder & Lamp etc. with surface/recess mounting arrangement and all fixing accessories. All luminaries and accessories shall be as per Specification E08.									
	The Tubular Florecent lamps to be used must be similar to Philips Lamp Model No 'TL' D 80 NG in terms of Lumen Output, Efficency, Colour Rendering Index, Life and other technical parameters.									
	All wiring within the luminarries must be with Low Smoke Zero Halogen Type and / or Fire Survival Type Wires, as per requirements of section E 08 of M & W Specifications.									
A	General purpose, basic batten luminaries (Similar to Philips catalogue No.TMS 122 2x28 t5 OR Keselec Catalog no.Railux 2x28 HF) for 'TL'D fluorescent lamp (T5 Lamp) with - Surface mounting arrangement on wall or ceiling - Single piece channel construction made of powder coated CRCA white sheet steel - Lamp holder brackets and HF electronics ballast. The luminaries should be suitable for 2 x 28W Tubular Flourescent Lamp (T5 lamp) and supplied with 2 Nos 28W Tubular Fluorescent lamp (T5 lamp)	Nos.		~~140~~ **70**	~~140~~ **70**	~~280~~ **140**				
B	General purpose, basic batten luminaries (Similar to Philips catalogue.No. TMC 122 / 1X28 OR Keselec Catalog no Railux 1x28 HF) for 'TL'D fluorescent lamp (T5 Lamp) with - Surface mounting arrangement on wall or ceiling - Single piece channel construction made of powder coated CRCA white sheet steel - Lamp holder brackets and HF electronics ballast. The luminaries should be suitable for 1 x 28W Tubular Flourescent Lamp (T5 lamp) and supplied with 1 No. 28W Tubular Fluorescent lamp (T5 lamp)	Nos.		~~100~~ **50**	~~100~~ **50**	~~200~~ **100**				
C	General purpose basic batten luminaries (Similar to Philips catalogue.No. TMS 122 / 2X28W OR Keselec Catalog no. Indilux V 228 HF with vitreous enamelled reflector) for 'TL'D fluorescent lamp (T5 Lamp) with - Surface mounting arrangement on wall or ceiling - Single piece channel construction made of powder coated CRCA white sheet steel - Vitreous Enamelled Reflector of white colour - Lamp holder brackets and HF electronics ballast. The luminaries should be suitable for 2x28W Tubular Flourescent lamp and supplied with 2 Nos 28W Tubular Fluorescent lamp (T5 lamp). B1428B1439B1442	Nos.		~~300~~ **150**	~~300~~ **150**	~~600~~ **300**				
D	NOT USED					0				

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
E	Efficient, low glare, surface mounted luminaries (Similar to Philips Catalogue No. MPF 922 / 1 X 70W) with integral gear, electrochemically brightened and anodized high purity aluminium reflector of asymmetrical type. The luminaries must be non corrosive pressure die cast aluminium housing and white powder coated finish and must be suitable for ceiling mounting. It should have cover made of heat resistant toughened glass and the must be conforming to Ingress Protection Classification of IP 65 (for dust and moisture protection). The luminaries should be suitable for, and supplied with, One No 70W Metal Halide lamp .	Nos.		~~10~~ **5**	~~10~~ **5**	~~20~~ **10**				
F	Mirror Optic Recess mounted luminaries (Similar to Philips catalogue.No TCS 252 / 2x28 OR Keselec equivalent subject to approoval by ER, Catalog no Pharma (Sym/Asym) 2x28 OR Keselec Catalog no FZ (Sym/Asym) 2x28) with housing made of white powder coated CRCA sheet steel, accommodating all electrical accessories pre-wired upto a terminal block. It should have high efficiency mirror optic anodised aluminium reflector for symmetrical and asymmetrical light distribution and must conform to Ingress Protection Classification of IP 54 (for dust and moisture protection). The luminaries should be suitable for 2x28W Tubular Fluorescent lamp (T5 lamp) and supplied with 2 Nos 28W Tubular Fluorescent lamp (T5 lamp).	Nos.		~~100~~ **50**	~~100~~ **50**	~~200~~ **100**				
G	Efficient, low glare, surface mounted luminaries (Similar to Philips Catalogue No. MPF 112 / 1 X 70W) with integral gear, electrochemically brightened and anodized high purity aluminium reflector of symmetrical type. The luminaries must be non corrosive pressure die cast aluminium housing and white powder coated finish and must be suitable for ceiling mounting. It should have cover made of heat resistant toughened glass and the must be conforming to Ingress Protection Classification of IP 65 (for dust and moisture protection). The luminaries should be suitable for, and supplied with, One No 70W Metal Halide lamp .	Nos.		1	1	2				
H	General purpose basic batten luminaries (Similar to Philips catalogue.No. TCW 450 / 1X28 OR Keselec Catalog no.Railux 1x28 HF) for 'TL'D fluorescent lamp (T5 Lamp) with - Surface mounting arrangement on wall or ceiling - Single piece channel construction made of powder coated CRCA white sheet steel - Lamp holder brackets and HF electronics ballast - Wire Guard to protect the lamp The luminaries should be suitable for 1x28W Tubular Flourescent lamp and supplied with 1 Nos 28W Tubular Fluorescent lamp (T5 lamp).	Nos.		~~100~~ **50**	~~100~~ **50**	~~200~~ **100**				
I	Recessed Circular Down Light luminaries (Similar to Philips catalogue.No FBH 145 / 218 **OR Keselec Catalog no.Nova 2x18 (G))** with satin finished, anodised aluminium reflector and clear glass cover. The luminaries should be suitable for 2 x 18 W CFL lamps and supplied with 2 Nos 18W CFL lamps.	Nos.		1	1	2				

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
J	Mirror Optic, recessed mounted Luminaries (Similar to Philips catalogue.No TBS 255 TCS 228 OR Keselec Catalog no.Pharma 2x28 HF) with housing made of white powder coated CRCA Sheet Steel, accomodating all electrical accessories pre-wired upto a terminal box. It should have high efficiency mirror optic anodised aluminium reflector and must conform to Ingress Protection Classification of IP 54 (for dust and moisture Protection). The Luminaries should be suitable for 2x28W Tubular Flourescent lamp and supplied with 2 Nos. 28W Tubular Flourescent Lamp (T5 Lamp).	Nos.		1	1	2				
K	Mirror Optic Recess mounted luminaries (Similar to Philips catalogue.No TBS 669 / 228 D6 OR Keselec Catalog no.CT lux 2x28 HF) with housing made of white powder coated CRCA sheet steel, accommodating all electrical accessories pre-wired upto a terminal block. It should have high efficiency mirror optic reflector of high quality aluminium with parabolic side reflector, 3D cross lamallae with fresnell top and concave lower contour. The luminaries should be suitable for 2x28W Tubular Fluorescent lamp (T5 lamp) and supplied with 2 Nos 28W Tubular Fluorescent lamp (T5 lamp).	Nos.		1	1	2				
L	Mirror Optic Recess mounted luminaries (Similar to Philips catalogue.No TBS 669 / 128 D6 OR Keselec Catalog no.CT lux DL 1x28 HF) with housing made of white powder coated CRCA sheet steel, accommodating all electrical accessories pre-wired upto a terminal block. It should have high efficiency mirror optic reflector of high quality aluminium with parabolic side reflector, 3D cross lamallae with fresnell top and concave lower contour. The luminaries should be suitable for 1x28W Tubular Fluorescent lamp (T5 lamp) and supplied with 1 Nos 28W Tubular Fluorescent lamp (T5 lamp).	N o.		~~60~~ **30**	~~60~~ **30**	~~120~~ **60**				
M	Recessed mounted square type luminaire (Similar to Keselec Zumtobel No. Nova Square with highly specular facted optic made of aluminised polycarbonate reflector accomodating all electrical accessories pre-wired upto a terminal box. Having high operating efficiency and homogenous lighting solutions with pyramid shape pattern of luminous intensity with glass and supplied with 2 Nos. 26W CFL lamps.	Nos.		~~160~~ **80**	~~160~~ **80**	~~320~~ **160**				
N	**Tunnel** luminaire consisting of an extruded anodised aluminium alloy body sealed onto an extruded polycarbonate prismatic protector with high impact resistance IK10; a removable sliding plate equipped with control gear on one side and lamp(s) on the other; one or two frames made out of injection moulded on the other; one or two frames made out of injection moulded two polycarbonate covers closed with two stainless steel screws. This system ensures tightness of IP-67 for the whole luminaire. The fixture suitable for 1x36W CFL lamp with all mounting accessories and 2 nos glands (suitable for loop in & loop out with 4x4 sq mm/4x2.5 sq mm cable). similar to Schreder Cat MY-1 and supplied with one lamp suitable for the above fixture.	Nos.		~~10~~ **5**	~~10~~ **5**	~~20~~ **10**				
O	NOT USED									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
P	Bulk Head luminaries (Similar to Philips Catalogue No FXC 101 **OR Keselec Catalog no. KBH 1x9 W**) suitable for mounting on wall / ceiling having -Single piece pressure die cast Aluminium housing - Wire Guard made of powder coated MS - Heat resistant Glass cover The luminaries must conform to Ingress Protection Classification of IP 54 (for dust and Moisture Protection). The luminaries should be suitable for 1 x 9W CFL lamp and supplied with 1 No. 9W CFL lamp and control accessories.	Nos.		~~30~~ **15**	~~30~~ **15**	~~60~~ **30**				
Q	Surface/Suspended type moisture proof diffuser luminiare with housing made of grey, high impact resistant polycarbonate, with Non-ageing gasket consisting of 2-component polyurethane foam. Difuser made of one piece injection moulded high impact resistant polycarbonate also computer optimised internal prismatic structure for precise direction of light and glare reduction, with difuser clips made of stainless steel, roll formed galvanised steel reflector that is enamelled white and can be suspended from either side of the housing. Suitable for 2x28W FTL Lamp (T5 Lamp) prewired upto a terminal box with lamp. Having IP 65 (similar to Philips catalogue No. TCW 097 \ 2x28W D6 HF or Keselec zumtobel make FZ 2x28W HF) and supplied with 2 Nos 28W Tubular Fluorescent lamp (T5 lamp).	Nos.		~~70~~ **35**	~~70~~ **35**	~~140~~ **70**				
FL-1	Compact, sturdy, general purpose floodlight luminaries (Similar to Philips catalogue. No TEMPO3 SWF 330 SK type) with integral gear, electrochemically brightened and anodized high purity aluminium reflector of symmetrical type. The luminaries must be adjustable with rugged, non corrosive pressure die cast aluminium housing and black powder coated finish and must be suitable for column mounting. It should have cover made of heat resistant toughened glass and the must be conforming to Ingress Protection Classification of IP 65 (for dust and moisture protection). The luminaries should be suitable for, and supplied with, One No 250W Sodium Vapour lamp.	Nos.		~~10~~ **5**	~~10~~ **5**	~~20~~ **10**				
5.2	**Temperory Lighting at Station**									
1	Installation and Commisioning of 40 Watt tube lights with cover along with the necessary wiring and power supply arrangement ,to provide general lighting at Concourse,Platform,Undercroft and Tunnel area during construction period.	per tube light for 240 days		200	200	400				
2	Cost (Addition/Deletion) of Installation and Commisioning of 40 Watt tube lights with cover 10 No/day approx along with the necessary wiring and power supply arrangement ,to provide general lighting at Concourse,Platform,Undercroft and Tunnel area during construction period.	L/s		1	1	2				
5.3	Supply, installation, testing and commissions of External lights as per specifications and as per following details.									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a	Bajaj ~~Cat. No. BOP 1030~~/Philips/Keselec or equivalent welded baseplate, padestal of specified height to IS:2713 part II-1980 or latest as per specifications and drawings.									
b	1:3:6 concrete foundation and pedestal coping 300 dia of height as per specification and relevant IS and as required. Contractor to obtain approval of foundation design before proceeding further.									
c	6 ways, 20A connector & 6A MCB mounted on 6mm thick painted MS/GI plate, insulated, and accommodated inside the pole with gasketted weather, vermin proof, hinged lockable covered GI/MS box or integaral cast box in padestal as required.									
d	Wiring to Luminaries from the 2A SP MCB, with 3 x 2.5 FRLS copper stranded conductor (P+N+PE) double sheathed wire and making connections & earthing of pole.									
e	Painting of pole accessories with 2 coats of primer and 2 coats of oil paint of approved colour.									
f	Luminaire as specified with lamps, necessary cross arm to the luminaire, integral control gear and as under.									
i	Poles									
a	9.0 meter hot dipped galvanised Octagonal with single overhang arm & with foundation bolts, base plate complete with foundation, entry and exit pipes, control JB with connector generally as shown on drawings and as per specifications.	No.		5	5	10				
b	9.0 meter hot dipped galvanised Octagonal with double overhang arm & with foundation bolts, base plate complete with foundation, entry and exit pipes, control JB with connector generally as shown on drawings and as per specifications.	No.		5	5	10				
ii	Luminaires									
a	Supply, installation, testing and commissioning of street light luminaire with aesthetically designed die cast aluminium housing POT optics reflector and tougened flat glass (IP 65) (Similar to Philips Cat. No. CRP330/150W SON-T/CDM-TT including Lamp as required.	No.		~~15~~ **5**	~~15~~ **5**	~~30~~ **10**				
b	**Supply, installation, testing and commissioning of LED street light luminaire with efficacy of >95 lm/watt aesthetically designed Pressure die cast aluminium LM6 (IP 65) (Similar to Philips Cat. No. BRP322 LED 125 CW).**	No.		**5**	**5**	**10**				

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
c	**Supply, installation, testing and commissioning of LED street light luminaire with efficacy of >95 lm/watt aesthetically designed Pressure die cast aluminium LM6 (IP 65) (Similar to Philips Cat. No. BRP410 LED CW 069).**	No.		**8**	**8**	**16**				
d	**Supply, installation, testing and commissioning of LED street light luminaire with efficacy of >95 lm/watt aesthetically designed Pressure die cast aluminium LM6 (IP 65) (Similar to Philips Cat. No. BRP409 LED CW 035).**	No.		**5**	**5**	**10**				
5.4	Supply, installation, Testing and Commissioning 20 m high area lighting High Mast of Bajaj/Philips suitable for ~~06~~ **12** nos ~~1 x 400 W~~ luminaires complete with all standard accessaries like winches, latern carriage etc. including the cost of providing supplying and fixing **12nos.** ~~6 nos 2 x 400 W HPSV~~ **LED with efficacy of 100 lumen/Watt** flood light luminaires with die cast / extruded Aluminium body, pre anodised Aluminium asymetrc/symetric reflector, IP **65** ~~54~~ and above, heavy duty control gear housed in a weather proof housing ~~of~~ Similar to Philips/Bajaj or equivelent to cat no. **BVP410 LED 242 CW HE NB FG** ~~RT 3/N/2x400 of philips equvelent and including cost of the 400 W lamps type SON-T plus of Plilips,~~also including Lightning Arrestor and others accessaries like phosper Bronz Gear, double drum, stainless steel wire ropes, suitable MCB wires/cables as required with alongwith the folowing accessaries as required as under:									
a	Suitable foundation for the Mast considering soil bearing capacity 10 Ton per Sqm, with base pedestal of approve design, incoporating a suitable cable looping box with terminal blocks MCB etc. High Mast foundation design shall be approved by employer's representative before executing.									
b	S.I.T.C. of Earth station of Pipe earthing as per IS 3043-1987(or latest) , including duplicate earth connection to the mast with 25x3 mm size GI Strip or equivalent insulated copper cable.									
c	S.I.T.C. of suitable neon Aviation lights.									
	High mast complete as above & as per technical specifications	No.		1	1	2				
5A	**INDOOR LED LIGHTING**									
5A.1	LED Lights to be used must be similar to Philips Products in terms of Lumen Output, Efficency, Colour Rendering Index, Life and other technical parameters.									
	All wiring within the luminarries must be with Low Smoke Zero Halogen Type and / or Fire Survival Type Wires, as per requirements of section E 08 of M & W Specifications.									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
A	Energy Efficient and low Maintenace (Similar to Philips Sereno LED ~~of 42W~~) Power consumption with lumen output of 3275Lm. - ~~Surface~~ Reccess mounting arrangement ~~on wall or ceiling~~ - High Efficiency Opal Diffuser - Exturded Aluminium Housing	Nos.		~~1~~ **120**	~~1~~ **120**	~~2~~ **240**				
A1	**4' LED luminaire (similar to philips BN 108C LED 40S PSU WH) Luminaire should be suitable for surface mounting on wall or ceiling. The fixture should be with complete accessories as required.**	Nos.		**440**	**440**	**880**				
B	~~Energy Efficient and low Maintenace (Similar to Philips Arcus LED of 24W) Power consumption with lumen output of 2000Lm - Surface mounting arrangement on wall or ceiling - Exturded Aluminium Housing~~ **LED 2X2 recess mounting luminaire with Mid flux LED using efficient optics enclosed in a Metallic CRCA powder coated housing with high efficieny Lumio diffuser. Luminaire must be sealed from bottom and has an inbuilt gear. The luminaire should be IP 20 protected. (Similar to Philips Fullglow RC380B LED-30S)(SCR, TOM)**	Nos.		~~1~~ **50**	~~1~~ **50**	~~2~~ **100**				
B1	**4' LED luminaire (similar to philips BN 108C LED 20S PSU WH) Luminaire should be suitable for surface mounting on wall or ceiling. The fixture should be with complete accessories as required.**	Nos.		**100**	**100**	**200**				
C	~~Energy Efficient and low Maintenace (Similar to Philips Stratus LED of 54W) Power consumption with lumen output of 4400Lm- Installation Pendant Mounted- Exturded Aluminium Housing- High Efficieny Opal Diffuser~~ LED Bulkhead with a lumen package of 600 lumens in Cool White color.Fixture is protected to IP 66 and IK 09 . Fixture has a housing of High pressure die cast aluminum and a front diffuser of Poly carbonate. Similar to Philips Endura LED WT202W LED6S PSU S1 PC and supplied with same as required.(LIFT AND SHAFT AREA)	Nos.		~~1~~ **50**	~~250~~ **50**	~~251~~ **100**				
D	NOT USED									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
E	Efficient ~~Green Bay Gen II-Versatile~~ LED Lighting @100 Lm/W, suitable for recessed /Surface mounting/Suspended Mounting with suspension or eyebolt ,system Power-140W, electrochemically brightened and anodized high purity aluminium reflector of asymmetrical type..The luminaries must be non corrosive pressure die cast aluminium housing and white powder coated finish.It should have cover made of heat resistant toughened glass and the must be conforming to Ingress Protection Classification of IP 65 (for dust and moisture protection) Similer **to philips Cat. No. BY400V LED145S CW AK.** (Double height area)	Nos.		~~20~~ **10**	~~20~~ **10**	~~40~~ **20**				
F	~~Energy Efficient and low Maintenace (Similar to Philips Stratus LED of 54W) Power consumption with lumen output of 4400Lm~~ ~~- Installation Pendant Mounted~~ ~~- Exturded Aluminium Housing~~ ~~- High Efficieny Opal Diffuser~~	~~Nos.~~		~~1~~	~~1~~	~~0~~				
G	Efficient ~~Green Bay Gen II-Versatile~~ LED Lighting @100 Lm/W, suitable for recessed /Surface mounting/Suspended Mounting with suspension or eyebolt ,system Power-70W, electrochemically brightened and anodized high purity aluminium reflector of symmetrical type.The luminaries must be non corrosive pressure die cast aluminium housing and white powder coated finish.It should have cover made of heat resistant toughened glass and the must be conforming to Ingress Protection Classification of IP 65 (for dust and moisture protection).**Similer to philips Cat. No. BY400V LED72S CW SK.** **(Double height area)**	Nos.		~~10~~ **30**	~~10~~ **30**	~~20~~ **60**				
H	~~Endura~~LED Waterproof ~~-~~**(Similar to Philips Cat No.** WT550C Series), and must conform to Ingress Protection Classification of IP 65,LED based-Virgin PC Housing and cover ~~with system Power 42W~~,Suitable for Chain wire Mounting/Surface mounting (Undercroft, Platform track side)	Nos.		~~1~~ **125**	~~1~~ **125**	~~2~~ **250**				
I	Recessed Circular Down Light luminaries (Similar to Philips catalogue.**DN392 B LED**~~Green LEDi1200 DN195B~~) having optics with high quality Diffuser with satin finished, anodised aluminium reflector and clear glass cover. ~~The luminaries shouldHave system power of 18W and lumen package 1200 Lm.~~	Nos.		~~70~~ **100**	~~70~~ **100**	~~140~~ **200**				
I-1	**Recessed Circular Down Light luminaries (Similar to Philips catalogue.DN394 B LED having optics with high quality Diffuser with satin finished, anodised aluminium reflector and clear glass cover.**	Nos.		**25**	**25**	**50**				

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
I-2	**Recessed Circular Down Light luminaries (Similar to Philips catalogue.DN395 B LED having optics with high quality Diffuser with satin finished, anodised aluminium reflector and clear glass cover.**	Nos.		**100**	**100**	**200**				
J	~~Green Perform~~ LED Batten **(Similar to Philips Cat No**. BN208C) ~~with 40W system Wattage~~ having system effi**c**acy >90% with Conduit/Suspended/Surface type mounting. **(Concourse, Platform Area)**	Nos.		200	200	400				
K	~~Energy Efficient and low Maintenace (Similar to Philips LED of 54W) Power consumption with lumen output of 4400Lm - Reccessed Type - Exturded Aluminium Housing- High Efficieny Opal Diffuser~~ 4' LED luminaire (similar to Philips LED trunking **"LL199X 1XDLED40-4000PSE OD WH IP 54**). Luminaire should be suitable for surface mounting / suspended/Continue mounting, The housing shall be made of extruded aluminium and CRCA front frame with polycorbonate diffuser cover. the LED fixture should be complete with all accessories as required. **(Platform Edgeside, Entry/Exit)**	Nos.		198	198	396				
K1	**Spacer/blanker for above item.**	Mtr.		**200**	**200**	**400**				
L	~~Energy Efficient and low Maintenace (similar to Philips Arcus LED of 24W) Power consumption with lumen output of 2000Lm - Surface mounting arrangement on wall or ceiling- Exturded Aluminium Housing~~ 4' LED luminaire (similar to Philips LED trunking "**LL199X 1XDLED40-4000PSE OD WH IP 20)**. Luminaire should be suitable for surface mounting / suspended/Continue mounting, The housing shall be made of extruded aluminium and CRCA front frame with polycorbonate diffuser cover. the LED fixture should be complete with all accessories as required.	N o.		1	1	2				
M	**Tunnel** luminaire consisting of a high-presuure diecasting aluminium alloy body sealed onto an extruded polycarbonate prismatic protector with high impact resistance IK10; This system ensures tightness of IP-67 for the whole luminaire. The fixture suitable for LED lamp with all mounting accessories and 2 nos glands (suitable for loop in & loop out with 4x4 sq mm/4x2.5 sq mm cable). (**similar to Philips LED BWP120 LED 16CW PC)**	Nos.		280	350	630				
FL-2	**LED floodlight luminaries for wall, ceiling and surface mounting (Similar to Philips catalogue. No BVP 410 LED172 CW HE NB FG) with all accessories.symmetrical type. the LED fixture must be conforming to Ingress Protection Classification of IP 65 (for dust and moisture protection). The luminaries efficacy should be >100ln/Watt.**	Nos.		**10**	**10**	**20**				

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
6.8	Labour charges for making earth pit with 250 mm diameter, 3 meter long copper earth rod by driving directly in ground including termination with grid, as required, and as per technical specifications and as required.	Nos.		16	16	32				
6.9	Supplying & making of test joints with the following sizes of Copper Strip of length 125 mm with 4 nos. bolts, nuts and washers of brass, DMC support, as required, and as per technical specifications and as required.									
a	25 mm x 3 mm Copper strip	Nos.		16	16	32				
6.10	Providing and making plate earthing station with 600 x 600 x 6 mm copper plate earth electrode, 50 mm dia GI watering pipe, reducer & CI funnel with wire mesh, 150 mm coke / charcoal and salt around plate earth, all earth work, masonary enclosure with frame & cast iron hinged cover plate as per IS 3043.	Nos.		6	6	12				
6.11	Earth terminations with 50 mm dia GI perforated pipe complete with 15mm GI watering pipe with funnel with wire mesh etc. complete as per specification and as required	Nos.		8	8	16				
6.12	Supplying and laying of the GI strip down conductor size 25 x 3 on surface/wall/parapet/shaft complete with joints, bimetallic connectors, testing links & other fixing accessories and clamping/ connection with earth terminations as per specifications & as required (For Lightning Protection)	Metres		1200	1200	2400				
6.13	Supplying and laying of the . bimetallic connectors, testing links & other fixing accessories and clamping/ connection with earth terminations as per specifications & as required (as per specification or drawing.)	Nos.		16	16	32				
	TOTAL FOR SH 06 carried over to summary									
7	**UNINTERRUPTED POWER SUPPLY SYSTEM**									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
7.1	Supply, Installation, Testing and Commissioning of true parallel redundant 2 x 80 KVA online, UPS system suitable for providing power supply to emergency lighting and Computerised Control panel load of approved make, suitable for incoming 415 volts, 3 phase +10 % -20%, 50 Hz, supply and 3 phase 415 volts, output voltage, variation ± 1%, including inbuilit isolation transformer, IGBT rectifier Modules /dual converter, static switch, inverter, filters, Bypass & static transfer switch for automatic switch over without giving any break of power, maintenance bypass switch, Micro processor/software controlled annunciation,protection (including against input phase reversal), and menu run diagnostic module,associated cabling and connections/terminations, erection including associated foundation/masonorey or RCC work for mounting on base channels etc. complete as per specifications and as required.	Nos.		2	2	4				
	Note-1: The price of above item is exclusive of Automatic changeover switch suitable for terminating 2 nos of fire survival copper conductor cables as per technical specifications on the incoming side of UPS and is included in the UPS ATS item . The Automatic change over switch may be wall mounted in the UPS room or as provided. From chnageover switch to UPS, the connection should be through an adequately rated fire survival copper cable, and RS 485 port for display of ON/OFF status of UPS on BMS work station through MODBUS protocol									
7.1.a	Supply, Installation, Testing and Commissioning SMF VRLA each having ~~120~~ **30**minutes back up time at full load with interconnecting cables, racks and standard accessories UPS above. Battery shall comply with relevant regulations & Battery racks shall be made of acid resistant material.	Nos.		2	2	4				
	All the Items / parts mentioned in relevant clauses of the M & W specifications and not specifically mentioned in BOQ shall be deemed to be included in the quoted rates, unless specifically excluded									
	TOTAL FOR SH 07 carried over to summary									
8	**COMPACT SANDWICH TYPE BUS DUCT**									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
i a)	1 No. 3200 A, 415V, 65 KA, 4 Pole~~/4Pole~~, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor.									
f)	3 Nos. CTs, 3200/5A, 15VA, CL-1 for metering.									
i a)-1	**4 Pole, ACB of above item**	No.		**1**	**1**	**2**				
i a)-2	**3 Pole, ACB of above item**	No.		**1**	**1**	**2**				
i b)	1 No. 2500 A, 415V, 65 KA, 4 ~~Pole,~~ Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor.									
f)	3 Nos. CTs, 2500/5A, 15VA, CL-1 for metering.									
i b)-1	**4 Pole, ACB of above item**	No.		**1**	**1**	**2**				
i b)-2	**3 Pole, ACB of above item**	No.		**1**	**1**	**2**				

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
i c	1 No. 2000 A, 415V, 65 KA, 4 ~~Pole~~, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor.									
f)	3 Nos. CTs,1600/5A 15VA, CL-1 for metering.									
i c)-1	**4 Pole, ACB of above item**	No.		**1**	**1**	**2**				
i c)-2	**3 Pole, ACB of above item**	No.		**1**	**1**	**2**				
i d)	1 No. 1600 A, 415V, 65 KA, 4 ~~Pole,~~ Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor.									
f)	3 Nos. CTs,1600/5A 15VA, CL-1 for metering.									
i d)-1	**4 Pole, ACB of above item**	No.		**1**	**1**	**2**				
i d)-2	**3 Pole, ACB of above item**	No.		**1**	**1**	**2**				

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
i e)	1 No. 1250/1250 A, 415V, 65 KA, 4 ~~Pole~~, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor.									
f)	3 Nos. CTs,1250/5A 15VA, CL-1 for metering.									
i e)-1	**4 Pole, ACB of above item**	No.		**1**	**1**	**2**				
i e)-2	**3 Pole, ACB of above item**	No.		**1**	**1**	**2**				
i f)	1 No. 1000/100**0** A, 415V, 65 KA, 3 ~~Pole~~, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	Digital Ammeter with Inbuilt Selector Switch									
f)	3 Nos. CTs,1000/5A 15VA, CL-1 for metering.									
i f)-1	**4 Pole, ACB of above item**	No.		**1**	**1**	**2**				
i f)-2	**3 Pole, ACB of above item**	No.		**1**	**1**	**2**				

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
i g)	1 No. 800 A, 415V, 65 KA, 4 ~~Pole~~, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) 1 No. CT in the neutral to connect with the trip unit.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor.									
f)	3 Nos. CTs,800/5A 15VA, CL-1 for metering.									
i g)-1	**4 Pole, ACB of above item**	No.		1	1	2				
i g)-2	**3 Pole, ACB of above item**	No.		1	1	2				
ii	630/630 A 415 volts, ~~3 pole,~~ 50 kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit									
ii-1	**4 Pole, MCCB of above item**	No.		1	1	2				
ii-2	**3 Pole, MCCB of above item**	No.		1	1	2				
iii	400/400 A 415 volts, ~~3 pole~~, 50 kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit									
iii-1	**4 Pole, MCCB of above item**	No.		1	1	2				
iii-2	**3 Pole, MCCB of above item**	No.		1	1	2				
iiia	400/250 A 415 volts, ~~3 pole,~~ 50 kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit									
iiia-1	**4 Pole, MCCB of above item**	No.		1	1	2				
iiia-2	**3 Pole, MCCB of above item**	No.		1	1	2				
v	160/100 A, 415 volts, ~~3 pole~~, 35 kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit									
v-1	**4 Pole, MCCB of above item**	No.		1	1	2				

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
v-2	**3 Pole, MCCB of above item**	No.		**1**	**1**	**2**				
vi	Less than 100A, 415 volts, 3 pole, 35 kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and adjustable protection against Short Circuit	No.		1	1	2				
vii	Electrical Operating mechanism (Motorised mechanism) for all types of above MCCBs	No.		1	1	2				
a	5-32A FP MCB 9/10 kA	No.		1	1	2				
b	40-63A FP MCB 9/10 kA	No.		1	1	2				
c	5-32A TP MCB 9/10 kA	No.		1	1	2				
d	40-63A TP MCB 9/10 kA	No.		1	1	2				
e	5-32A DP MCB 9/10 kA	No.		1	1	2				
f	40-63A DP MCB 9/10 kA	No.		1	1	2				
g	5-32A SP MCB 9/10 kA	No.		1	1	2				
h	40-63A SP MCB 9/10 kA	No.		1	1	2				
i	16-32Amp DP RCCB, 30 mA	No.		1	1	2				
j	16-32Amp DP RCBo, 30 mA	No.		1	1	2				
k	2-6A TP MPCB 25KA	No.		1	1	2				
l	6.3-16 A TP MPCB 25KA	No.		1	1	2				
m	17-32A TP MPCB 25KA	No.		1	1	2				
	TOTAL FOR SH 09 carried over to summary									
9A	**OPTIONAL ITEM FOR DG SETS**									
9A.1	**DG Supply Incoming feeder IN DB-100/DB-200**	Sets		1	1	2				
a	1 No. 2500A/2500A, 415V, 65KA, ~~3~~ **4**Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signailing of the cause of tripping and alarms, maximeter reset etc (7) NO / NC contacts for interlocks and indications (8) ~~1 No. CT in the neutral to connect with the trip unit~~.								
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
e)	1 No. Multifunction energy meter for measurement of voltage, line current, power & energy.									
g)	3 Nos. CTs, 2500/5A, 15VA, CL-1 for metering.									
9A.2	**DG Panel (DB-290) as per Technical Specifications and as per the following details.**									
A	**INCOMER**									
	DG SET - I & II INCOMING each comprising of following									
a)	1 No. 1600 A/1600 A, 415V, 65 KA, 4 Pole, Electrically operated Draw Out type ACB, complete with safety shutters, 240V AC shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of V, A, W, VAR, VA, Wh, VARh, Hz, power factor etc shall be as per I/O Schedule (3) Protection against long time + short time + earth fault (all with adjustable time delays) + instantaneous, over and under voltage, minimum and maximum frequency, voltage and current imbalance, phase sequence, load shedding and reconnection (4) Measurement of inturrepted currents, differenciated fault indications, maintenance indicators (5) Last few trippings and event histories and time stamping with facility for consulting the history file, maintenance indicator register etc (6) Communication options to remotely read and set parameters for the protection functions, transmission of all the calculated indicators and measurements (7) Signailing of the cause of tripping and alarms (8) NO/NC contacts for interlocks and indications.									
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for the following-									
	ON, OFF, TRIP, spring charged & phase indication (R-Y-B).									
e)	Metering									
i)	Multifunction energy meter for measurement of voltage, line current, power factor, power & energy.									
ii)	4 Nos. CTs 1600/5A, 15VA, CL-1 for metering.									
B	**Main Grid Supply Incomer**									

PART-A FOR ELECTRICAL WORKS

S. No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
b)	TNC switch									
c)	Auto / Local / Remote Selector Switch key operated.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor.									
f)	3 Nos. CTs 40/5A, 15VA, CL-1 for metering.									
D	**INTERLOCKING ARRANGEMENT with DB 100 & DB 200**									
	~~PLC unit, suitable for interlocking 16 Nos Circuit Breakers, complete with all hardware and software as per interlocking schedule.~~									
E	**SCADA CONNECTIVITY**									
	All the breakers should be provided with communication facilities & contractor should provide single point to the marshelling box to communicate with BMS/SCADA for all system parameters of the panel. DC source & other accessories including software and hardware required for this is in the scope of contractor.									
	Transducer and wiring upto marshalling box for all relevant I/O points for panels for SCADA/BMS Connectivity in the scope of contractor.									
	Supply of above item	**Sets**		1	1	2				
	Insallation of above item	**Sets**		1	1	2				
	Testing and Commissioning of above item	**Sets**		1	1	2				
9A.3	**D.G. Auxilary panel DB-291 as per technical Specifications & as per the following details.**	**Sets**		1	1	2				
A.	**INCOMER**									
a)	1No. 100A/40 A, 415V, 35kA, 3P MCCB having Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit and Earth fault and having NO/NC contacts for operation and 1 No.CT in Neutral for earth fault protection.									
b)	LED phase indication lamp for R-Y-B.									
c)	Metering									
i)	1 No.Multifunction energy meter for measurement of voltage, line current, power factor.									
ii)	3 Nos. CTs, 4**0/5A,** 10VA, CL-1 for metering.									
B	**BUS BARS**									
	Electrolytic high conductivity T P & N (full size) copper conductor bus-bars rated 40 Amps, suitable to withstand symetrical fault level of 35kA for 1 second at 415 volts.									

S. No.	Description	Unit	Country of Origin	Qty Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
11.2	SOFTENER UNITS									
	Providing and fixing of mild steel (rubber Lined) pressure vessel confirming to IS:2825 **Softener** complete in all respects as per M & W specifications, having following	NO.		1.00	1.00	2.00				
	1) Capacity = 10 Cum / hr									
	2) Rate of flow = Not more than 15 Cum / hr / sqm of surface area									
	3) Wall thickness of shell and of dished ends as per IS:2825									
	4) Initial charge of media.									
	5) Sample valves									
	6) OBR (~~13 Hrs~~) 200 cum									
	7) Pressure gauge at inlet and outlet with isolating cocks and supports.									
	8) All Face piping and diaphragm valve etc..									
	9) Thickness of rubber lining not less then 3mm									
	10) All pipes to be as per IS : 1239 class "c"									
	11) Ejector for regeneration									
	12) For resin quantity and design purpose consider hardness of water as 350 ppm, quality of outgoing water - commercial Zero hardness.									
11.3	IRON REMOVAL FILTER									
	Providing and fixing of mild steel (rubber Lined) pressure vessel confirming to IS:2825 ~~r~~ **Iron Removal Filter** complete in all respects as per M & W specifications, having following	NO.		1.00	1.00	2.00				
	1) Capacity = 10 Cum / hr									
	2) Rate of flow = Not more than 15 Cum / hr / sqm of surface area									
	3) Wall thickness of shell and of dished ends as per IS:2825									
	4) Initial charge of media.									
	5) Sample valves									
	6) Pressure gauge at inlet and outlet with isolating cocks and supports.									
	7) All Face piping and diaphragm valve etc..									
	8) Thickness of rubber lining not less then 3mm									
	9) All pipes to be as per IS : 1239 class "c"									
	10) For design purpose consider , **quality** of outgoing water **0.3 PPM iron(as Fe) as per IS 10500.**									
11.4	REGENERATION TANK / SALT DILUTION TANK									

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
12	**PUMPS FOR FIRE PROTECTION SYSTEM**									
	Whether explicity specify or not, the pumps for Fire protection system Specified herein , must conform to Section E16 of the M & W specifications and motors must conform to Section E 12 of the M & W specifications and , in addition to description given in respective items of BOQ, In case of contradication between M & W specification and Description in BOQ the most stringent of the condition will prevail.									
	The motor HP to be conformed by the supplier for the duty mentioned for each pump.									
	Rates quoted shall be inclusive of all structural support, clamps etc. as per approved design/Specification									
	All Main Fire Pumps shall be capable of delivering 150% of the rated flow at a head not less than 65% of the rated head. Also the shut-off head shall not exceed 140 % of the rated head.									
	All the items / parts mentioned in relevant clauses of the M & W specifications and not specifically mentioned in BOQ shall be deemed to be included in the quoted rates, unless specifically excluded.									
	Actual Head Should be as Per Contractor Calculation , Without Any Extra cost for all pump .									
12.1	Providing and fixing horizontal/Vertical Fire Pumping Set with CI body, Bronze Impeller, Stainless Steel Shaft and connected by a flexible coupling to a totally enclosed, fan cooled induction motor, mounted on common structural base plate with all pump accessories complete as per Section E16 of M & W Specifications including mechanical seal & neoprene lined vibration eliminators. Motors shall be suitable for 415 volts, 3 phase, 50 cycles, A/C supply as per Section E12 of M & W Specifications.									
a)	MAIN FIRE PUMPS FOR HYDRANT SYSTEM.									
	Horizontal Split Casing									
	Capacity - 2839 LPM									
	Head - 75 MWC									
	HP - To suit power requirements for flow at 150% of the duty point									
	RPM - ~~1450~~/2950	Nos		1	0	1				
b)	MAIN FIRE PUMPS FOR HYDRANT SYSTEM.									
	Horizontal Split Casing									
	Capacity - 2839 LPM									
	Head - 88 MWC									

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
	HP - To suit power requirements for flow at 150% of the duty point									
	RPM - ~~1450~~/2950	Nos		0	1	1				
c)	MAIN FIRE PUMPS FOR SPRINKLER SYSTEM.									
	Horizontal Split Casing									
	Capacity - 2839 LPM									
	Head - 56 MWC									
	HP - To suit power requirement for flow at 150% of the duty point									
	RPM - ~~1450~~/2950	Nos		1	1	2				
d)	JOCKEY PUMP (FOR FIRE HYDRANT SYSTEM)									
	Capacity - 189 LPM									
	Head - 75 MWC									
	HP - As required									
	RPM - 2900	Nos		1	0	1				
e)	JOCKEY PUMP (FOR FIRE HYDRANT SYSTEM)									
	Capacity - 189 LPM									
	Head - 88 MWC									
	HP - As required									
	RPM - 2900	Nos		0	1	1				
f)	JOCKEY PUMP (FOR SPRINKLER SYSTEM)									
	Capacity - 189 LPM									
	Head - 56 MWC									
	HP - As required									
	RPM - 2900	Nos		1	1	2				
12.2	Supply, installation, testing and commissioning of Diesel Engine driven fire pump suitable for automatic operation comprising of the following and conforming to BS 649/IS 10002 all amended upto date. Horizontal, end section/split casing, high pressure single/ ~~multistage~~ centrifugal pump, The installation shall be complete with flexible coupling and coupling guard as required. Fire pump shall have C.I. casing, CS diffusers, bronze impeller (hard finished and dynamically balanced) and SS (304) shaft with mechanical seal, gland packing seal, capable for delivering ……. LPS at outlet head of …. mts to ensure a minimum pressure of **6.9/**3.5 Kg/Sqcm at the farthest or topmost hydrant / sprinkler. The installation shall be complete with necessary pressure gauge with gun metal shut off cock on delivery side (The pump should be tested for bench mark duty point test at factory and shall be gotten got approved by the Local Fire Authority). Pump shall be capable of furnishing not less than 150% of rated discharge capacity at a head of not less than 65% of the rated head. The shut off head shall not exceed 120% of rated head.									

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
	Heat exchanger/Radiator cooled (secondary cooling) diesel engine of speed 1500 RPM suitable for the above pump with automatic starting mechanism and other accessories including fuel tank (fabricated from 3mm MS sheet, painted with two coats of synthetic enamel paint over a coat of primer) of capacity adequate to sustain pump operation for 8 hours continuous working. The tank shall be fitted with Magnetic oil level indicator, MH with cover, drain valve, air vent including structural supports (painted with approved shade), 2 Nos. x 12 volt battery, heat exchanger with necessary piping connections & fittings, flexible coupling, coupling guard & exhaust pipe connection complete as required. Common base plate for (a) and (b) from M.S. channel of required size. Suitable cement concrete foundation with plaster, (design and drawing to be provided by the Contractor while the foundation will be done by others) complete with antivibration arrangement of cushy foot mountings. Set									
a)	STAND BY FIRE PUMPS FOR HYDRANT SYSTEM.									
	Horizontal Split Casing									
	Capacity - 2839 LPM									
	Head - 88 MWC	Nos		0	1	1				
	RPM-~~1400~~/2900									
b)	STAND BY FIRE PUMPS FOR HYDRANT SYSTEM.									
	Horizontal Split Casing									
	Capacity - 2839 LPM									
	Head - 75 MWC	Nos		1	0	1				
	RPM-~~1400~~/2900									
c)	STAND BY FIRE PUMPS FOR SPRINKLER SYSTEM.									
	Horizontal Split Casing									
	Capacity - 2839 LPM									
	Head - 56 MWC	Nos		1	1	2				
	RPM-~~1400~~/2900									
	TOTAL OF SH-12									
13	**PIPE WORK FOR FIRE SYSTEM**									
	The Pipe Work specified herein, must conform to M & W Specifications, in addition to the description given in respective items of BOQ, whether explicitly specified or not. In case of contradiction between M & W specifications and description in BOQ, the most stringent of the condition will prevail.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.0	**Switch Boards/panels**									
a	Main LV Switchboards must conform to Section A15 specifications and panel should be confirm to IEC 61439 with latest Amendment.									
b	All the items mentioned in relevant Sections / Clauses of the specifications and not specifically mentioned in BOQ shall be deemed to be included in the quoted rates									
c	In case of any contradiction between BOQ / Specifications and Drawings, the most stringent conditions of the above will									
d	The Switchboards shall be provided with detachable gland plates 3mm thick for less than and equal to 185sqmm and 5mm thick for more than 185sqmm. cable for entry of cables from the top / bottom as required.									
e	All live accessible parts shall be shrouded and all equipment shall be finger touch proof. SMC / DMC shrouds and busbar supports suitably spaced shall be used. Hinged doors with padlocking facility shall be provided on all outgoing feeders with switch handles lockable in OFF position.									
f	The panel shall have high conductivity copper busbars as specified in Specifications with bar type feeder connections, spacers etc. with full sized neutral.									
g	Earthing all components, frames etc. to a common internal earth bar size 50 x 6 mm. Cu., or higher, as required by the fault withstand level specified for the board.									
h	All accessories & supporting structures such as channels, ISMC-100 base frame, mounting brackets, lifting lugs, panel heaters, ventilation arrangement etc. shall be provided as required.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
i	Each incomer and outgoing feeder shall be provided with LED type status indication lamps suitable for 240 V, AC, as									
j	The make of all switchgear (ACB / MCCB / MCB etc.) must be same to have total discrimination.									
k	Components and accessories shall be same for switchboards and panels for uniformity, standardisation and replace ability and shall be applicable to all panels/ boards									
l	All interconnections, labeling, earthing, associated foundation / masonry work, sealing of gaps around the panels by chequered plates & erection etc. complete shall be executed as required.									
m	MCCB's shall be as per Specifications and shall be current limiting type with front adjustable electronic releases for required protections against fault, suitable for isolation as per Annexure 7.1.2 of IEC 60947 – 2, with Ics and Icu values as specified in relevant clauses of Section A15 Specifications and confirming to latest IEC 60947. The operating voltage (Ue) shall be 415 V and insulation voltage (Ui) 690V with trip free mechanism, handle indicating ON / OFF / tripped positions. The breaking capacity as mentioned in items of BOQ below, shall be Ics values and shall not be less then 50kA. Breakers must have Ics = 100% Icu. Electronic trip units (plugin type) shall comply with the requirements as specified in Appendix F (EMC /EMI Compatibility) of IEC 60947-2 or EN 60947-2.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
n	MCCBs for Network / Feeder Protection shall have adjustable protection against Overload and adjustable protection against Short Circuit as specified in Specifications, whether specifically asked in BOQ or not. MCCB's for Network / Feeder Protection shall have releases with Earth Fault protection feature, wherever and as indicated in Bill of Quantities or Drawings. However, on completion of Cable Sizing Calculations and Fault calculations by the Contractor, if Earth Fault releases are required for additional feeders, where this requirement is not indicated in the BOQ, same shall be provided at no extra cost to the Employer. For Motor Protection MCCB's, requirements of Specifications shall be followed.									
o	ACBs/MCCBs shall be compact, suitably designed to provide protection of motors, cables, busbars to suit rated current, unbalanced power distribution, as required.									
p	Panel / Switchboard board design shall be compact and components / accessories of compact sizes shall be used to economize the room space available. Employer reserve the right to seek compact items in place of larger ones.									
q	Incomer ACB'S / MCCBs / MCBs of switchboards / panels shall be provided with NO / NC contacts as specified in specifications for interface with SCADA System and for manual / auto and local / remote operation.									
r	ACB's shall have Microprocessor based releases as specified in the Specifications.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
s	In case higher frame sizes (than those specified in the BOQ) are required to be provided to achieve the requirement of Total Discrimination mentioned in Specifications, due to selection of a particular make, the same shall be provided at no extra cost if other makes are able to achieve the same with the specified frame size.									
t	Contractor must carry out Cable Sizing based on actual lengths of cables and Discrimination study for selection of trip units and settings for the releases during production of									
u	All Motor feeders, having separate Electronic over current relay (EOCR) , shall be provided with Reset push button & group by pass arrangement.									
v	Even though, ratings of MPCB / Contactors for Motor Feeders are mentioned in BOQ items below, after Selection of a particular make of Switchgear, MPCB / Contactors with ratings as per tested Type II Coordination from the selected manufacturer, only shall be provided.									
w	Description of Various panels/boards covered under this BOQ is as given below:									
x	**All panel internal wiring shall be of LSZH type complying to BS 7211.**									
xi	**All incomer of DB131, 132, 231, 232 and 330 shall be TPN.**									
1.1	**MAIN PLANT PANEL DB-170/270**									
	Panel complete as per specifications, drawings, requirements & following details:	Sets		1	1	2				
1.1.01										
A	**INCOMERS**									
1)	~~2~~ **3**Nos. 2500A, 415 V, ~~50~~ **65**KA, 50 Hz ~~TPN~~ **4P** EDO type ACBs interlocked with bus coupler and complete with microprocessor based releases having SCADA compatibility and energy metering.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
2)	~~2~~ **3**sets of Red (on), Green (off) and amber (C.B. Fault) indicating lamps									
3)	~~2~~ **3**sets of (three) R, Y, B phase indicating lamps									
4)	TNC switch									
5)	Selector switch for auto/manual operation.									
6)	Metering									
i)	3 Nos. CTs 2500/5A, 15VA, CL-1 for metering.									
ii)	2 Nos. CTs 2500/5A, 15VA, CL-1 for APFCR.									
iii)	2 Nos. Multifunction energy meter for measurement of voltage, current, power factor, power & energy with BMS connectivity (RS 485).									
7)	Terminals to receive XLPE **insulated** armoured power & control cables									
8)	2 Nos. Front Display Module									
1.1.02										
B	**BUSBAR**									
	2 Nos. Electrolytic high conductivity tinned copper three phase and neutral busbars rated at 2500 A, suitable to withstand symmetrical fault level of ~~50~~ **65** KA for 1 second at 415 V .									
1.1.03										
C	**BUS COUPLER**									
a)	1 Nos. 2500A, 415 V, ~~**50**~~ **65**KA for 1 second, 50 Hz ~~TPN~~ **4P** EDO type ACBs interlocked with bus coupler and complete with microprocessor based releases having BMS and SCADA compatibility.									
b)	TNC switch									
c)	Selector switch for auto/manual operation.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	3 Nos. CTs, 2500/5A, 15VA, CL-1 for metering.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
f)	1 No. Multifunction energy meter for measurement of voltage, current, power factor, power & energy with BMS connectivity (RS 485).									
g)	Terminals to receive XLPE insulated armoured power & control cables.									
h)	1 Nos. Front Display Module									
D	**OUT GOING FEEDERS**									
1.1.04	3 Sets feeder for Chiller Motors up to 250 KW each shall be equipped with the followings but not limited to:									
a)	1 No. 800 A, 415V, 50kA, 3 Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC or 110V DC (control supply voltage to be selected in consultation with BMS Contractor) shunt trip coil & closing coil and having microprocessor based releases with (1) Protection against long time + short time + instantaneous + earth fault (all with adjustable time delays) (2) NO / NC contacts for interlocks and indications (3) 1 no CT in neutral to connect with the trip unit.									
b)	TNC switch									
c)	Selector switch for auto/manual operation.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	3 Nos. CTs 800/5A, 15VA, CL-1 for metering.									
f)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
g)	Power & control terminals for cable connections.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.1.05	4 Sets of Star - Delta Starter Unit for Primary Chilled Water Pump Motors of 11KW (3 Working + 1 Standby) and each shall be equipped with the followings but not limited to:(For - CHWP-001P, CHWP-002P, CHWP-003P, CHWP-04P)									
a)	1 No. 3 Pole 100A, 50kA at 415V, 3P motor duty MCCB with Electronic Trip Unit(with inbuilt over load and short circuit protection) over load range to suit actual pump selection, and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 100/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	3 Nos with suitable rating AC-3 duty, 3 Pole Contactor with Auxiliary Contacts, Operating coil 230V / 110V AC (for Main, Star & Delta Contactor).									
i)	One no star-delta timer.									
j)	1 No. Auxiliary Contactor with 4 Nos. Auxiliary Contacts for Remote Operation.									
k)	1 No Single Phasing Preventer Relay.									
l)	Power & control terminals for cable connections.									
m)	Provision for terminals for wiring to Local control panel (LCP)									
1.1.06	3 Nos. Feeder for Secondary Chilled Water Pump Motors of 37 KW (2 Working + 1 Standby) and each shall be equipped with the followings but not limited to:(For CHWP-001S, CHWP-002S, CHWP-003S)									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. 3 Pole 100A, 50kA at 415V, 3P motor duty MCCB with Electronic Trip Unit(with inbuilt over load and short circuit protection) over load range according to motor selection, and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 100/5A, 15VA, class - I for metering.									
d)	LED indication lamp for ON, OFF, Trip.									
1.1.07	4 Sets of Star - Delta Starter unit for Condenser Water Pump Motors up to 37 KW (3 Working + 1 Standby) and each shall be equipped with the followings but not limited to:(For CDWP-001, CDWP-002, CDWP-003, CDWP-04)									
a)	1 No. 3 Pole 100A, 50kA at 415V, 3P motor duty MCCB with Electronic Trip Unit(with inbuilt over load and short circuit protection) over load range to suit actual pump selection, and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 100/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	3 Nos with suitable rating AC-3 duty, 3 Pole Contactor with Auxiliary Contacts, Operating coil 230V / 110V AC (for Main, Star & Delta Contactor).									
i)	One no star-delta timer.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
j)	1 No. Auxiliary Contactor with 4 Nos. Auxiliary Contacts for Remote Operation.									
k)	1 No Single Phasing Preventer Relay.									
l)	Power & control terminals for cable connections.									
m)	Provision for terminals for wiring to Local control panel (LCP)									
1.1.08	8 Sets of Star - Delta Starter unit of 11 kW and each shall be equipped with the followings but not limited to:(For CT-001-F1, CT-001-F2,CT-002-F1,CT-002-F2,CT-003-F1,CT-003-F2 & 2 no spare)									
a)	1 No. 3 Pole 25 Amps MPCB (with Under Voltage Protection and inbuilt Single Phasing Preventer) with 20-25 A Over - load release and having contacts for indications - On, Off, Trip.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 25/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	3 No. with suitable rating AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230 V / 110 V AC.(for Main, Star & Delta Contactor).									
i)	One no Star-Delta timer.									
j)	1 No. Auxiliary Contactor with 4 Nos. Auxiliary Contacts for Remote Operation.									
k)	Power & control terminals for cable connections.									
l)	Provision for terminals for wiring to Local control panel (LCP)									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.1.09	2 nos outgoing feeders for Capacitor Panel with each consisting of the following									
a)	1 No. 800 A, 415V, 50kA, 3 Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC or 110V DC (control supply voltage to be selected in consultation with BMS Contractor) shunt trip coil & closing coil and having microprocessor based releases with (1) Protection against long time + short time + instantaneous + earth fault (all with adjustable time delays) (2) NO / NC contacts for interlocks and indications (3) 1 no CT in neutral to connect with the trip unit.									
b)	TNC switch									
c)	Selector switch for auto/manual operation.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
f)	3 Nos. CTs 800/5A, 15VA, CL-1 for metering.									
g)	Power & control terminals for cable connections.									
1.1.10	4No. 100 A, 415V, 50KA, 3P MCCB having Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit.(For DB-330, LDB-AB, SPDB-AB & 1NO. SPARE).									
a)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
b)	3 Nos. CT 100/5A, 15VA, class - I for metering.									
c)	LED indication lamp for ON, OFF, Trip.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
8)	~~4~~ **3**No. 400 A, 415V, 50KA, 3P MCCB having Electronic Trip Unit for Fire Pump Panel, Air Cooled Chiller Panel, ~~Pump Room Panel~~ & 1 no. spare with adjustable protection against Overload, adjustable protection against Short Circuit.									
a)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
b)	3 Nos. CT 400/5A, 15VA, class - I for metering.									
c)	LED indication lamp for ON, OFF, Trip.									
1.1.11	Delivery of equipment to site	set		1	1	2				
1.1.12	Installation and Equipment testing	set		1	1	2				
1.1.13	System testing, Commissioning and hand over	set		1	1	2				
1.1.14	Interlocking Arrangement	set		1	1	2				
1.1.15	Scada\ BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & transducers mounting prewired up to Marshelling box terminal boards from the factory itself and audited in factory from the BMS provider.	set		1	1	2				
1.2	**Sub-Distribution Boards, DB-330 as per Specifications , as per tender drawings Complete and as per the following details.**	Sets		1	1	2				
1.2.01										
A.	**INCOMER**									
a)	1 No. 100 A, 415V, 50KA, 3 P MCCB having Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit.									
b)	LED indication lamp for the following-									
	ON, OFF, TRIP (each for both the supplies)									
c)	LED phase indication lamp for R-Y-B.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
d)	1 No. Multifunction energy meter for measurement of voltage, current, power factor, power & energy with BMS connectivity (RS 485).									
e)	3 Nos. CTs, 100/5A, 15VA, CL-1 for metering.									
f)	Local / Remote Selector Switch key operated.									
1.2.02										
B.	**BUS BAR**									
	Electrolytic high conductivity T P &N (full size) copper conductor bus-bars (as specified in A15 Specifications) rated 100 Amps, suitable to withstand symmetrical fault level of 50kA for 1 second at 415 volts.									
C.	**OUTGOING**									
1.2.03	5 Sets of Star - Delta Starter unit (2 Nos. For VSF & 2 Nos. for VEF +1 No. Spare) of up to 7.5 kW and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole suitable rating MPCB (with Inbuilt Single Phasing Preventer) with Over - load release and having contacts for indications - On, Off, Trip.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT suitable rating, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	3 No. with suitable rating , AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230 V / 110 V AC.(for Main, Star & Delta Contactor).									
i)	One no Star-Delta timer.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
j)	1 No. Auxiliary Contactor with 4 Nos. Auxiliary Contacts for Remote Operation.									
k)	Power & control terminals for cable connections.									
1.2.04	8 Sets of DOL Starter Unit (for 4 Nos. Single Phase Damper & 2 Nos. PF motors & 2 nos. spare) of 0.5 KW and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole suitable rating **MPCB** with only magnetic tripping (for short circuit protection) with overload range 2.5-4 Amp and having contacts for indications - On, Off, Trip.									
b)	Local / Remote Selector Switch key operated.									
c)	Door mounted push buttons for Start, Stop and over load by pass functions.									
d)	Emergency stop push button lockable type.									
e)	LED indication lamp for ON, OFF, Trip.									
f)	1 No. 9A, AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230\110 V AC.									
g)	Auxiliary Contactors for Local / Remote Operation.									
h)	Power & control terminals for cable connections.									
1.2.05	14 Nos, DOL 0.5 kW single phase feeder for Motor Operated Valves									
1.2.06	Delivery of equipment to site	set		1	1	2				
1.2.07	Installation and Equipment testing	set		1	1	2				
1.2.08	System testing, Commissioning and hand over	set		1	1	2				
1.2.09	Interlocking Arrangement	set		1	1	2				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.2.10	Scada\ BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & transducers mounting prewired up to Marshelling box terminal boards from the factory itself and audited in factory from the BMS provider.	set		1	1	2				
1.3	**DB-310 Air Cooled Scroll Chillers**	No.		1	1	2				
1.3.01										
A.	**INCOMER**									
1)	Automatic transfer switch with 2 Nos 400A, 4 pole 50kA, MCCB having Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit, Earth fault.									
a)	1 No. Multifunction energy meter for measurement of voltage, current, power factor, power & energy with BMS connectivity (RS 485).									
b)	3 Nos. CT 400/5A, 15VA, class - I for metering.									
c)	LED indication lamp for ON, OFF, Trip.									
1.3.02										
B.	**BUS BAR**									
	Electrolytic high conductivity T P &N (full size) copper conductor bus-bars (as specified in A15 Specifications) rated 400 Amps, suitable to withstand symmetrical fault level of 50 kA for 1 second for 1 second at 415 volts.									
C.	**OUTGOING**									
1.3.03	3 Nos. 250 A, 415V, 50KA, 3P MCCB having Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit.(For Air Cooled Chiller-2 Nos. Working+ 1 No. Spare).									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
b)	3 Nos. CT 250/5A, 15VA, class - I for metering.									
c)	LED indication lamp for ON, OFF, Trip.									
1.3.04	3 Sets of Star - Delta Starter unit (2 No. For Pump + 1 No. for Spare) of up to 7.5 kW and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole -suitable rating MPCB (with inbuilt Single Phasing Preventer) with 11 - 16 A Over - load release and having Auxiliary contacts for indications - On, Off, Trip.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 15/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	3 No. with suitable rating AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230\110 V AC.									
i)	One no Star-Delta timer.									
j)	Auxiliary Contactors for Auto / Local / Remote Operation.									
k)	Power & control terminals for cable connections.									
1.3.05	8 nos.(6 Nos. for MOV+2NOS. FOR SPARE) 0.5 kW single phase feeder for Motor Operated Valves									
1.3.06	Delivery of equipment to site	set		1	1	2				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.3.07	Installation and Equipment testing	set		1	1	2				
1.3.08	System testing, Commissioning and hand over	set		1	1	2				
1.3.09	Scada\ BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & tranducers mounting prewired up to Marshelling box terminal boards from the factory itself and audited in factory from the BMS provider.	set		1	1	2				
1.4	**Main Distribution Board (MDB), DB-130 & DB-230 as per Specifications, as per tender drawings Complete & as per following details:**	Sets		2	2	4				
1.4.01										
A	**INCOMER**									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1	Automatic transfer switch with 2 Nos 1000A, 4 pole ~~50~~ **65**kA electric drawout (EDO) ACBs, electrically and mechanically interlocked , controller having selector switch for automatic & forced operation on normal and emergency sources, monitoring of normal source and automatic changeover, test facility, circuit breaker status indication (On, Off & Trip), 3 ph Under - voltage protection, Phase Sequence Protection inbuilt in the controller or separately provided, the controller should have communication capability with BMS/SCADA. The ACB complete with safety shutters, 240V AC or 110V DC (control supply voltage to be selected in consultation with BMS Contractor) shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + instantaneous + earth fault (all with adjustable time delays), Energy metering (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission									
	of ammeter measurements (6) Signaling of the cause of tripping and alarms, maximum meter reset etc. (7) NO / NC contacts for interlocks and indications (8) 1 no CT in neutral to connect with the trip unit. must have Electronic Trip Unit (plugin type) with Overload & Short Circuit Protection, closing & shunt trip coil, auxiliary contacts for ON, OFF, TRIP indication etc. as per drawing and specification.									
a)	LED indication lamp for the following-									
	ON, OFF, TRIP (each for both the supplies)									
b)	LED phase indication lamp for R-Y-B.									
c)	Metering									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
i)	Multifunction energy meter for measurement of voltage, current, power factor, power & energy with BMS connectivity (RS 485).									
ii)	3 Nos. CTs 1000/5A, 15VA, CL-1 for metering.									
iii)	1 Nos. CTs 1000/5A, 15VA, CL-1 for APFCR relay.									
d)	2 Nos. Front Display Module									
1.4.02										
B.	**BUS BAR**									
	Electrolytic high conductivity T P &N+E copper conductor bus-bars (as specified in the Specifications) rated 1000 Amps, suitable to withstand symmetrical fault level of ~~50~~ **65**KA for 1 second at 415 volts.									
C.	**OUTGOING**									
1.4.03	5 Sets of Star - Delta Starter unit for AHU Motors up to 45 kW , 1 no spare and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole 160A, 50kA at 415V, 3P Motor Duty MCCB (with inbuilt over load and short circuit protection and having add-on type earth leakage protection) over load range to suit AHU motor selection, and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 160/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
g)	LED indication lamp for ON, OFF, Trip, Damper Open, Earth leakage trip.									
h)	3 No. with suitable rating AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230\110 V AC.									
I)	One no star delta timer.									
j)	Auxiliary Contactors for Local / Remote Operation.									
k)	Power & control terminals for cable connections.									
l)	1 No Single Phasing preventer Relay.									
1.4.04	3 Sets of Star - Delta Starter unit for Track way exhaust Fan Motors up to 75 kW, (2 Nos. For TEF+ 1 No. Spare) and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole 250A, 50kA at 415V, 3P motor duty MCCB with Electronic Trip Unit(with inbuilt over load and short circuit protection) over load range to suit actual pump selection, and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 250/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip,									
h)	LED indication lamp for Earth leakage, Over load bypass, Damper Open.									
I)	Over load by pass switch.									
j)	1 No. with suitable rating Soft starter.									
k)	Auxiliary Contactors for Local / Remote Operation.									
l)	Power & control terminals for cable connections.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
m)	Triple pole saturable C.T. operated electronic over Current relays (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.).									
1.4.05	3 Sets of Star - Delta Starter unit (1 No. FAF, 1 Nos. SPF & 1 No. spare) of 7.5 kW and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole suitable rating MPCB (with inbuilt Single Phasing preventer) with 14 - 18 A Over - load release and having Auxiliary contacts for indications - On, Off, Trip.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 20/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	LED indication lamp for Earth leakage, Damper Open.									
i)	Auxiliary Contactors for Local / Remote Operation.									
j)	Power & control terminals for cable connections.									
k)	**VFD for FAF operation with the CO_2 sensor.**									
	SPF shall be equipped with following extra item									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	Triple pole saturable C.T. operated Electronic over Current relays(EOCR) (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.).									
b)	OLR by Pass Switch									
c)	OLR by Pass Indication Lamp									
d)	3 No. with suitable rating AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230\110 V AC.									
e)	One no Star-Delta timer.									
1.4.06	5 Sets (4W+1S) of Star - Delta Starter unit for VEF(4Working+1 Spare) of up to 11 kW and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole 100A, 50kA at 415V, 3P Motor Duty MCCB (with inbuilt over load and short circuit protection and having add-on type earth leakage protection) over load range to suit the motor selection, and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 100 / 5A, 15VA, class - I for metering.									
d)	Auto / Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	3 No. with suitable rating AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230\110 V AC.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
i)	One no star-delta timer.									
j)	Auxiliary Contactors for Auto / Local / Remote Operation.									
k)	Power & control terminals for cable connections.									
1.4.07	3 Sets of Star - Delta Starter unit for VSF (2Working+1Spare) of up to 15 kW and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole 100A, 50kA at 415V, 3P Motor Duty MCCB (with inbuilt over load and short circuit protection and having add-on type earth leakage protection) over load range to suit the motor selection, and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 100 / 5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	LED indication lamp for Earth leakage, Damper Open.									
i)	3 No. with suitable rating AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230\110 V AC.									
j)	One no star-delta timer.									
k)	Auxiliary Contactors for Local / Remote Operation.									
l)	Power & control terminals for cable connections.									
1.4.08	3 Sets of Star - Delta Starter Unit (2 Nos. SEF & 1 No Spare) of 15 kW and each shall be equipped with the followings but not limited to:									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. 3 Pole 100A, 50kA at 415V, 3P Motor Duty MCCB (with inbuilt over load and short circuit protection and having add-on type earth leakage protection) over load range to suit the motor selection, and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 100/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	LED indication lamp for Earth leakage, Damper Open.									
i)	3 No. with suitable rating AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230/110 V AC.									
j)	One no star delta timer.									
k)	Auxiliary Contactors for Auto / Local / Remote Operation.									
l)	Power & control terminals for cable connections.									
	Each SEF shall be equipped with following extra item.									
a)	Triple pole saturable C.T. operated Electronic over Current relays(EOCR) (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.).									
b)	OLR by Pass Switch									
c)	OLR by Pass Indication Lamp									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.4.09	28 Sets of DOL Starter unit of 0.50 kW and each shall be equipped with the followings but not limited to: To be interlocked in panel with different fan motors etc.									
a)	1 No. 3 Pole suitable rating MPCB (with inbuilt Single Phasing preventer) with 2.5-4.0 A Over - load release and having Auxiliary contacts for indications - On, Off, Trip.									
b)	Door mounted push buttons for Start and Stop functions.									
c)	Emergency stop push button lockable type.									
d)	Local / Remote Selector Switch key operated.									
e)	LED indication lamp for ON, OFF, Trip.									
f)	1No. with suitable rating AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230/110 V AC.									
g)	Auxiliary Contactors for Auto / Local / Remote Operation.									
h)	Power & control terminals for cable connections.									
	Each MFD shall be equipped with following extra item.									
a)	Triple pole saturable C.T. operated Electronic over Current relays(EOCR) (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.).									
b)	OLR by Pass Switch									
c)	OLR by Pass Indication Lamp									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.4.10	3 Nos. 100 A, 415V, 50KA, 3P MCCB having Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit.(For FCU unit panel , Damper panel & 1 No. spare). equipped with the followings but not limited to:									
a)	LED indication lamp for the following-									
	Phase indication lamp for R-Y-B									
b)	Indication lamp for ON, OFF, TRIP.									
c)	1 No. Digital Ammeter, CT operated.									
d)	1 Nos. CTs100/5A, 15VA, CL-1 for metering.									
8)	1 No. outgoing feeders for Capacitor Panel with each consisting of the following-									
a)	1 No. feeder (for Capacitor Panel) with 630 A, 415V, 50KA, 3P MCCB having (1) Electronic Trip Unit with adjustable Overload, adjustable Short Circuit and adjustable E/F (All with adjustable time delays) protection; (2) NO/NC contacts for operation and neutral sensor for earth fault protection.									
b)	LED indication lamp for ON, OFF & TRIP.									
c)	1 No digital Ammeter with Inbuilt Selector Switch.									
d)	3 Nos. CTs 630/5A, 15VA, CL-1 for metering.									
1.4.11	Delivery of equipment to site	set		2	2	4				
1.4.12	Installation and Equipment testing	set		2	2	4				
1.4.13	System testing, Commissioning and hand over	set		2	2	4				
1.4.14	Interlocking Arrangement	set		2	2	4				
1.4.15	Scada\ BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & tranducers mounting prewired up to Marshelling box terminal boards from the factory itself and audited in factory from the BMS provider.	set		2	2	4				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.5	**Sub-Distribution Board DB-131 & DB-231 as per Specifications & Drawing complete and as per the following details.**	Sets		2	2	4				
1.5.1										
A	**INCOMER**									
a)	1 No. 100A, 415V, 50KA, 3P MCCB having Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit.									
b)	1 Nos with suitable rating, 4 Pole, AC-3 duty Contactor with Auxiliary Contacts, Operating coil 230V AC, with mechanical & electrical interlock between the contactors.									
c)	LED indication lamp for the following-									
	Phase indication lamp for R-Y-B									
d)	Indication lamp for ON, OFF, TRIP.									
e)	1 Nos. digital Ammeter with Inbuilt Selector Switch.									
f)	3 Nos. CTs100/5A, 15VA, CL-1 for metering.									
1.5.02										
B.	**BUS BAR**									
	Electrolytic high conductivity T P &N copper conductor bus-bars (as specified in the Specifications) rated 100 Amps, suitable to withstand symmetrical fault level of 50 KA for 1 second at 415 volts.									
C.	**OUTGOING**									
1.5.03	16 Sets of DOL Starter Unit (for 13 nos. Single Phase Damper & PF motors & 3 nos. spare) of 0.5 KW and each shall be equipped with the followings but not limited to:									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. 3 Pole suitable rating **MPCB** with only magnetic tripping (for short circuit protection) with overload range 2.5-4 Amp and having contacts for indications - On, Off, Trip.									
b)	Local / Remote Selector Switch key operated.									
c)	Door mounted push buttons for Start, Stop and over load by pass functions.									
d)	Emergency stop push button lockable type.									
e)	LED indication lamp for ON, OFF, Trip.									
f)	1 No. 9A, AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230\110 V AC.									
g)	Auxiliary Contactors for Local / Remote Operation.									
h)	Power & control terminals for cable connections.									
	Each MFD shall be equipped with following extra item.									
i)	Triple pole saturable C.T. operated Electronic over Current relays(EOCR) (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.).									
j)	OLR by Pass Switch									
k)	OLR by Pass Indication Lamp									
1.5.04	5 Sets of Star - Delta Starter unit (Two Nos. For VEF, Two Nos. for SEF One no. for spare) of up to 7.5 kW and each shall be equipped with the followings but not limited to:									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. 3 Pole suitable rating MPCB (with inbuilt Single Phasing preventer) with 14 - 18 A Over - load release and having Auxiliary contacts for indications - On, Off, Trip.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 20/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Start and Stop functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	3 No. with suitable rating AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230\110 V AC.									
i)	One no Star-Delta timer.									
j)	Auxiliary Contactors for Local / Remote Operation.									
k)	Power & control terminals for cable connections.									
1.5.05	Delivery of equipment to site	set		2	2	4				
1.5.06	Installation and Equipment testing	set		2	2	4				
1.5.07	System testing, Commissioning and hand over	set		2	2	4				
1.5.08	Interlocking Arrangement	set		2	2	4				
1.5.09	Scada\ BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & tranducers mounting prewired up to Marshelling box terminal boards from the factory itself and audited in factory from the BMS provider.	set		2	2	4				
1.6	**Sub Distribution Board DB- FCU panel 132 with PLC to operate working and standby FCUs as per programmed set and as per Specifications & Drawing complete and as per the following details.**	Sets		1	1	2				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.6.01										
A	**INCOMER**									
a)	1 No. 100 A, 415V, 50KA, 3P MCCB having Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit.									
b)	1 Nos suitable rating 3 Pole, AC-3 duty Contactor with Auxiliary Contacts, Operating coil 230\110 V AC, with mechanical & electrical interlock between the contactors.									
c)	LED indication lamp for the following-									
i)	Phase indication lamp for R-Y-B									
ii)	Indication lamp for ON, OFF, TRIP.									
iii)	1 Nos. digital Ammeter with Inbuilt Selector Switch.									
iv)	3 Nos. CTs100/5A, 15VA, CL-1 for metering.									
1.6.02										
B.	**BUS BAR**									
	Electrolytic high conductivity T P &N copper conductor bus-bars (as specified in the Specifications) rated 100 Amps, suitable to withstand symmetrical fault level of 50 KA for 1 second at 415 volts.									
C.	**OUTGOING**									
1.6.03	46 Sets of feeder (Single Phase) (for Fan coil unit) and each shall be equipped with the followings but not limited to:									
a)	1 No. 10 Amps, DP MCB (C Curve)									
b)	1 No. 9A, AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230 VAC.									
c)	Local / Remote Selector Switch key operated.									
d)	Door mounted push buttons for Start and Stop functions.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
e)	LED indication lamp for ON, OFF.									
f)	Auxiliary Contactors for Local / Remote Operation.									
g)	Power & control terminals for cable connections.									
1.6.04	Delivery of equipment to site	set		1	1	2				
1.6.05	Installation and Equipment testing	set		1	1	2				
1.6.06	System testing, Commissioning and hand over	set		1	1	2				
1.6.07	Interlocking Arrangement	set		1	1	2				
1.6.08	Scada\ BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & tranducers mounting prewired up to Marshelling box terminal boards from the factory itself and audited in factory from the BMS provider.	set		1	1	2				
1.7	**Sub Distribution Board DB- FCU panel 232 with PLC to operate working and standby FCUs as per programmed set and as per Specifications & Drawing complete and as per the following details.**	Sets		1	1	2				
1.7.01										
A	**INCOMER**									
a)	1 No. 100 A, 415V, 50KA, 3P MCCB having Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit.									
b)	1 Nos suitable rating 3 Pole, AC-3 duty Contactor with Auxiliary Contacts, Operating coil 230\110 V AC, with mechanical & electrical interlock between the contactors.									
c)	LED indication lamp for the following-									
	Phase indication lamp for R-Y-B									
d)	Indication lamp for ON, OFF, TRIP.									
e)	1 Nos. digital Ammeter with Inbuilt Selector Switch.									
f)	3 Nos. CTs100/5A, 15VA, CL-1 for metering.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.7.02										
B.	**BUS BAR**									
	Electrolytic high conductivity T P &N copper conductor bus-bars (as specified in the Specifications) rated 100 Amps, suitable to withstand symmetrical fault level of 50 KA for 1 second at 415 volts.									
C.	**OUTGOING**									
1.7.03	10 Sets of feeder (Single Phase) (for Fan coil unit) and each shall be equipped with the followings but not limited to:									
a)	1 No. 10 Amps, DP MCB (C Curve)									
b)	1 No. 9A, AC-3 Duty, 3 - pole Contactor with Auxiliary Contacts and Operating Coil of 230 VAC.									
c)	Local / Remote Selector Switch key operated.									
d)	Door mounted push buttons for Start and Stop functions.									
e)	LED indication lamp for ON, OFF.									
f)	Auxiliary Contactors for Local / Remote Operation.									
g)	Power & control terminals for cable connections.									
1.7.04	Delivery of equipment to site	set		1	1	2				
1.7.05	Installation and Equipment testing	set		1	1	2				
1.7.06	System testing, Commissioning and hand over	set		1	1	2				
1.7.07	Interlocking Arrangement	set		1	1	2				
1.7.08	Scada\ BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & tranducers mounting prewired up to Marshelling box terminal boards from the factory itself and audited in factory from the BMS provider.	set		1	1	2				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.8	**Power Factor Correction Panel of 250 KVAR for Panel 130 & 230 as per specifications & Drawing Complete & as detailed below:(CP-130 & CP-230)**	Sets		2	2	4				
1.8.01										
A	**INCOMER**									
a)	1 No. 630 A, 415V, 50kA, 3P MCCB having Electronic Trip Unit with adjustable protection against Overload, adjustable protection against Short Circuit and Earth Fault (With Adjustable time delay); having Zone Selective Interlocking and NO/NC contacts for operation and neutral sensor for earth fault protection.									
b)	LED indication lamp for the following-									
	ON, OFF, TRIP									
c)	LED phase indication lamp for R-Y-B.									
d)	12 Step APFCR relay communication type.									
e)	1 No Auto / manual Selector Switch.									
f)	1 No Off delay timer									
	Metering									
i)	1 No digital Voltmeter with Inbuilt Selector Switch.									
ii)	1 No digital Ammeter with Inbuilt Selector Switch.									
iii)	3 Nos. CTs 630/5A, 15VA, CL-1 for metering.									
1.8.02										
B	**BUS-BARS**									
	Electrolytic high conductivity T P &N copper conductor bus-bars (as specified in M & W Specifications) rated 630 Amps, suitable to withstand symmetrical fault level of 50 KA for 1 second at 415 volts.									
C	**OUTGOINGS**									
1.8.03	10 nos feeder with following-									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. 100 / 100 A, 3 pole, 50kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and Short Circuit									
b)	Capacitor Duty 3 - Pole Contactor suitable for 25 kVAR capacitor , with Auxiliary Contacts.									
c)	Local / Remote Selector Switch key operated.									
d)	2 Nos Push Button for ON & OFF.									
e)	2 Nos LED Indication Lamp for ON & OFF indication.									
f)	1 No. 25 KVAR, 3 - phase, 415V, hermetically sealed metalized polypropylene capacitor (heavy-duty) with 7% harmonic D-tuned filters (as specified in M & W Specifications).									
1.8.04	Delivery of equipment to site	set		2	2	4				
1.8.05	Installation and Equipment testing	set		2	2	4				
1.8.06	System testing, Commissioning and hand over	set		2	2	4				
1.8.07	Interlocking Arrangement	set		2	2	4				
1.8.08	Scada\BMS Connectivity	set		2	2	4				
1.9	**Power Factor Correction Panel of 300 KVAR for Panel 170/270 as per specifications & Drawing Complete & as detailed below:(CP-300)**	Sets		2	2	4				
1.9.01										
A	**INCOMER**									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. 800 A, 415V, 50kA, ~~3~~ **4** Pole, Electrically operated Draw Out type, ACB complete with safety shutters, 240V AC or 110V DC (control supply voltage to be selected in consultation with BMS Contractor) shunt trip coil & closing coil and having microprocessor based releases with (1) Protection against long time + short time + instantaneous + earth fault (all with adjustable time delays) (2) NO / NC contacts for interlocks and indications (3) 1 no CT in neutral to connect with the trip unit.									
b)	TNC switch									
c)	Selector switch for auto/manual operation.									
d)	LED indication lamp for ON, OFF & TRIP.									
e)	3 Nos. CTs 800/5A, 15VA, CL-1 for metering.									
f)	LED phase indication lamp for R-Y-B.									
g)	12 Step APFCR relay communication type.									
h)	Power & control terminals for cable connections.									
i)	1 No Off delay timer									
	Metering									
i)	1 No digital Voltmeter with Inbuilt Selector Switch.									
ii)	1 No digital Ammeter with Inbuilt Selector Switch.									
1.9.02										
B	**BUS-BARS**									
	Electrolytic high conductivity T P &N copper conductor bus-bars (as specified in M & W Specifications) rated 800 Amps, suitable to withstand symmetrical fault level of 50 KA for 1 second at 415 volts.									
C	**OUTGOINGS**									
1.9.03	10 Nos. feeder with following-									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
a)	1 No. 100 / 100 A, 3 pole, 50 kA, MCCB having Electronic Trip Unit with adjustable protection against Overload and Short Circuit									
b)	Capacitor Duty 3 - Pole Contactor suitable for 30 kVAR capacitor , with Auxiliary Contacts.									
c)	Local / Remote Selector Switch key operated.									
d)	2 Nos Push Button for ON & OFF.									
e)	2 Nos LED Indication Lamp for ON & OFF indication.									
f)	1 No 30 KVAR, 3 - phase, 415V, hermetically sealed metalized polypropylene capacitor (heavy-duty) with 7% harmonic D-tuned filters (as specified in M & W Specifications).									
1.9.04	Delivery of equipment to site	set		2	2	4				
1.9.05	Installation and Equipment testing	set		2	2	4				
1.9.06	System testing, Commissioning and hand over	set		2	2	4				
1.9.07	Interlocking Arrangement	set		2	2	4				
1.9.08	Scada\BMS Connectivity	sets		2	2	4				
1.10	Providing, fixing, connecting, testing and commissioning of 15A single phase flush type **metal clad industrial** socket **with MCB** outlet in recess/surface mounted complete as per specification.(For FCU)	Nos.		45	45	90				
1.11	**Main Distribution Board DB-140/ DB-240 as per Specifications & Drawing Complete & as per following details: (Type-1 with TVS motors up to 220kW)**	Sets		~~0~~ 1	1	~~1~~ 2				
1.11.01										
A	**INCOMER**									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1	Automatic transfer switch with 2 Nos ~~1600~~ **1000** A, 4 pole, ~~50~~ **65**kA electric drawout (EDO) ACBs, electrically and mechanically interlocked , controller having selector switch for automatic & forced operation on normal and emergency sources, monitoring of normal source and automatic changeover, test facility, circuit breaker status indication (On, Off & Trip), 3 ph Under - voltage protection, Phase Sequence Protection inbuilt in the controller or separately provided, the controller should have communication capability with BMS/SCADA. The ACB complete with safety shutters, 240V AC or 110V DC (control supply voltage to be selected in consultation with BMS Contractor) shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + instantaneous + earth fault (all with adjustable time delays) (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission of ammeter measurements (6) Signaling of the cause of tripping and alarms, maxi meter reset etc. (7) NO / NC contacts for interlocks and indications (8) 1 no CT in neutral to connect with the trip unit. must have Electronic Trip Unit with Overload & Short Circuit Protection, closing & shunt trip coil, auxiliary contacts for ON, OFF, TRIP indication etc. as per drawing and specification.									
b)	LED indication lamp for the following-									
	ON, OFF, TRIP (each for both the supplies)									
c)	LED phase indication lamp for R-Y-B.									
d)	Metering									
i)	1 No. Multifunction energy meter for measurement of voltage, current, power factor, power & energy with BMS connectivity (RS 485).									
ii)	3 Nos. CTs as per breaker rating, 15VA, CL-1 for metering.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
iii)	1 Nos. CTs as per breaker rating, 15VA, CL-1 for APFCR relay.									
1.11.02										
B.	**BUS BAR**									
	Electrolytic high conductivity T P &N+E copper conductor bus-bars (as specified in the Specifications) rated ~~1600~~ **1000**Amps, suitable to withstand symmetrical fault level of ~~50~~ **65**KA for 1 second at 415 volts.									
C.	**OUTGOING**									
1.11.03										
1	2 Sets of Soft Starter for bidirectional (Forward and reverse rotation) TVF Motors up to 220KW and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole 630 A, 50kA at 415V, 3P Motor Duty MCCB with Magnetic Trip Unit (having only short circuit protection) and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 630/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Supply, Exhaust and Stop & over load by pass functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for Supply, Exhaust, Off & Trip.									
h)	2 Nos 630A, 3 Pole, AC-3 duty Contactor with Auxiliary Contacts, Operating coil 230V.									
i)	Auxiliary Contactors for Local / Remote Operation.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
j)	Triple pole saturable C.T. operated Electronic over Current relays(EOCR) (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.).									
k)	OLR by Pass Switch									
l)	OLR by Pass Indication Lamp									
m)	1 No. 3 - phase, 415V, hermetically sealed metalized polypropylene capacitor (heavy-duty) with 7% harmonic D-tuned filters to suit the TVF Fan selection (as specified in A18 of the Specifications).									
n)	1 No. 3P, suitable rating Capacitor duty contactor for TVF Fan .									
o)	Power & control terminals for cable connections.									
~~**1.11.03a**~~										
~~**i)**~~	~~4 Sets of soft Starter Unit for bidirectional (Forward and reverse rotation)~~ ~~**TBF Motors up to 75 KW**~~ ~~and each shall be equipped with the followings but not limited to:~~									
~~a)~~	~~1 No. 3 Pole 160 A, 50kA at 415V, 3P Motor Duty MCCB with Magnetic Trip Unit (having only short circuit protection) and auxiliary Contacts.~~									
~~b)~~	~~1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).~~									
~~c)~~	~~3 Nos. CT 160/5A, 15VA, class - I for metering.~~									
~~d)~~	~~Local / Remote Selector Switch key operated.~~									
~~e)~~	~~Door mounted push buttons for Supply, Exhaust and Stop & over load by pass functions.~~									
~~f)~~	~~Emergency stop push button lockable type.~~									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
~~g)~~	~~LED indication lamps for Supply, Exhaust, Off & Trip.~~									
~~h)~~	~~2 Nos suitable rating, 3 Pole, AC-3 duty Contactor with Auxiliary Contacts, Operating coil 230\110 AC.~~									
~~i)~~	~~Auxiliary Contactors for Local / Remote Operation.~~									
~~j)~~	~~Triple pole saturable C.T. operated Electronic over load relays (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.)~~									
~~k)~~	~~1 No. 3 - phase, 415V, hermetically sealed metalized polypropylene capacitor (heavy-duty) with 7% harmonic D-tuned filters to suit the TBF Fan selection (as specified in A18 of the Specifications).~~									
~~l)~~	~~1 No. 3P, suitable rating Capacitor duty contactor for Capacitor Bank .~~									
~~m)~~	~~Power & control terminals for cable connections.~~									
~~**ii)**~~	~~1 Sets of soft Starter Unit for bidirectional (Forward and reverse rotation) **TBF Motors up to 55 KW** and each shall be equipped with the followings but not limited to:~~									
~~a)~~	~~1 No. 3 Pole 160 A, 50kA at 415V, 3P Motor Duty MCCB with Magnetic Trip Unit (having only short circuit protection) and auxiliary Contacts.~~									
~~b)~~	~~1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).~~									
~~c)~~	~~3 Nos. CT 160/5A, 15VA, class - I for metering.~~									
~~d)~~	~~Local / Remote Selector Switch key operated.~~									
~~e)~~	~~Door mounted push buttons for Supply, Exhaust and Stop & over load by pass functions.~~									
~~f)~~	~~Emergency stop push button lockable type.~~									
~~g)~~	~~LED indication lamps for Supply, Exhaust, Off & Trip.~~									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
~~h)~~	~~2 Nos suitable rating, 3 Pole, AC-3 duty Contactor with Auxiliary Contacts, Operating coil 230\110 AC.~~									
~~i)~~	~~Auxiliary Contactors for Local / Remote Operation.~~									
~~j)~~	~~Triple pole saturable C.T. operated Electronic over load relays (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.)~~									
~~k)~~	~~1 No. 3 - phase, 415V, hermetically sealed metalized polypropylene capacitor (heavy duty) with 7% harmonic D-tuned filters to suit the TBF Fan selection (as specified in A18 of the Specifications).~~									
~~l)~~	~~1 No. 3P, suitable rating Capacitor duty contactor for Capacitor Bank .~~									
~~m)~~	~~Power & control terminals for cable connections.~~									
1.11.04										
2)	~~11~~ **3** Nos. 10 A Single phase MCB feeder for space heaters in TVF +~~TBF~~									
3)	10 Sets of DOL Starter Unit (9Nos. Damper Motor +1 No. spare) of 0.5 KW (single phase) and each shall be equipped with the followings but not limited to:									
a)	1 Nos. 3 Pole 4 Amps MPCB (with inbuilt Single Phasing preventer) with 2.5-4 A Over - load release and having contacts for indications - On, Off, Trip.									
b)	Local / Remote Selector Switch key operated.									
c)	Door mounted push buttons for Start and Stop functions.									
d)	LED indication lamp for ON, OFF, Trip.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
e)	1 No. 9A, AC-3 Duty, 3 - pole Contactor with 8 Nos. Auxiliary Contacts and Operating Coil of 230 V / 110 V AC.									
f)	1 No. Auxiliary Contactor with 4 Nos. Auxiliary Contacts for Remote Operation.									
g)	Power & control terminals for cable connections.									
1.11.05	2 No. 10 A MCCB feeder for compressor Drier									
1.11.06	2 No. 100 A MCCB feeder for compressor									
1.11.07	Delivery of equipment to site	set		~~0~~ 1	1	~~1~~ 2				
1.11.08	Installation and Equipment testing	set		~~0~~ 1	1	~~1~~ 2				
1.11.09	System testing, Commissioning and hand over	set		~~0~~ 1	1	~~1~~ 2				
1.11.10	Interlocking Arrangement	set		~~0~~ 1	1	~~1~~ 2				
1.11.11	Scada\ BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & tranducers mounting prewired upto Marshelling box terminal boards from the factory itself and audited in factory from the BMS provider.	set		~~0~~ 1	1	~~1~~ 2				
1.12	**Main Distribution Board DB-140/DB-240 as per Specifications & Drawing Complete & as per following details: (Type-2 with TVS motors upto 270kW)**	Sets		~~2~~ 1	~~1~~ 0	~~3~~ 1				
1.12.01										
A	**INCOMER**									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1	Automatic transfer switch with 2 Nos ~~1600~~**1250**A, 4 pole, 50kA electric drawout (EDO) ACBs, electrically and mechanically interlocked , controller having selector switch for automatic & forced operation on normal and emergency sources, monitoring of normal source and automatic changeover, test facility, circuit breaker status indication (On, Off & Trip), 3 ph Under - voltage protection, Phase Sequence Protection inbuilt in the controller or separately provided, the controller should have communication capability with BMS/SCADA. The ACB complete with safety shutters, 240V AC or 110V DC (control supply voltage to be selected in consultation with BMS Contractor) shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + instantaneous + earth fault (all with adjustable time delays) (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission									
	of ammeter measurements (6) Signaling of the cause of tripping and alarms, maxi meter reset etc. (7) NO / NC contacts for interlocks and indications (8) 1 no CT in neutral to connect with the trip unit. must have Electronic Trip Unit with Overload & Short Circuit Protection, closing & shunt trip coil, auxiliary contacts for ON, OFF, TRIP indication etc. as per drawing and specification.									
b)	LED indication lamp for the following-									
	ON, OFF, TRIP (each for both the supplies)									
c)	LED phase indication lamp for R-Y-B.									
d)	Metering									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
i)	1 No. Multifunction energy meter for measurement of voltage, current, power factor, power & energy with BMS connectivity (RS 485).									
ii)	3 Nos. CTs ~~1600~~ **1250**/5A, 15VA, CL-1 for metering.									
iii)	1 Nos. CTs ~~1600~~ **1250**/5A, 15VA, CL-1 for APFCR relay.									
1.12.02										
B.	**BUS BAR**									
	Electrolytic high conductivity T P &N+E copper conductor bus-bars (as specified in the Specifications) rated ~~1600~~ **1250** Amps, suitable to withstand symmetrical fault level of 50 KA for 1 second at 415 volts.									
C.	**OUTGOING**									
1.12.03										
1	2 Sets of Soft Starter for bidirectional (Forward and reverse rotation) TVF Motors up to 270KW and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole 1000 A, 50kA at 415V, 3P Motor Duty ACB with Trip Unit and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 1000/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Supply, Exhaust and Stop & over load by pass functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for Supply, Exhaust, Off & Trip.									
h)	2 Nos 1000A, 3 Pole, AC-3 duty Contactor with Auxiliary Contacts, Operating coil 230V.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
i)	Auxiliary Contactors for Local / Remote Operation.									
j)	Triple pole saturable C.T. operated Electronic over Current relays(EOCR) (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.).									
k)	OLR by Pass Switch									
l)	OLR by Pass Indication Lamp									
m)	1 No. 3 - phase, 415V, hermetically sealed metalized polypropylene capacitor (heavy-duty) with 7% harmonic D-tuned filters to suit the TVF Fan selection (as specified in A18 of the Specifications).									
n)	1 No. 3P, suitable rating Capacitor duty contactor for TVF Fan .									
o)	Power & control terminals for cable connections.									
p)	Provision for terminals for wiring to Local control panel (LCP)									
1.12.04										
2)	3 Nos. 10 A Single phase MCB feeder for space heaters in TVF (2W+1 Spare)									
3)	10 Sets of DOL Starter Unit (9Nos. Damper Motor +1 No. spare) of 0.5 KW (single phase) and each shall be equipped with the followings but not limited to:									
a)	1 Nos. 3 Pole 4 Amps MPCB (with inbuilt Single Phasing preventer) with 2.5-4 A Over - load release and having contacts for indications - On, Off, Trip.									
b)	Local / Remote Selector Switch key operated.									
c)	Door mounted push buttons for Start and Stop functions.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
d)	LED indication lamp for ON, OFF, Trip.									
e)	1 No. 9A, AC-3 Duty, 3 - pole Contactor with 8 Nos. Auxiliary Contacts and Operating Coil of 230 V / 110 V AC.									
f)	1 No. Auxiliary Contactor with 4 Nos. Auxiliary Contacts for Remote Operation.									
g)	Power & control terminals for cable connections.									
1.12.05	2 No. 10 A MCCB feeder for compressor Drier									
1.12.06	2 No. 100 A MCCB feeder for compressor									
1.12.07	Delivery of equipment to site	set		~~2~~ 1	~~1~~ 0	~~3~~ 1				
1.12.08	Installation and Equipment testing	set		~~2~~ 1	~~1~~ 0	~~3~~ 1				
1.12.09	System testing, Commissioning and hand over	set		~~2~~ 1	~~1~~ 0	~~3~~ 1				
1.12.10	Interlocking Arrangement	set		~~2~~ 1	~~1~~ 0	~~3~~ 1				
1.12.11	Scada\ BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & tranducers mounting prewired upto Marshelling box terminal boards from the factory itself and audited in factory from the BMS provider.	set		~~2~~ 1	~~1~~ 0	~~3~~ 1				
1.12.A	**Main Distribution Board DB-140/DB-240 as per Specifications & Drawing Complete & as per following details: (Type-3 with TVS motors upto 270kW + 8 Nos. TBF upto 55 KW)**	Sets			1	1				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.12.A.01										
A	INCOMER									
1	Automatic transfer switch with 2 Nos 2000A, 4 pole, 65kA electric drawout (EDO) ACBs, electrically and mechanically interlocked , controller having selector switch for automatic & forced operation on normal and emergency sources, monitoring of normal source and automatic changeover, test facility, circuit breaker status indication (On, Off & Trip), 3 ph Under - voltage protection, Phase Sequence Protection inbuilt in the controller or separately provided, the controller should have communication capability with BMS/SCADA. The ACB complete with safety shutters, 240V AC or 110V DC (control supply voltage to be selected in consultation with BMS Contractor) shunt trip coil & closing coil and having microprocessor based releases with (1) Communication capability (2) Provision for measurement of three phase current (3) Protection against long time + short time + instantaneous + earth fault (all with adjustable time delays) (4) Zone Selective Interlocking Unit for Total Discrimination (5) Communication options to remotely read and set parameters for the protection functions, transmission									
	of ammeter measurements (6) Signaling of the cause of tripping and alarms, maxi meter reset etc. (7) NO / NC contacts for interlocks and indications (8) 1 no CT in neutral to connect with the trip unit. must have Electronic Trip Unit with Overload & Short Circuit Protection, closing & shunt trip coil, auxiliary contacts for ON, OFF, TRIP indication etc. as per drawing and specification.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
b)	LED indication lamp for the following-									
	ON, OFF, TRIP (each for both the supplies)									
c)	LED phase indication lamp for R-Y-B.									
d)	Metering									
i)	1 No. Multifunction energy meter for measurement of voltage, current, power factor, power & energy with BMS connectivity (RS 485).									
ii)	3 Nos. CTs 2000/5A, 15VA, CL-1 for metering.									
iii)	1 Nos. CTs 2000/5A, 15VA, CL-1 for APFCR relay.									
1.12.A.02										
B.	BUS BAR									
	Electrolytic high conductivity T P &N+E copper conductor bus-bars (as specified in the Specifications) rated 2000 Amps, suitable to withstand symmetrical fault level of 65 KA for 1 second at 415 volts.									
C.	OUTGOING									
1.12.A.03										
1	2 Sets of Soft Starter for bidirectional (Forward and reverse rotation) TVF Motors up to 270KW and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole 1000 A, 50kA at 415V, 3P Motor Duty ACB with Trip Unit and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 1000/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Supply, Exhaust and Stop & over load by pass functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for Supply, Exhaust, Off & Trip.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
h)	2 Nos 1000A, 3 Pole, AC-3 duty Contactor with Auxiliary Contacts, Operating coil 230V.									
i)	Auxiliary Contactors for Local / Remote Operation.									
j)	Triple pole saturable C.T. operated Electronic over Current relays(EOCR) (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.).									
k)	OLR by Pass Switch									
l)	OLR by Pass Indication Lamp									
m)	1 No. 3 - phase, 415V, hermetically sealed metalized polypropylene capacitor (heavy-duty) with 7% harmonic D-tuned filters to suit the TVF Fan selection (as specified in A18 of the Specifications).									
n)	1 No. 3P, suitable rating Capacitor duty contactor for TVF Fan .									
o)	Power & control terminals for cable connections.									
p)	Provision for terminals for wiring to Local control panel (LCP)									
2)	8 Sets of soft Starter Unit for bidirectional (Forward and reverse rotation) TBF Motors up to 55 KW and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole 160 A, 50kA at 415V, 3P Motor Duty MCCB with Magnetic Trip Unit (having only short circuit protection) and auxiliary Contacts.									
b)	1 No. Multifunction energy meter for measurement of current & energy with BMS connectivity (RS 485).									
c)	3 Nos. CT 160/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
e)	Door mounted push buttons for Supply, Exhaust and Stop & over load by pass functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamps for Supply, Exhaust, Off & Trip.									
h)	2 Nos suitable rating, 3 Pole, AC-3 duty Contactor with Auxiliary Contacts, Operating coil 230\110 AC.									
i)	Auxiliary Contactors for Local / Remote Operation.									
j)	Triple pole saturable C.T. operated Electronic over load relays (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.)									
k)	1 No. 3 - phase, 415V, hermetically sealed metalized polypropylene capacitor (heavy-duty) with 7% harmonic D-tuned filters to suit the TBF Fan selection (as specified in A18 of the Specifications).									
l)	1 No. 3P, suitable rating Capacitor duty contactor for Capacitor Bank .									
m)	Power & control terminals for cable connections.									
1.12.A.04										
1)	11 Nos. 10 A Single phase MCB feeder for space heaters in TVF+TBF (2W for TVF+ 8W for TBF +1 Spare)									
2)	10 Sets of DOL Starter Unit (9Nos. Damper Motor +1 No. spare) of 0.5 KW (single phase) and each shall be equipped with the followings but not limited to:									
a)	1 Nos. 3 Pole 4 Amps MPCB (with inbuilt Single Phasing preventer) with 2.5-4 A Over - load release and having contacts for indications - On, Off, Trip.									
b)	Local / Remote Selector Switch key operated.									
c)	Door mounted push buttons for Start and Stop functions.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
d)	LED indication lamp for ON, OFF, Trip.									
e)	1 No. 9A, AC-3 Duty, 3 - pole Contactor with 8 Nos. Auxiliary Contacts and Operating Coil of 230 V / 110 V AC.									
f)	1 No. Auxiliary Contactor with 4 Nos. Auxiliary Contacts for Remote Operation.									
g)	Power & control terminals for cable connections.									
1.12.A.05	2 No. 10 A MCCB feeder for compressor Drier									
1.12.A.06	2 No. 100 A MCCB feeder for compressor									
1.12.A.07	Delivery of equipment to site	set			1	1				
1.12.A.08	Installation and Equipment testing	set			1	1				
1.12.A.09	System testing, Commissioning and hand over	set			1					
1.12.A.10	Interlocking Arrangement	set			1	1				
1.12.A.11	Scada\ BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & tranducers mounting prewired upto Marshelling box terminal boards from the factory itself and audited in factory from the BMS provider.	set			1	1				
1.13.	Adjustment of rates for addition/deletion of supply of compartmentalized switchgear in the panels DB-140/DB240 of following ratings including the supply fabrication , extension, modifications of enclosures, earthing, bus bars, other sub system accessories etc. complete as required and as per specification									
i)	addition of 2 Sets of Star - Delta Starter Unit for Compressor motors (1no working + 1 no Standby) up to 20 kW and each shall be equipped with the followings but not limited to:									
a)	1 No. 3 Pole 100 A, 50kA at 415V, 3P Motor Duty MCCB with Magnetic Trip Unit (having only short circuit protection) and auxiliary Contacts.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
b)	1 No. digital Ammeter with Inbuilt Selector Switch, CT operated.									
c)	3 Nos. CT 100/5A, 15VA, class - I for metering.									
d)	Local / Remote Selector Switch key operated.									
e)	Door mounted push buttons for Supply, Exhaust and Stop & over load by pass functions.									
f)	Emergency stop push button lockable type.									
g)	LED indication lamp for ON, OFF, Trip.									
h)	3 Nos suitable rating , AC-3 duty, 3 Pole Contactor with Auxiliary Contacts, Operating coil 230V110V AC.									
i)	One no star-delta timer.									
j)	Auxiliary Contactors for Local / Remote Operation.									
k)	Triple pole saturable C.T. operated Electronic over Current relays(EOCR) (with in built single phasing protection) suitable for above mentioned motor; by passing arrangement in case of emergency with all accessories (3nos saturable C.T.s, auxiliary contactors etc.).									
l)	Power & control terminals for cable connections.									
	in Type-1 DB 140 or DB- 240 Panel	set		0	1	1				
	in Type-2 DB 140 or DB- 240 Panel	set		1	0	1				
1.14	Local Control Panel for(LCP) DBs for chilled water, condenser water, Cooling tower pump, & TVF fan	set		23	23	46				
~~**1.14.01**~~	~~Local Push button control for chilled water, condenser water, Cooling tower pump, & TVF fan, each shall be equipped with:~~									
a)	Auto / Manual Selector Switch Key operated.									
b)	Door mounted push buttons for Start, Stop, Emergency Stop									
c)	LED indication lamp for On, Off & Trip.									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
1.14.02	Delivery of equipment to site.	set		23	23	46				
1.14.03	Installation and Equipment testing	set		23	23	46				
1.14.04	System testing, Commissioning and hand over	set		23	23	46				
1.14.05	Scada\ BMS Connectivity at the separate Marshelling box in the panel with provision of all necessary I/O points & tranducers mounting prewired upto Marshelling box terminal boards from the factory itself and audited in factory from the BMS provider.	set		23	23	46				
1.15	Supply & Installing of Key lockable Emergency Stop push button box (including Emergency push button with contact, gland plate at both end for cable connection) conforming to IP-65 protection for each motor & pump.	Nos.		20	20	40				
1.16	Supply & placing of ribbed surface rubber mat 12 mm thick and 900 mm width as required including cutting or required lengths, of approved make, with test certificates for L.T. panels.	Mtr		100	100	200				
1.17	Providing and fixing of M.V danger plate of 200 X 150 mm of mild steel at least 2 mm thick and vitreous enameled white on both side and with inscription in signal red colour on front side as required.	Nos.		1	1	2				
	TOTAL FOR SH01									
2.0	**CABLES, CABLE TRAYS & STEELWORK**									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
	The Cable and Cable Containment System specified herein, must conform to Specifications, in addition to the description given in respective items of BOQ, whether explicitly specified or not. In case of contradiction between M & W specifications and description in BOQ, the most stringent of the condition will prevail.									
	All the items / parts mentioned in relevant clauses of the specifications and not specifically mentioned in BOQ shall be deemed to be included in the quoted rates, unless specifically excluded.									
	It may be noted that Contractor will be required to carry out cable sizing based on actual cable lengths, as per Working Drawings developed by him and after incorporating any changes in load requirements from the tendering stage. Optimization must be carried out during cable sizing to reduce the cable requirement and size. Further, Contractor must obtain Engineer's approval on the Cable Sizing Calculation.									
2.01	Supply at the site of work of 600/1000 V grade, Copper Conductor, XLPE Insulated, armoured, Low Smoke Zero Halogen Type Cables conforming to specifications of the following sizes:									
	(Note: In case of any contradiction between BS 6724 and Specification, the stringent conditions of the two will apply)									
a	1 x 630 Sq.mm	Metres		RO	RO	0				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
b	4 x 400 Sq.mm	Metres		RO	RO	0				
c	3 x 400 Sq.mm	Metres		RO	RO	0				
d	4 x 300 Sq.mm	Metres		RO	RO	0				
e	3 x 300 Sq.mm	Metres		RO	RO	0				
f	4 x 240 Sq.mm	Metres		115	115	230				
g	3 x 240 Sq.mm	Metres		RO	RO	0				
h	4 x 185 Sq.mm	Metres		143	143	286				
i	3 x 185 Sq.mm	Metres		196	196	392				
j	4 x 150 Sq.mm	Metres		RO	RO	0				
k	3 x 150 Sq.mm	Metres		RO	RO	0				
l	4 x 120 Sq.mm	Metres		242	242	484				
m	3 x 120 Sq.mm	Metres		RO	RO	0				
n	4 x 95 Sq.mm	Metres		RO	RO	0				
o	3 x 95 Sq.mm	Metres		140	140	280				
p	4 x 70 Sq.mm	Metres		RO	RO	0				
q	3 x 70 Sq.mm	Metres		RO	RO	0				
r	4 x 50 Sq.mm	Metres		30	30	60				
s	3 x 50 Sq.mm	Metres		296	296	592				
t	4 x 35 Sq.mm	Metres		311	311	622				
u	3 x 35 Sq.mm	Metres		207	207	414				
v	4 x 25 Sq.mm	Metres		40	40	80				
w	3 x 25 Sq.mm	Metres		RO	RO	0				
x	4 x 16 Sq.mm	Metres		150	150	300				
y	3 x 16 Sq.mm	Metres		RO	RO	0				
z	4 x10 Sq.mm	Metres		RO	RO	0				
aa	3 x 10 Sq.mm	Metres		699	699	1398				
ab	4 x 6 Sq.mm	Metres		RO	RO	0				
ac	3 x 6 Sq.mm	Metres		711	711	1422				
ad	4 x 4 Sq.mm	Metres		RO	RO	0				
ae	3 x 4 Sq.mm	Metres		2118	2118	4236				
af	4 x 2.5 Sq.mm	Metres		RO	RO	0				
ag	3 x 2.5 Sq.mm	Metres		RO	RO	0				
ah	2 x 2.5 Sq.mm	Metres		3476	3635	7111				
ai	2 x 4 Sq.mm	Metres		368	2553	2921				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
2.02	Supply at the site of work of 600/1000 V grade, Copper Conductor, XLPE Insulated, armoured, Low Smoke Zero Halogen, Fire Resistant / Survival Type Cables conforming to BS 7846 and specifications, of the following sizes:									
	(Note: In case of any contradiction between BS 7846 and Specification specifications, the stringent conditions of the two will apply)									
a	1 x 630 Sq.mm	Metres		RO	RO	0				
b	4 x 400 Sq.mm	Metres		RO	RO	0				
c	3 x 400 Sq.mm	Metres		RO	RO	0				
d	4 x 300 Sq.mm	Metres		RO	RO	0				
e	3 x 300 Sq.mm	Metres		RO	RO	0				
f	4 x 240 Sq.mm	Metres		RO	RO	0				
g	3 x 240 Sq.mm	Metres		782	782	1564				
h	4 x 185 Sq.mm	Metres		RO	RO	0				
i	3 x 185 Sq.mm	Metres		RO	RO	0				
j	4 x 150 Sq.mm	Metres		RO	RO	0				
k	3 x 150 Sq.mm	Metres		RO	1840	1840				
l	4 x 120 Sq.mm	Metres		RO	RO	0				
m	3 x 120 Sq.mm	Metres		RO	345	345				
n	4 x 95 Sq.mm	Metres		RO	RO	0				
o	3 x 95 Sq.mm	Metres		530	1320	1850				
p	4 x 70 Sq.mm	Metres		RO	RO	0				
q	3 x 70 Sq.mm	Metres		552	552	1104				
r	4 x 50 Sq.mm	Metres		621	621	1242				
s	3 x 50 Sq.mm	Metres		RO	RO	0				
t	4 x 35 Sq.mm	Metres		RO	RO	0				
u	3 x 35 Sq.mm	Metres		RO	RO	0				
v	4 x 25 Sq.mm	Metres		RO	RO	0				
w	3 x 25 Sq.mm	Metres		RO	RO	0				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
x	4 x 16 Sq.mm	Metres		RO	RO	0				
y	3 x 16 Sq.mm	Metres		748	748	1496				
z	4 x10 Sq.mm	Metres		RO	RO	0				
aa	3 x 10 Sq.mm	Metres		566	566	1132				
ab	4 x 6 Sq.mm	Metres		RO	RO	0				
ac	3 x 6 Sq.mm	Metres		299	299	598				
ad	4 x 4 Sq.mm	Metres		RO	RO	0				
ae	3 x 4 Sq.mm	Metres		RO	RO	0				
af	4 x 2.5 Sq.mm	Metres		RO	RO	0				
ag	3 x 2.5 Sq.mm	Metres		RO	RO	0				
ah	2 x 2.5 Sq.mm	Metres		5808	6054	11862				
ai	2 x 4 Sq.mm	Metres		368	2553	2921				
2.03	Supply & Laying at the site of work of 600/1000 V grade, Copper Conductor, XLPE Insulated, armoured, Low Smoke Zero Halogen Type Control Cables conforming to BS 6724 and Specifications, of the following sizes:									
	(Note: In case of any contradiction between BS 6724 and Specification A16, the stringent conditions of the two will apply)									
a	2 C x 1.5 Sq. mm Copper cable	Metres		500	500	1000				
b	2 C x 2.5 Sq. mm Copper cable	Metres		3000	3000	6000				
c	3 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
d	4 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
e	5 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
f	7 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
g	9 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
h	12 C x 2.5 Sq. mm Copper cable	Metres		250	250	500				
I	15 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
j	19 C x 2.5 Sq. mm Copper cable	Metres		400	400	800				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
2.04	Supply & Laying at the site of work of 600/1000 V grade, Copper Conductor, XLPE Insulated, armoured, Low Smoke Zero Halogen, Fire Resistant / Survival Type Auxiliary / Control Cables conforming to BS 7846 and Section A16 of M&W Specifications , of the following sizes:									
	(Note: In case of any contradiction between BS 7846 and Specification E02, the stringent conditions of the two will apply)									
a	2 C x 1.5 Sq. mm Copper cable	Metres		100	100	200				
b	2 C x 2.5 Sq. mm Copper cable	Metres		2000	2000	4000				
c	3 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
d	4 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
e	5 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
f	7 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
g	9 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
h	12 C x 2.5 Sq. mm Copper cable	Metres		250	250	500				
I	15 C x 2.5 Sq. mm Copper cable	Metres		20	20	40				
j	19 C x 2.5 Sq. mm Copper cable	Metres		300	300	600				
2.05	Laying, testing and commissioning of 600/1000 V grade, Copper Conductor, XLPE Insulated, armoured, Low Smoke Zero Halogen Type and Fire Resistant / Survival Type Cables (as specified in Schedule 2.01 & 2.02) on existing trays/ walls/ columns/ indoor/ trenches with suitable clamps, saddles, hooks, bolts etc.									
a	1 x 630 Sq.mm	Metres		RO	RO	0				
b	4 x 400 Sq.mm	Metres		RO	RO	0				
c	3 x 400 Sq.mm	Metres		RO	RO	0				
d	4 x 300 Sq.mm	Metres		RO	RO	0				
e	3 x 300 Sq.mm	Metres		RO	RO	0				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
f	4 x 240 Sq.mm	Metres		115	115	230				
g	3 x 240 Sq.mm	Metres		782	782	1564				
h	4 x 185 Sq.mm	Metres		143	143	286				
i	3 x 185 Sq.mm	Metres		196	196	392				
j	4 x 150 Sq.mm	Metres		RO	RO	0				
k	3 x 150 Sq.mm	Metres		RO	1840	1840				
l	4 x 120 Sq.mm	Metres		242	242	484				
m	3 x 120 Sq.mm	Metres		RO	345	345				
n	4 x 95 Sq.mm	Metres		RO	RO	0				
o	3 x 95 Sq.mm	Metres		670	1460	2130				
p	4 x 70 Sq.mm	Metres		RO	RO	0				
q	3 x 70 Sq.mm	Metres		552	552	1104				
r	4 x 50 Sq.mm	Metres		651	651	1302				
s	3 x 50 Sq.mm	Metres		296	296	592				
t	4 x 35 Sq.mm	Metres		311	311	622				
u	3 x 35 Sq.mm	Metres		207	207	414				
v	4 x 25 Sq.mm	Metres		40	40	80				
w	3 x 25 Sq.mm	Metres		RO	RO	0				
x	4 x 16 Sq.mm	Metres		150	150	300				
y	3 x 16 Sq.mm	Metres		748	748	1496				
z	4 x10 Sq.mm	Metres		RO	RO	0				
aa	3 x 10 Sq.mm	Metres		1265	1265	2530				
ab	4 x 6 Sq.mm	Metres		RO	RO	0				
ac	3 x 6 Sq.mm	Metres		1010	1010	2020				
ad	4 x 4 Sq.mm	Metres		RO	RO	0				
ae	3 x 4 Sq.mm	Metres		2118	2118	4236				
af	4 x 2.5 Sq.mm	Metres		RO	RO	0				
ag	3 x 2.5 Sq.mm	Metres		RO	RO	0				
ah	2 x 2.5 Sq.mm	Metres		9284	9689	18973				
ai	2 x 4Sq.mm	Metres		736	5106	5842				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
2.06	Supply and providing terminations conforming to Specifications for XLPE insulated, LSZH (as specified in Schedule 2.01) and Fire Survival (as specified in Schedule 2.02) armoured / unarmoured cables of sizes given below including the cost of supplying, fixing and crimping copper lugs, double compression Flame proof brass glands, insulation tape etc. This also includes making holes in gland plate complete as per specifications and as required.									
a	1 x 630 Sq.mm	Nos.		RO	RO	0				
b	4 x 400 Sq.mm	Nos.		RO	RO	0				
c	3 x 400 Sq.mm	Nos.		RO	RO	0				
d	4 x 300 Sq.mm	Nos.		RO	RO	0				
e	3 x 300 Sq.mm	Nos.		RO	RO	0				
f	4 x 240 Sq.mm	Nos.		8	8	16				
g	3 x 240 Sq.mm	Nos.		16	16	32				
h	4 x 185 Sq.mm	Nos.		10	10	20				
i	3 x 185 Sq.mm	Nos.		16	16	32				
j	4 x 150 Sq.mm	Nos.		RO	RO	0				
k	3 x 150 Sq.mm	Nos.		RO	8	8				
l	4 x 120 Sq.mm	Nos.		2	2	4				
m	3 x 120 Sq.mm	Nos.		RO	2	2				
n	4 x 95 Sq.mm	Nos.		RO	RO	0				
o	3 x 95 Sq.mm	Nos.		4	4	8				
p	4 x 70 Sq.mm	Nos.		RO	RO	0				
q	3 x 70 Sq.mm	Nos.		16	16	32				
r	4 x 50 Sq.mm	Nos.		6	6	12				
s	3 x 50 Sq.mm	Nos.		26	26	52				
t	4 x 35 Sq.mm	Nos.		4	4	8				
u	3 x 35 Sq.mm	Nos.		28	28	56				
v	4 x 25 Sq.mm	Nos.		2	2	4				
w	3 x 25 Sq.mm	Nos.		RO	RO	0				
x	4 x 16 Sq.mm	Nos.		4	4	8				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
y	3 x 16 Sq.mm	Nos.		24	20	44				
z	4 x10 Sq.mm	Nos.		RO	RO	0				
aa	3 x 10 Sq.mm	Nos.		78	78	156				
ab	4 x 6 Sq.mm	Nos.		RO	4	4				
ac	3 x 6 Sq.mm	Nos.		64	64	128				
ad	4 x 4 Sq.mm	Nos.		RO	RO	0				
ae	3 x 4 Sq.mm	Nos.		92	92	184				
af	4 x 2.5 Sq.mm	Nos.		RO	RO	0				
ag	3 x 2.5 Sq.mm	Nos.		RO	RO	0				
ah	2 x 2.5 Sq.mm	Nos.		218	216	434				
ai	2 x 4 Sq.mm	Nos.		8	18	26				
2.07	Supply and Providing terminations conforming to Section A16 of M & W Specifications for XLPE, LSZH, armoured / unarmoured cables (as specified in Schedule 2.03 and 2.04) of sizes given below including the cost of supplying, fixing and crimping copper lugs, double compression Flame proof brass glands, insulation tape etc. This also includes making holes in gland plate complete as per specifications and as required.									
a	2 C x 1.5 Sq. mm Copper cable	Nos		200	200	400				
b	2 C x 2.5 Sq. mm Copper cable	Nos		500	500	1000				
c	3 C x 2.5 Sq. mm Copper cable	Nos		10	10	20				
d	4 C x 2.5 Sq. mm Copper cable	Nos		10	10	20				
e	5 C x 2.5 Sq. mm Copper cable	Nos		10	10	20				
f	7 C x 2.5 Sq. mm Copper cable	Nos		10	10	20				
g	9 C x 2.5 Sq. mm Copper cable	Nos		10	10	20				
h	12 C x 2.5 Sq. mm Copper cable	Nos		10	10	20				
I	15 C x 2.5 Sq. mm Copper cable	Nos		5	5	10				
j	19 C x 2.5 Sq. mm Copper cable	Nos		10	10	20				
	CABLE TRAY									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
2.08	Supply & installation of Prefabricated, wrap around type, perforated GI cable trays made of GI sheets continuously connected including Factory made horizontal and vertical bends, reducers, tees, coupling plate and nut bolts washers and all material required for installation i.e. Tie Rods, GI angles, Channels, earth link etc,conforming to - Specifications, complete as required.									
a	600 mm wide x 50 mm deep x 2 mm thick	Meters		250	250	500				
b	450 mm wide x 50 mm deep x 2 mm thick	Meters		100	100	200				
c	300 mm wide x 50 mm deep x 2 mm thick	Meters		900	900	1800				
d	150mm wide x 50mm deep x 2 mm thick	Meters		1100	1100	2200				
d	100mm wide x 50mm deep x 2 mm thick	Meters		300	300	600				
	CABLE LADDER									
2.09	Supply & installation of prefabricated, GI, ladder type cable tray conforming to Specifications - continuously connected including Factory made horizontal & vertical bends reducers, tees, coupling plate, nut bolts washers and all material required for installation i.e. Tie Rods, GI angles, Channels, earth link etc. The side runners shall be 100 x 20 x 2.5 mm and center rungs shall be of size 30 x 15 x 2.5 mm with center to center distance of 250 mm, as required.									
a	900 mm wide x 50 mm deep x 2 mm thick	Meters		50	50	100				
b	750 mm wide x 50 mm deep x 2 mm thick	Meters		50	50	100				
a	600 mm wide x 50 mm deep x 2 mm thick	Meters		180	180	360				
b	450 mm wide x 50 mm deep x 2 mm thick	Meters		100	100	200				
c	300 mm wide x 50 mm deep x 2 mm thick	Meters		100	100	200				
d	150 mm wide x 50 mm deep x 2 mm thick	Meters		50	50	100				
e	100 mm wide x 50 mm deep x 2 mm thick	Meters		50	50	100				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
2.10	Supply, fabrication & installation of fabricated GI steel work conforming to specification - to support ***services as required*** ~~bus duct, light fixtures, conduit wirings , Bracket ,& other electrical works including Tunnel services etc., as required~~. This includes all the fixing accessories like fastners and all masonry works.	Kgs		1500	1500	3000				
	TOTAL FOR SH02									
3.0	**EARTHING**									
	The Earthing and Lightning Protection System specified herein, must conform to Specifications, in addition to the description given in respective items of BOQ, whether explicitly specified or not. In case of contradiction between M & W specifications and description in BOQ, the most stringent of the condition will prevail.									
	All the items / parts mentioned in relevant clauses of the M & W specifications and not specifically mentioned in BOQ shall be deemed to be included in the quoted rates, unless specifically excluded.									
3.01	Supply of copper strips / rods / wires (minimum 97% conductivity) of the following sizes (as specified Specifications) for provision in Earthing System.									
a	50 mm x 4 mm copper strip	Metres		50	50	100				
b	32 mm x 5 mm copper strip	Metres		50	50	100				
c	25 mm x 3 mm copper strip	Metres		50	50	100				
d	8 SWG / 4 mm diameter, copper Wire	Metres		100	100	200				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
3.02	Laying, testing and commissioning of the following sizes of copper strips / rods / wires in trenches / surface / wall / trays / ladders etc. including provision of spacers and saddles etc. for interconnecting the Earthing Stations, Earth Grid, Electrical Distribution Switchboards, Distribution Boards, Motor Control Centers, Transformer, DG Set, Motors and any other equipment / service / structure etc. required to be earthed.									
a	50 mm x 4 mm copper strip	Metres		50	50	100				
b	32 mm x 5 mm copper strip	Metres		50	50	100				
c	25 mm x 3 mm copper strip	Metres		50	50	100				
d	8 SWG / 4 mm dia copper. Wire	Metres		100	100	200				
3.03	Supply, laying and testing of unarmoured, stranded copper conductor, Low Smoke Zero Halogen, green coloured cables of following sizes, conforming to BS 7211 and Specifications, for earthing, including termination of the same by copper lugs at both ends.									
a	1 x 6 sq. mm	Metres		50	50	100				
b	1 x 10 sq. mm	Metres		50	50	100				
c	1 x 16 sq. mm	Metres		50	50	100				
d	1 x 70 sq. mm	Metres		50	50	100				
e	1 x 150 sq. mm	Metres		50	50	100				
	MS /GI As per IS/IEEE									
3.04	Supply of GI earthing strips for provision in Earthing System as per IS Or Steel ropes of equivalent cross sectional area suitable for earthing as per best international practices.									
a	25 mm x 3 mm GI strip	Metres		50	50	100				

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
b	32 mm x 5 mm GI strip	Metres		50	50	100				
c	40 mm x 5 mm GI strip	Metres		8000	8000	16000				
d	50 mm x 6 mm GI strip	Metres		50	50	100				
e	65 mm x 6 mm GI strip	Metres		50	50	100				
f	75 mm x 6 mm GI strip	Metres		50	50	100				
g	8 SWG Rope	meters		2000	2000	4000				
3.05	Laying, testing and commissioning of the following sizes of GI (MS) strips / rods / wires / ropes in trenches / surface / wall / trays / ladders etc. including provision of spacers including welding and treatment as per earthing practices and saddles etc. for interconnecting the Earthing Stations, Earth Grid, Electrical Distribution Switchboards, Distribution Boards, Motor Control Centers, Transformer, Motors and any other equipment / service / structure etc. required to be earthed. **Including Bimetallic connectors as required at site**									
a	25 mm x 3 mm GI strip	Metres		50	50	100				
b	32 mm x 5 mm GI strip	Metres		50	50	100				
c	40 mm x 5 mm GI strip	Metres		8000	8000	16000				
d	50 mm x 6 mm GI strip	Metres		50	50	100				
e	65 mm x 6 mm GI strip	Metres		50	50	100				
f	75 mm x 6 mm GI strip	Metres		50	50	100				
g	8 SWG Rope	meters		2000	2000	4000				
3.06	**PANEL INTERNAL Clean Agent FLOODING SYSTEM**									
	All the items not specifically mentioned here but necessary to make the system complete and suitable for desired application as per M & W Specifications and Drawings will be deemed to be included in the quoted prices									

SCHEDULE OF QUANITITIES FOR PART-A ECS ELECTRICAL WORKS

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
	Providing, Installation, Testing and Commissioning of internal clean agent Panel Flooding System complete in following Panels	**Lot**		**1**	**1**	**2**				
a	Panel 130									
b	Panel 230									
c	Panel 170/270									
d	Panel 140									
e	Panel 240									
	TOTAL FOR SH 03									
	Note:- 1.Quantity may be vary as per latest drawing.									
Grand Total Amount for Electrical Works(SH01+SH02+SH 03)										

SCHEDULE OF QUANITITIES FOR PART-B ECS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
	Cold Water Temperature: 30.0 °C									
A)	Capacity :- 86.04 LPS									
4.1.1A	Delivery of Equipment to site	Nos.		3	3	6				
4.1.2A	Installation and equipment testing	Nos.		3	3	6				
4.1.3A	System testing, commissioning and hand over	Nos.		3	3	6				
B)	Capacity :- 90.96 LPS									
4.1.1B	Delivery of Equipment to site	No.		RO	RO	RO				
4.1.2B	Installation and equipment testing	No.		RO	RO	RO				
4.1.3B	System testing, commissioning and hand over	No.		RO	RO	RO				
C)	Capacity :- 98.33 LPS									
4.1.1C	Delivery of Equipment to site	No.		RO	RO	RO				
4.1.2C	Installation and equipment testing	No.		RO	RO	RO				
4.1.3C	System testing, commissioning and hand over	No.		RO	RO	RO				
5	**Air handling Units(Double Skin)**									
5.1	~~Sectional Air Handling Unit double skin type (Euro Vent Certified for mechanical & unit Performance), complete with twin plug type fans, fan section, twin cooling coils, coil section,V filter section with 50mm thick panel type filters, fan motor(IE-2) with VFD and with UVC emitter fitted etc. AHU shall be with cooling coil minimum 8 Row Deep and fin spacing shall be Max 10 FPI. The complete compartmentation shall be provided in fan and coil section.~~ Sectional Air Handling Unit double skin type (AHRI & Euro Vent Certified), complete with twin blowers, fan section, twin cooling coils, coil section,V filter section with 50mm thick ~~HDPE~~ panel type filters, fan motor, isolator for motor (IE-2) (mounted out side AHU) belt drive , with UVC emitter fitted etc.including all necessary civil work as per specification and data sheet. AHU shall be with cooling coil minimum 6 Row Deep and fin spacing shall be min max 10 FPI.									
a)	126000 CMH Capacity; 920 kW, Rows to suite ,1500Pascal									
5.1.1	Delivery of Equipment to site	Nos.		4	4	8				
5.1.2	Installation and equipment testing	Nos.		4	4	8				
5.1.3	System testing, commissioning and hand over	Nos.		4	4	8				

SCHEDULE OF QUANITITIES FOR PART-B ECS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
	~~f) Chemical for 1 year~~	~~Lot~~		~~1~~	~~1~~	~~2~~				
17.3	Automatic motorised Condenser water bleed off 25 mm valve complete with sensing device	No.		1	1	2				
18	Ducting									
	Sheet metal ducting complete with supports, vanes etc. as per specifications and drawings including all necessary civil work.									
18.1	GI Sheet Metal Ducting									
a	0.63 mm thick (24 Gauge)	Sqm		400	400	800				
b	0.83 mm thick (22 Gauge)	Sqm		3400	3400	6800				
c	1.00 mm thick (20 Gauge)	Sqm		1400	1400	2800				
d	1.20 mm thick (18 Gauge)	Sqm		1600	1600	3200				
18.2	Fire Rated Ducting									
	Fire rated Sheet metal ducting complete with supports, vanes, insulation etc. as per manufacturer's recommendations complying to relevent standards such as BS 476 part 24 s including all necessary civil work.									
18.2.1	Sheet Metal Duct painted with fire-resistan paint and 100 mm thick, 120 kg/m^3 density Rock wool insulation (Price shall include cost of paint and Rock wool insulation)									

SCHEDULE OF QUANITITIES FOR PART-B ECS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
g	VSF 6.5 cms ,750 pa cms For Chillerand Fire pump Plant Rooms	Nos.		0	2	2				
h	Fire Rated VEF 4.8 cms, 600 Pa. For ASS Rooms at Concourselevel	Nos.		6	6	12				
j	Fire rated SEF11.76, 850 Pa cms	Nos.		4	4	8				
k	SPF-5.5 cms, 550 Pa	Nos.		3	3	6				
l	WEF-Capacity 1.3 CMS, total pressure 150 pascals	Nos.		2	2	4				
m	FAF 7 cms, 650 pa compatible with VFD and CO2 level monitor controlled	Nos.		2	0	2				
n	FAF 6 cms, 650 pa compatible with VFD and CO2 level monitor controlled	Nos.		R.O.	R.O.					
o	Toilet exhaust Inline Fan 3.85 cms, 400 Pa	Nos.		2	2	4				
23.2	Attenuators as per specifications (Sizes are indicative, Bidders to supply as per selection of fans & equipments)	SQM		1	1	2				
a	Attenuator AHU Supply- (2300x1400)	~~No.~~ SQM		~~4~~ **13**	~~4~~ **13**	~~8~~ **26**				
c	Attenuator VSF Supply-ECA- (1200x1200)	~~No.~~ SQM		~~12~~ **17**	~~12~~ **17**	~~24~~ **34**				
d	Attenuator VEF Exhaust-ECA- (1200x1200)	~~No.~~ SQM		~~16~~ **23**	~~16~~ **23**	~~32~~ **46**				
g	Attenuator FAF ECS PLANT ROOM-ECA- (1000x1000)	~~No.~~ SQM		4	4	8				
h	Attenuator S.E.F. -ECA-(1400x700)	~~No.~~ SQM		~~2~~ **1.96**	~~2~~ **1.96**	~~4~~ **3.92**				
24	EU4 Panel type Filters, complete with filter fixing frame, holding frame gaskets etc. complete filter shall have arrestance efficiency as per specifications.									
a	(610x610x50) mm	Nos.		6	6	12				

SCHEDULE OF QUANITITIES FOR PART-B ECS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
b	(450x450x50) mm	Nos.		2	2	4				
25	Gas leakage detection system	Nos.		1	1	2				
26	Misc. items									
26.1	Supply, Installation, Testing & commissioning of CO2 ~~& Air quality monitor~~ sensors with controller with all the mounting accessories included. The sensor shall be Infra Red Type with 4 to 20 mA transmitter. The measurment shall be 0 to 2000 ppm. To control the operation of FAFs in ECS Plant Room through VFD.	Lot		1	1	2				
26.2	Supply, installation, testing & commissioning of flow meter compatible with BMS including all wiring	No.		~~0~~ 4	~~0~~ 4	~~0~~ 8				
	GRAND TOTAL FOR ECS WORK									

SCHEDULE OF QUANITITIES FOR PART - D BMS WORKS FOR ECS and E&M

S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
	CPU Module with on board Ethernet RS 485 port, . Integrated Remote I/O Bus Manager, 96 word Base memory, 12,000 I/O capacity, 64 process channels :~~4 nos~~									
	CPU Module with Remote I/O Bus manager : ~~2 nos~~									
	256 KB memory Extension Capsule: ~~2 nos~~									
	AI Module									
	DI Module									
	DO Module									
	AO Module									
	IO Rack Power Supply Module , 230 V , 50 W									
	6 slot CPU rack									
	Redundancy Module									
	Back Plane Rack for PC modules & IO									
	Expansion Rack for remote IO modules									
	~~FIPIO~~ trunk cable									
	Ethernet Module TCP/IP 10/100 MBPS CP 343-1									
	~~FIPWAY~~ adopter for remote IO rack									
	Remote ~~FIPWAY~~ Agent Module									
	Tap for each Node on the remote IO module									
8.02	Assorted connectors, pre-formed connecting cables, special terminal blocks, bus cables, taps, tap links, networking accessories consisting of patch Pannels, Cat 5 patch cords etc.	Lot		1	1	2				
	Manufacturer :									
	Country of Origin :									

2	Level Sensor	Nos	2	
3	Float Valve	Nos	4	
4	Gate Valve	Nos	2	
5	Gear Oil	Ltr	96	
6	Fills	Set	10 (set)	
7	Nozzles	Nos	100(Nos)	
8	Fan Blades	Set	1	
Axial Flow Fan				
1	Flexible Convass Connection	Sets	20	
2	Grease	Kgs	40	
3	Lubricant Oil Can(500ml)	Nos	4	
4	Water Treatment Chemical for ~~1~~ 2 year dosing	Lots	2	
5	Filter for VSF	Sets	1	
Damper				
1	Fusible link	Nos	12	
2	Actuators for MFD	Nos	4	
3	Actuator for MOD	Nos	4	
BMS SPARES				
DLP SPARE				
S.No	**ECS System**	**Unit**	**Quantity**	
1	Input 24 VDC POS/NEG Logic (4 Groups of 8) 32 points	Nos	1	
2	Output 12/24 VDC POS Logic 0.5A, 2 Groups of 16, 32 Points	Nos	1	
3	Analog Input 15 Bit Current 15 Channel	Nos	1	
4	Analog Output 13 Bit Current 8 Channel	Nos	1	
5	Remote I/O Ethernet Network Inteface Unit	Nos	1	
6	Power Supply with Expended 3.3 VDC 24 VDC Input	Nos	1	
7	Relay Board 16 Channel with 2C/O Omron G2R2 Relays 24 VDC Coil and Contact rating 223 VAC/24 VDC 5A	Nos	1	
8	PS/1AC/24DC/20 Power Supply- Input AC : 85-264, Output : 24V DC, 20 A	Nos	1	
9	PS/1AC/24DC/10 Power Supply- Input AC : 85-264, Output : 24V DC, 10 A	Nos	1	
10	Fan 220 VAC Operated, 4 inch	Nos	1	
11	Glass Cartridge Fuse link, 0.5 A	Nos	15	
12	Glass Cartridge Fuse link, 1.0 A	Nos	15	
13	Glass Cartridge Fuse link, 50 MA	Nos	15	
14	Normal Terminals	Nos	15	
15	Terminal block 4SQMM-Grey, Fuse type	Nos	15	

SCHEDULE OF QUANITITIES FOR PART-C TVS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
	GENERAL									
a.	The equipment covered below shall confirm to the latest relevant standards, specifications, drawing details and the contractor is required to go through them as referred in tender document while quoting the rates. The rates quoted shall be deemed to have included the stringent specifications/standards and the preferred make of the material and intend to provide the material/equipment for the specified service life or the endurance limits which ever is stringent/adequate in the opinion of employer's representative. All the samples/ material intended to use shall be subject to approval before use as the Employer's representative may opt.									
b.	The tender shall normally be quoted through a competent ventilation team . The Ventilation Sub-Contractor shall not be subject to change to ensure the quality of work unless approved by the employer's representative for change in cases of poor quality or delay in work during construction stage.									
c.	The foundation for the equipment shall be provided by civil contractor. The ECS/TVS contractor shall provide foundation detail to civil contractor, incase details are not provided on time then the foundation shall be provided by ECS/TVS system contractor without any extra cost to JMRC.									
d	The fan pressure shown in BOQ is approximate, same shall be augmented as per final design calculation, without any extra cost to JMRC. (within limit of 10% of BOQ)									

SCHEDULE OF QUANITITIES FOR PART-C TVS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
	SECTION-1									
1	**TUNNEL VENTILATION FAN UNITS**									
1.1	Supply, installation, testing and commissioning of axial flow fans including motors, anti vibration mounts, up and downstream metallic diffusers with their supports and flexible sleeves. Fans shall be axial flow type with reversible operation. Emergency fan-motor units shall be required to operate in the forward or reverse direction of airflow, with a capability of starting, stopping, or reversing the direction of flow at any time. Fans, motors, transitions shall be as per specifications and datasheet. All components of complete fan unit shall be rated for 250 Deg.C for two hour.									
1.1.1	Reversible axial flow fans, 2.0m diameter, 85cum/s, 1150 Pa with their motors and all accessories.									
1.1.1.1	Delivery of equipment to the site.	Nos.		0	2	2				
1.1.1.2	Installation and Equipment Testing	Nos.		0	2	2				
1.1.1.3	System Testing, Commissioning and Handover	Nos.		0	2	2				
1.1.2	Reversible axial flow fans, 2.0m diameter, 85cum/s, 1750 Pa with their motors and all accessories									
1.1.2.1	Delivery of equipment to the site.	Nos.		~~4~~ 2	~~2~~ 0	~~6~~ 2				
1.1.2.2	Installation and Equipment Testing	Nos.		~~4~~ 2	~~2~~ 0	~~6~~ 2				
1.1.2.3	System Testing, Commissioning and Handover	Nos.		~~4~~ 2	~~2~~ 0	~~6~~ 2				
1.1.3	Reversible axial flow fans, 2.0m diameter, 75cum/s, 1650 Pa with their motors and all accessories									

SCHEDULE OF QUANITITIES FOR PART-C TVS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
1.1.2.1	Delivery of equipment to the site.	Nos.		2	2	4				
1.1.2.2	Installation and Equipment Testing	Nos.		2	2	4				
1.1.2.3	System Testing, Commissioning and Handover	Nos.		2	2	4				
1.2	Supply, installation, testing and commissioning of axial flow jet fans including motors, anti vibration mounts, up and downstream metallic diffusers with their supports and flexible sleeves. Fans shall be axial flow type with reversible operation. Emergency fan-motor units shall be required to operate with a capability of starting, stopping at any time. Fans, motors, transitions shall be as per specifications and schedule of equipment. All components of complete fan unit shall be rated for 250 Deg.C for two hour.									
1.2.1	Reversible axial flow jet fans(Tunnel Booster Fans),1.25 M diameter, Thrust 1250 N, with their motors, Silencers and all accessories.									
1.2.1.1	Delivery of equipment to the site.	Nos.		0	~~1~~ 0	~~1~~ 0				
1.2.1.2	Installation and Equipment Testing	Nos.		0	~~1~~ 0	~~1~~ 0				
1.2.1.3	System Testing, Commissioning and Handover	Nos.		0	~~1~~ 0	~~1~~ 0				
1.2.2	Reversible axial flow jet fans(Tunnel Booster Fans),1.4 M diameter, Thrust ~~1600~~ 1450 N, with their motors, Silencers and all accessories.									
1.2.2.1	Delivery of equipment to the site.	Nos.		0	~~4~~ 8	~~4~~ 8				
1.2.2.2	Installation and Equipment Testing	Nos.		0	~~4~~ 8	~~4~~ 8				
1.2.2.3	System Testing, Commissioning and Handover	Nos.		0	~~4~~ 8	~~4~~ 8				

SCHEDULE OF QUANITITIES FOR PART-C TVS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
1.3	Supply, installation, testing and commissioning of axial flow fans including motors, anti vibration mounts, up and down stream diffusers with their supports and flexible sleeves. Fans shall be axial flow type with unidirectional operation. Fans, motors, transitions and all other accessories shall be as per specifications and schedule of equipment. Shall be fire rated for 250 degree centigrade for two hour.									
1.3.1	Unidirectional axial flow fans 1.4 M diameter, 31.5 cum/sec 1250 Pascal's.									
1.3.1.1	Delivery of equipment to the site.	Nos.		4	4	8				
1.3.1.2	Installation and Equipment Testing	Nos.		4	4	8				
1.3.1.3	System Testing, Commissioning and Handover	Nos.		4	4	8				
	SECTION-2									
2	**TUNNEL VENTILATION COMPRESSED AIR OPERATED DAMPERS**									

SCHEDULE OF QUANITITIES FOR PART-C TVS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
	Supply, installation, testing and commissioning of Compressed Air Operated dampers. Dampers shall be furnished complete with damper mounting frames for each damper module and all components and incidentals as specified, with all structural support elements and hardware required for installation of the damper modules into composite damper units, and with any additional accessories which may be needed in order to meet the performance requirements as provided in the Specifications. Dampers are compressed air operated. Shall be fire rated for 250 Degree Celsius for 2 hrs. (In case of variation in size of dampers at site ,price quoted shall be paid as per the per square meter rates derived from the item rates of respective dampers)									
2.1	Fan isolation dampers 3.0m x4.0m									
2.1.1	Delivery of equipment to the site.	Nos.		~~4~~ 2	~~4~~ 2	~~8~~ 4				
2.1.2	Installation and Equipment Testing	Nos.		~~4~~ 2	~~4~~ 2	~~8~~ 4				
2.1.3	System Testing, Commissioning and Handover	Nos.		~~4~~ 2	~~4~~ 2	~~8~~ 4				

SCHEDULE OF QUANITITIES FOR PART-C TVS WORKS

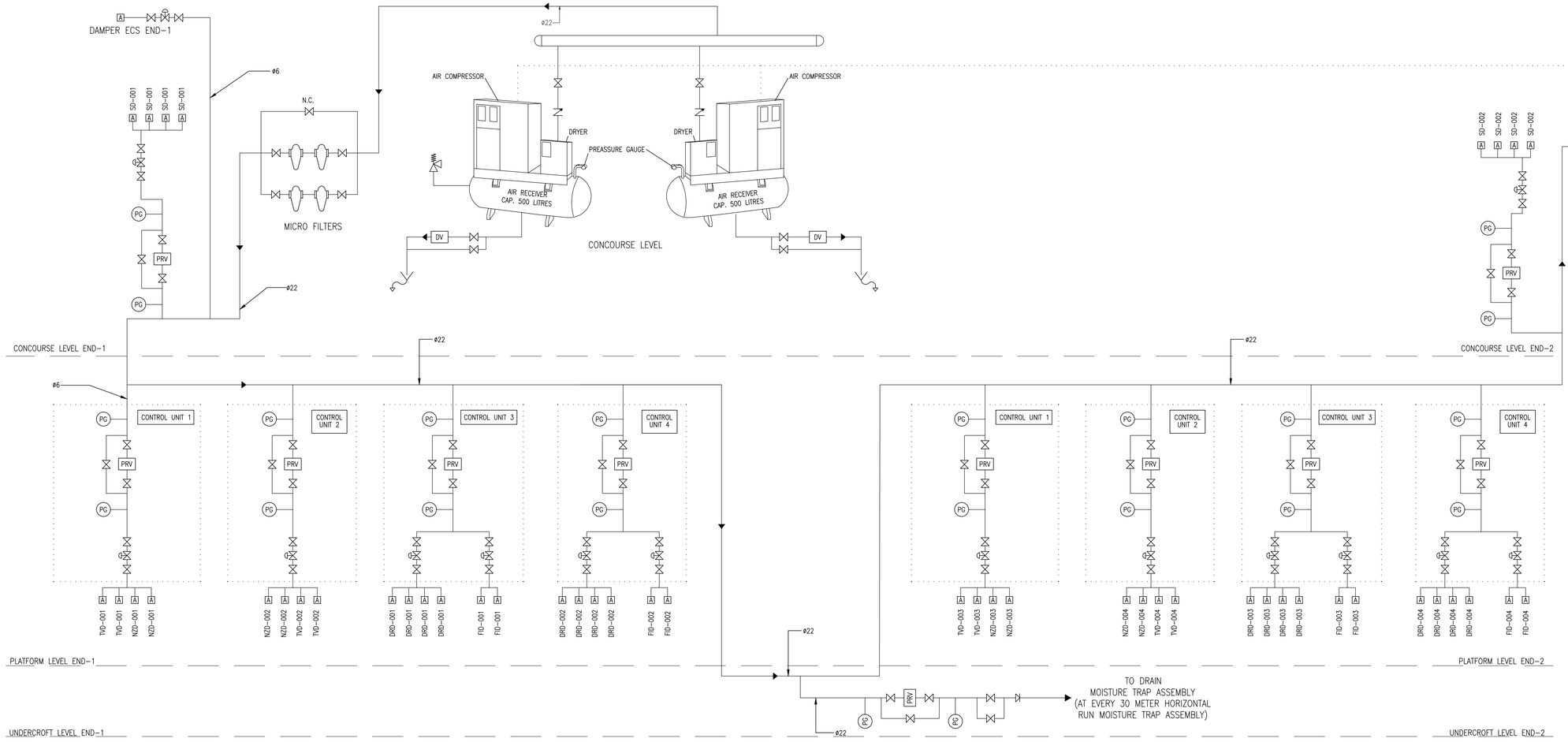
S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
2.2	Nozzle dampers									
2.2.1	Nozzle dampers 2.6 mx3.5m									
2.2.1.1	Delivery of equipment to the site.	Nos.		4	4*	8				
2.2.1.2	Installation and Equipment Testing	Nos.		4	4*	8				
2.2.1.3	System Testing, Commissioning and Handover	Nos.		4	4*	8				
	*** 2 Nos. Nozzle Dampers for Chand Pole Station**									
2.2.2	Draught relief dampers, 4.5m x 4.5m .									
2.2.2.1	Delivery of equipment to the site.	Nos.		4	4	8				
2.2.2.2	Installation and Equipment Testing	Nos.		4	4	8				
2.2.2.3	System Testing, Commissioning and Handover	Nos.		4	4	8				
2.3	Tunnel ventilation dampers, 3m x 4m									
2.3.1	Delivery of equipment to the site.	Nos.		~~4~~ 2	~~9~~ 5	~~13~~ 7				
2.3.2	Installation and Equipment Testing	Nos.		~~4~~ 2	~~9~~ 5	~~13~~ 7				
2.3.3	System Testing, Commissioning and Handover	Nos.		~~4~~ 2	~~9~~ 5	~~13~~ 7				
2.4	Shaft damper,4.5m x 4.5m									
2.4.1	Delivery of equipment to the site.	Nos.		2	2	4				
2.4.2	Installation and Equipment Testing	Nos.		2	2	4				
2.4.3	System Testing, Commissioning and Handover	Nos.		2	2	4				
2.5	Pneumatic ventilation dampers for ECS plant room 2.5mx2.6m (ETVD).									
2.5.1	Delivery of equipment to the site.	Nos.		2	2	4				
2.5.2	Installation and Equipment Testing	Nos.		2	2	4				
2.5.3	System Testing, Commissioning and Handover	Nos.		2	2	4				
2.6	Fan isolation dampers 3.2m x 3.2m									
2.6.1	Delivery of equipment to the site.	Nos.		2	2	4				
2.6.2	Installation and Equipment Testing	Nos.		2	2	4				
2.6.3	System Testing, Commissioning and Handover	Nos.		2	2	4				

SCHEDULE OF QUANITITIES FOR PART-C TVS WORKS										
S.No.	Description	Unit	Country of Origin	Qty. Chhoti Chaupar	Qty. Badi Chaupar	Total Quantity	Rate in INR	Rate in Foreign Currency	Amount in INR	Amount in Foreign Currency
2.7	Tunnel ventilation dampers, 2.5m x 4m									
2.7.1	Delivery of equipment to the site.	Nos.		2	2	4				
2.7.2	Installation and Equipment Testing	Nos.		2	2	4				
2.7.3	System Testing, Commissioning and Handover	Nos.		2	2	4				
	SECTION-3									
3	TUNNEL VENTILATION SOUND ATTENUATORS									
3.1	Supply, installation, testing and commissioning of sound attenuators as per Specifications and schedule of equipment, Casing shall be considered as a part attenuation system and casing thickness shall be considered while considering the acoustic properties. Bidders has to design & select attenuators as per site requirements & TVF equipment selected to meet the performance requirement , substantiated with calculations, without any extra cost to employer. Cross sections of attenuators provided is indicative.									
	Sound attenuators for TVF, 3.0m x 4.0m									
3.1.1	Delivery of equipment to the site.	Nos.		~~8~~ 4	~~8~~ 4	~~16~~ 8				
3.1.2	Installation and Equipment Testing	Nos.		~~8~~ 4	~~8~~ 4	~~16~~ 8				
3.1.3	System Testing, Commissioning and Handover	Nos.		~~8~~ 4	~~8~~ 4	~~16~~ 8				
	Sound attenuators for TEF, 2.1 x 2.1m									
3.2.1	Delivery of equipment to the site.	Nos.		8	8	16				
3.2.2	Installation and Equipment Testing	Nos.		8	8	16				
3.2.3	System Testing, Commissioning and Handover	Nos.		8	8	16				
	Sound attenuators for TVF, 3.2m x 3.2m									
3.3.1	Delivery of equipment to the site.	Nos.		4	4	8				
3.3.2	Installation and Equipment Testing	Nos.		4	4	8				
3.3.3	System Testing, Commissioning and Handover	Nos.		4	4	8				
	SECTION-4									
4	**TUNNEL VENTILATION NOZZLES**									

SCHEDULE OF QUANITITIES FOR PART-C TVS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
4.1	Supply, installation, testing and commissioning of nozzles to suite 85 cms for fans at Platform level made of SS-304 as per drawing enclosed herewith. Nozzles shall be complete with structural supports, mounting flanges and hardware required to complete the installation. All supports shall be galvanised mild steel.	Nos.		4*	~~2~~ 0	~~6~~ 4				
4.2	Supply, installation, testing and commissioning of nozzles to suite 75 cms for fans at Platform level made of SS-304 as per drawing enclosed herewith. Nozzles shall be complete with structural supports, mounting flanges and hardware required to complete the installation. All supports shall be galvanised mild steel.	Nos.		~~0~~ 2	~~0~~ 2	~~2~~ 4				
	*** 2 Nos. for Chandpole station**									
	SECTION-5									
5	**COMPRESSED AIR SYSTEMS**									
5.1	AIR COMPRESSORS									

SCHEDULE OF QUANITITIES FOR PART-C TVS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
5.1.1	Supply, installation, Testing & commissioning of, screw type air cooled compressed air package consisting of 2 nos. air compressors with safety devices and each having capacity of 0.79m3/Minute with working pressure of 13 bar and a air receiver of 500 litre capacity. Compressed shall be as per specifications, data sheet, drawings & as required. Each compressor shall have its own Air Tank & Refrigerated Air Dryer control panel, Air Dryer, Filters as per air flow diagram, specifications and data sheets enclosed. Price shall include hard drawn copper tubing, Ball Valves, Strainers Float Traps, Solenoid Valves, Pressure Regulating Valves, Electronic Drain Valves, Pressure Reducing Station, Moisture Separator and trap, solenoid boxes for BMS Control as per drawings, data sheets and specifications.	lot		1	0	1				

SCHEDULE OF QUANITITIES FOR PART-C TVS WORKS										
S.No.	**Description**	**Unit**	**Country of Origin**	**Qty. Chhoti Chaupar**	**Qty. Badi Chaupar**	**Total Quantity**	**Rate in INR**	**Rate in Foreign Currency**	**Amount in INR**	**Amount in Foreign Currency**
5.1.2	Supply, installation, Testing & commissioning of, screw type air cooled compressed air package consisting of 2 nos. air compressors with safety devices and each having capacity of 1.21m3/Minute with working pressure of 13 bar and a air receiver of 500 litre capacity. Compressed shall be as per specifications, data sheet, drawings & as required. Each compressor shall have its own Air Tank & Refrigerated Air Dryer control panel, Air Dryer, Filters as per air flow diagram, specifications and data sheets enclosed. Price shall include hard drawn copper tubing, Ball Valves, Strainers Float Traps, Solenoid Valves, Pressure Regulating Valves, Electronic Drain Valves, Pressure Reducing Station, Moisture Separator and trap, solenoid boxes for BMS Control as per drawings, data sheets and specifications.	lot		0	1	1				
	SECTION-6									
6	Fire rated Galvanized Iron ducting complete with supports as per specifications and drawings including all necessary civil work required for installation of complete TVS System in both the TVS Plant rooms in each station .	LS		1	1	2				
	TOTAL SECTION 6									
	GRAND TOTAL of Part - C									
	Note:- 1.Quantity may be vary as per latest drawing.									
	GRAND TOTAL FOR TVS WORK									



LEGEND

- SAFETY VALVE
- PG — PREASSURE GAUGE
- DV — ELECTRONIC DRAIN VALVE
- CHECK VALVE
- BALL VALVE
- FILTER
- SOLENOID VALVE
- PRV — PRESSURE REDUCING VALVE
- A — PNEUMATIC ACTUATOR
- FLOAT TRAP

EQUIPMENT	QTY.	RK TAG. NO.
TUNNEL VENTILATION FAN REVERSIBLE	4	TVF-001 to 004
TUNNEL VENTILATION DAMPER	4	TVD-001 to 004
FAN ISOLATION DAMPER	4	FID-001 to 004
DRAUGHT RELIEF DAMPER	4	DRD-001 to 004
NOZZLE DAMPER	4	NZD-001 to 004
SHAFT DAMPER	2	SD-001 to 002

NOTE:

1. ALL PIPE WORK IS LAID TO FALL IN THE DIRECTION OF COMPRESSED AIR FLOW IN 1/100 SLOPE
2. THE MOTOR CONTROL PANEL SHALL BE INCORPORATED WITH AUTOMATIC DAILY LEAS-LAG SEQUENCE OF THE AIR COMPRESSORS FOR OPTIMUM EFFICIENCY OPERATION.
3. DRAIN TRAP ASSEMBLIES SHALL BE PROVIDED AT THE BASE OF EACH VERTICAL BRANCH MAIN MOISTURE SEPARATORS AIR RECEIVERS, AND AT INTERVALS NOT EXCEEDING 30m OF HORIZONTAL PIPE RUN.
4. THE PRE-FILTER AND THE AFTER-FILTER SHALL CONSIST OF DRAIN VALVE AND SUMP TO FACILITATE PERIODICAL DRAINING OF THE HOUSING EITHER AUTOMATICALLY O MANUALLY

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5. ALL DOOR/WINDOW CILL & LINTEL LEVELS ARE MEASURED FROM MAIN FLOOR FINISHED LEVELS.

REFERENCE DRAWINGS

Drg. No.	Description

REVISIONS

REV	PARTICULARS	DRN.	CHD.	VER.	DATE	ISSUE DATE	REV. FOR CONSTRUCTION

APPROVAL BY DMRC

DMRC APPROVAL	MGR/ARCH	DY CA (UG)-III	CA/ARCH
DY CSTE/TELECOM	CSTE-I	DY CE/DESIGN	CE/TECH
DY CSTE/AFC		ED/S&T	CSO
DY CSTE/SIGNALLING	CSTE-III	GM/O	GM/M
DY CE/PLANNING	DY CEE/E&M	DY CEE/ECS	ED/ELEC -II
DY CEE/(E)UG-TR	CGM(E) UG-TR	PM	CPM

Certified that this document has been designed and checked in accordance with DDC Quality Assurance Plan.

Authorised Signatory for DDC.
JP/EW/1B/DDC01 Project Manager

Architecture	Structure	E&M
Design In-charge/ Coordinator	Design In-charge/ Coordinator	Design In-charge/ Coordinator

DETAIL DESIGN CONSULTANT (DDC) FOR CIVIL, ARCHITECTURAL & BUILDING WORKS OF TWO UNDERGROUND STATION (CHOTI CHOUPAR & BADI CHOUPAR), SHAFT AND TUNNELS OF PHASE 1B OF JAIPUR METRO

ayesa Engineering. Information. Imagination.

56, Indo-Asia House, Institutional Area, sector-44
Gurgaon - 122002 (Haryana)

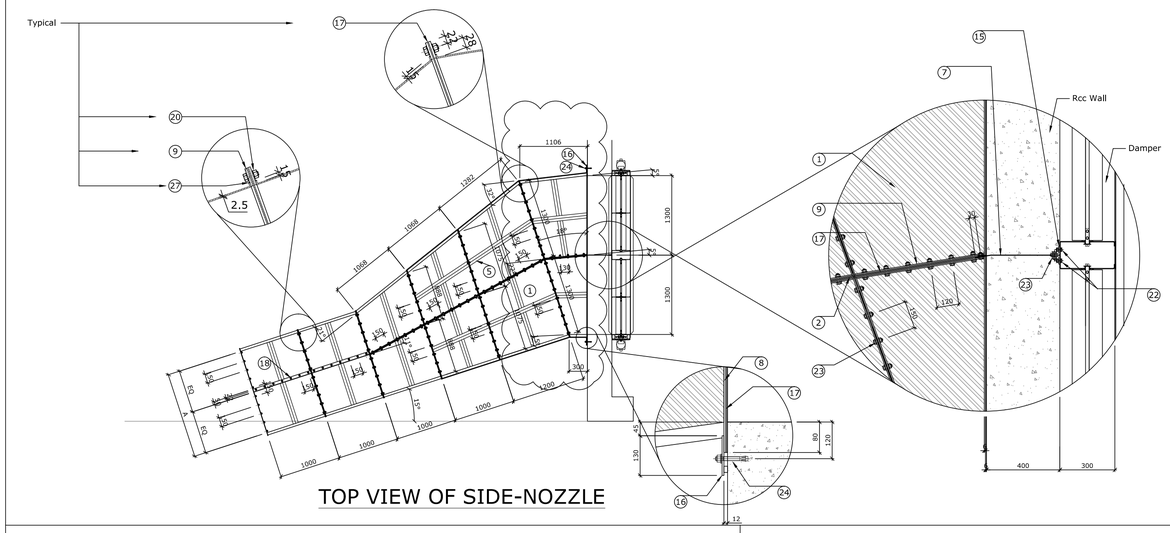
DELHI METRO RAIL CORPORATION LTD.
Metro Bhawan , Fire Brigade Lane, Barakhamba Road, New Delhi-110001

PHASE 1B JAIPUR METRO PROJECT

STATION: **CHOTI & BADI CHAUPAR**

DRAWING TITLE: AIR COMPRESSOR SCHEME

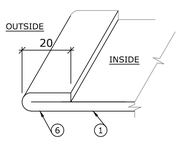
DRAWN BY :	CHECKED BY:	VERIFIED BY:		
MOHD ADIL	VIKAS	L.R. SHARMA		
DATE: 22-07-2016	REV: R1	GRAPHICAL SCALE: N.T.S	STATUS: CRD	
DRAWING NUMBER: JP-CRD-TVS-DET-1908	SHEET NO. 1 OF 1	SHEET SIZE UNE A1	ORDER Nº P36-0017	JP/EW/1B/DDC01 ECS/TVS



TOP VIEW OF SIDE-NOZZLE

Material of Construction

Part No.	Part Name	Material		Size	Unit	Qty.
1.	Nozzle Body	SS 304	Sheet	2.5mm thick		56 m^2
2.	Main Air Splitter	SS 304	Sheet	2.5mm thick		10.6m^2
3.	Sub Air Splitter	SS 304	Sheet	2.5mm thick		3.6m^2
4.	Mating angle welded to nozzle body	SS 304	Angle	50x50x6 thick	m	3.3
5.	Stiffners	SS 304	Angles formed from sheet	40x40x2.5 thick	lot	1
6.	End Stiffner	SS 304	Sheet	20mm reverse fold	m	8.2
7.	Joining Sheet	SS 304	Sheet	2.5 thick		1.5m^2
8.	Main Flange	SS 304	Flat	80x6mm	m	12.2
9.	Parting Flanges	SS 304	Flat	50x6mm	m	102
10.	Mating angle welded to nozzle body	SS 304	Angle	65x65x6 thick	m	0
11.	Support Material	MS HDG	Channel	100x50x5 thick	m	2.4
12.	Support Material	MS HDG	Channel	100x75x5 thick	m	0
13.	Support Material	MS HDG	Angle	75x75x6 thick	m	41
14.	Support Material	MS HDG	Angle	65x65x6 thick	m	0
15.	Support Material	MS HDG	Angle	50x50x6 thick	m	0
16.	Fixing Clamp	MS HDG	Plate	130x130x6 thick	no.	32
17.	Gasket	Ceremic Fire Rated		6mm	m	71
18.	Bolt, Lock Nut assembly	SS 304	-	M8	set	28
19.	Bolt, Lock Nut assembly	SS 316	-	M10	set	87
20.	Bolt, Lock Nut assembly	SS 316	-	M10	set	394
21.	Bolt, Lock Nut assembly	GI	-	M8	set	0
22.	Bolt, Lock Nut assembly	GI	-	M10	set	0
23.	Bolt, Lock Nut assembly	GI	-	M12	set	48
24.	Anchor Bolt	-	-	M10	set	92
25.	Anchor Bolt	-	-	M12	set	0
26.	Lifting Eye	SS 304	-		no.	12
27.	Welding	-	-		lot	1



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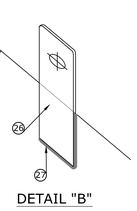

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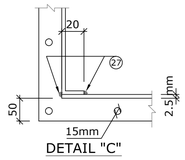

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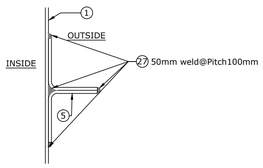

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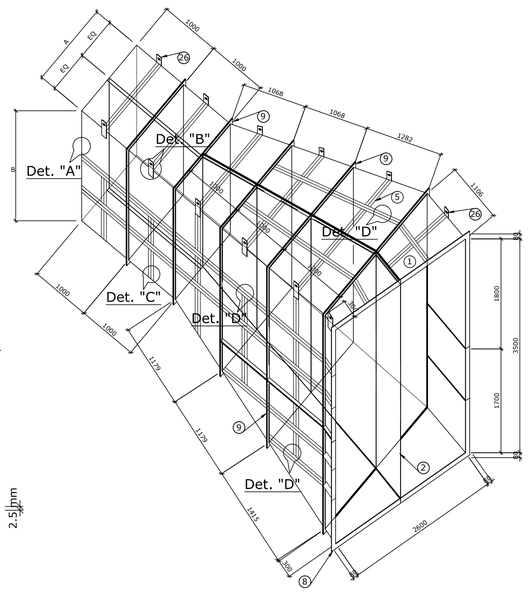
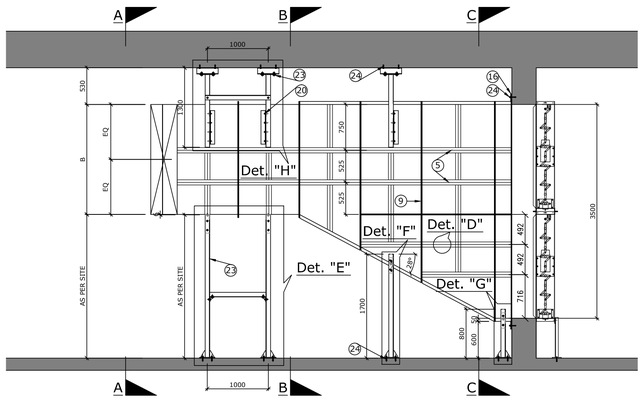


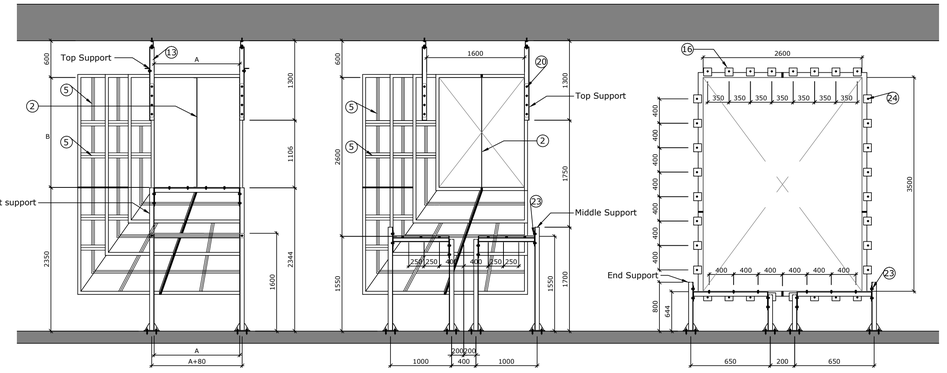
ISOMETRIC VIEW OF SIDE-NOZZLE

TYP. NOZZLE SIZE:-

TVS FAN CAP.(CMS)	NOZZLE DISCHARGE OPENING SIZE (MM)	
	A	B
75	1400	1800
85	1400	2000
100	1400	2400



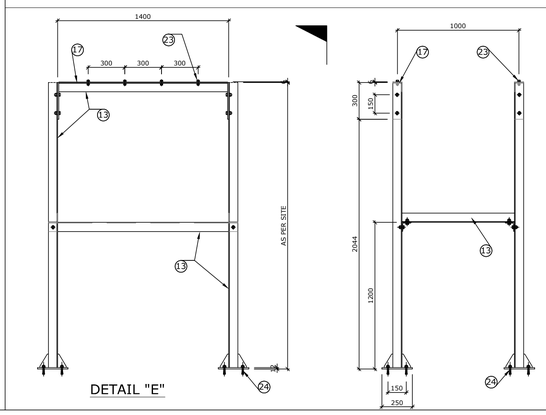
SIDE VIEW OF SIDE-NOZZLE



SECTION "A"

SECTION "B"

SECTION "C"



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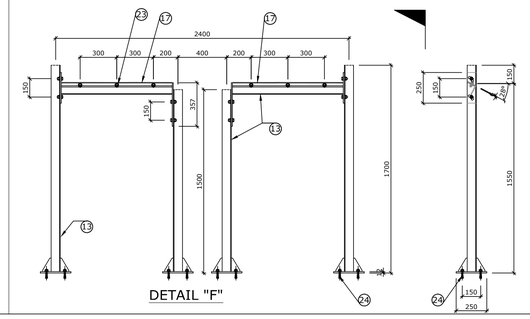

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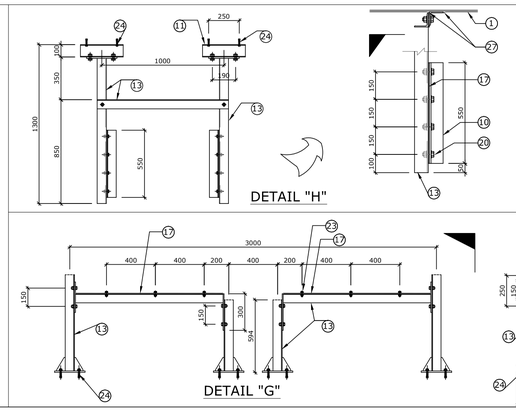

DETAIL "H"

DETAIL "G"

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REFERENCE DRAWINGS

Drg. No.	Description

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REVISIONS

REV	PARTICULARS	DRN.	CHD.	VER.	DATE	ISSUE DATE	REV. FOR CONSTRUCTION

APPROVAL BY DMRC

DMRC APPROVAL	MGR/ARCH	DY CA (UG)-III	CA/ARCH
DY CSTE/TELECOM	CSTE-I	DY CE/DESIGN	CE/TECH
DY CSTE/AFC		ED/S&T	CSO
DY CSTE/SIGNALLING	CSTE-III	GM/O	GM/M
DY CE/PLANNING	DY CEE/E&M	DY CEE/ECS	ED/ELEC -II
DY CEE/(E)UG-TR	CGM(E) UG-TR	PM	CPM

Certified that this document has been designed and checked in accordance with DDC Quality Assurance Plan.

Authorised Signatory for DDC.
JP/EW/1B/DDC01 Project Manager

Architecture	Structure	E&M
Design In-charge/ Coordinator	Design In-charge/ Coordinator	Design In-charge/ Coordinator

DETAIL DESIGN CONSULTANT (DDC) FOR CIVIL, ARCHITECTURAL & BUILDING WORKS OF TWO UNDERGROUND STATION (CHOTI CHOUPAR & BADI CHOUPAR), SHAFT AND TUNNELS OF PHASE 1B OF JAIPUR METRO

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Gurgaon - 122002 (Haryana)

DELHI METRO RAIL CORPORATION LTD.
Metro Bhawan , Fire Brigade Lane, Barakhamba Road, New Delhi-110001

PHASE 1B JAIPUR METRO PROJECT

STATION: **CHOTI & BADI CHAUPAR**

DRAWING TITLE: TVS STANDARD DETAILS SIDE NOZZLE INSTALLATION DETAILS

DRAWN BY:	CHECKED BY:	VERIFIED BY:	
MOHD ADIL	VIKAS	L.R. SHARMA	
DATE: 22-07-2016	REV: R1	GRAPHICAL SCALE: N.T.S	STATUS: CRD

DRAWING NUMBER:	SHEET NO.	SHEET SIZE	ORDER N°	
JP-CRD-TVS-DET-1909	1 OF 1	UNE A1	P36-0017	JP/EW/1B/DDC01 ECS/TVS

Appendix 7

ENGINEER'S ACCOMMODATION FOR OFF SITE WORK

Clause 15.6 of GS

1. Accommodation for the Engineer shall consists of a Project Office and 2 Number of site offices to be located at the Contractor's principal works areas.

   The project office shall be preferably close to the Contractors main office and provide the following rooms with assistant to engineer as mentioned here:-

S.N.	Principal Site Office	Nos. of Staff	Area (Sqm)	Area required (Sq.m)	Remarks
1	Resident Engineer OHE/E&M	1	20	20	Room+Toilet
2	Ex.EN/A.E (OHE)	1	10	10	Room
3	Ex. EN/A.E (E&M)	1	10	10	Room
4	Office Manager	1	6	6	Work Station
5	CAD Operator	1	6	6	Work Station
6	Secretary	1	6	6	Work Station
7	JE	6	6	36	Work Station
8	Driver Rest Room	1	8	8	Work Station
9	Meeting Room (Large)	1	30	30	Room
10	Visitors Lobby	1	30	30	Room+Toilet
11	Drawing Storage	1	10	10	Room
12	File & Document Storage	1	10	10	Room
13	Toilets with Changing Room	1	10	10	Room
14	Pantry	1	10	10	Room
	TOTAL			**202 Sqm**	

In addition to the project office, 2 nos. site offices at two stations ~~of 50 sq meters each of useable office area~~ including furniture and other facilities as required will be provided by contractor or as agreed by the Engineer. The building/rooms only for the project office shall be provided by the employer, however, the furnishing/preparation of the office to provide decent ambience & appearance of a good corporate shall be provided by the contractor. The site offices can be containerised in case the space/rooms are not provided by the employer.

Materials used for the construction/furnishing of the offices shall be new and of good quality material shall be chosen such that the buildings when erected shall give good heat and sound insulation, and when combined with the heating and air condition equipment installed by the Contractor will enable interior temperatures to be maintained at within a range of 20-24 deg C at all times ~~(with Approx. 30% area as air conditioned)~~ except for the toilets, pantry, storage, drivers rest room.

1. The contractor will provide the one air conditioned (A/C) car (Swift Desire or equivalent and mileage 2000 Km per month) & one non A/C car (Indigo or equivalent and mileage 3000 Km per month) in good working condition in addition to emergency site vehicle (Multi Utility Type and mileage 3000 Km per month) as required by Engineer.

2. ~~Windows to each room shall be of an area not less than 10% of the floor area. All windows to ground floor offices shall be fitted with burglar bars firmly attached to the structure of the building.~~ All windows shall be fitted with mosquito netting. All opening windows shall be fitted with locks and all sets of keys shall be delivered to the Engineer. All windows shall be fitted with Venetian blinds.

3. External doors shall have barrel bolts both at top and bottom of one leaf and a Yale lock on the other leaf as applicable. External doors shall be of solid external quality and hung with heavy-duty hinges as applicable.

4. All buildings shall be supplied with continuous (24 hour) running potable cold water to the kitchens and wash rooms. The toilets may use raw water for flushing, shall be equipped with water closets and sitting type stools and shall be adequately ventilated through the ceiling. The Contractor shall also arrange for the constant and hygienic disposal of all effluent, sewage and rubbish from the buildings. Storage tanks will be required due to restricted hours of water supply in the Jaipur Area as applicable.

   The offices shall be provided with round the clock security guards as required by the Engineer.

5. All buildings shall be supplied with electricity at 240 voltage and 50 Hz that shall be distributed to each room in accordance with the Regulations. Lighting and electrical power points shall be provided in each room. The disposition and location of light and power points will be as directed by the Engineer. A backup generator is required to be provided to meet the full power load in case of power disruption.

6. The office shall be provided with two landline telephone connections with STD and Broadband connections of speed as agreed by Engineer for EPBAX & Fax.

7. All stationary items shall be provided by the Contractor to ensure smooth functioning of the office as required by the Engineer. The maximum expenditure towards stationary shall be limited to an average of Rs. 20000.00 per month for the entire contract period.

8. Pantry shall be provided with worktops, a 2 drainer stainless steel double sink, cupboards beneath the worktop and mounted on the walls, a cooker with 2 no. 2 gas rings and 2 microwave oven and a 5 cu ft. refrigerator. Coffee making facilities for 20 persons shall be provided. Tiling shall be provided to the walls above the sink, cooker and worktops.

~~9. Changing and shower facilities shall be provided as follows:~~

   ~~- Male facilities: 1 shower and 2 wash basins with 15 clothes lockers and benching with pegs over for 6 persons.~~

   ~~- Female facilities: 1 showers and 1 wash basins with 5 clothes lockers and benching with pegs over for 2 persons.~~

   ~~Each shower shall be provided with hot and cold water supply and shall be contained in an individual cubicle with a screen or curtain to the entrance. Modesty screens shall be provided adjacent to the entrance to all changing and shower facilities.~~

10. The Contractor shall provide, erect and maintain appropriate name boards as specified for each of the offices. The wording on each name board and its location shall be agreed by the Engineer before it is erected.
11. All the facility as listed in appendix-7 shall be the in the contractor's scope up to the stipulated date of completion of the contract. In case, if the contract gets extended beyond the stipulated period, the actual expenses incurred shall be reimbursed by the employer

12. The Contractor shall supply the following new furniture and equipment to the Engineer's offices in the manner required by the Engineer.

- Conference table (2400 x 900) 1 Set

-	Conference chairs		20 No.
-	Communication Facility	All other Facilities as shown in Appendix-B)	
-	~~Other office stationary~~		~~As required~~
-	Waste paper baskets		10 ~~20~~ No.
-	4-hole document punches		2 No.
-	~~Desk tray sets~~		~~20 No.~~
-	5 L kettles		2 No.
-	2 L kettles		1 ~~3~~ No.
-	Potable water dispenser with hot/cold/normal		
	Caps and disposal cups/glasses of good quality		2 ~~3~~ No
-	Cups and saucers		50 No.
-	Side plates		40 No.
-	15- piece dinner service		1 set
-	15-piece cutlery service		1 set
-	Fire extinguisher		4 Nos.
-	Office Boy		4 Nos.
-	Messenger		2 Nos.
-	Security Guards		3 Nos

ASSISTANCE TO ENGINEER

Project Office	No. of staff	Sr. Ex. Table	Manager table	Office table	Sr. Ex. Chair	Ex. Chair	Sofa set	Visitor chair	Work station	Office chair	Digital camera	EPBX	Vehicle	Cad Operator	Secretary	Side unit with sliding	Filing cabinet	Messenger	Attendant	Conference Table	Internet connection	Refrigerator	Microwave oven	Drawing cabinet	Tea Coffee dispenser	Xerox Machine	Fire extinguisher	Hot case	Steel door cupboards	PC with UPS	Scanner cum printer	Fax
RE	1	1			1		1	6				1	1		1	1	1	1	1		For All								2	1	1	
Ex.En/A.En	2		2			2		4			2	2	1			2	2	1	2										2	2	2	
JE (Site)	2			2						6									1										1			
JE	4								4																					6		
Office Manager	1								1	1																						
Common Facilities								10						1						1	1	1	2	1	1	1	1	2	1	1	1	1

(d) The discounts offered and the methodology for their application are as follows: _____

(e) Our Bid shall be valid for a period of 180 days from the date fixed for the submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

(f) If our Bid is accepted, we commit to obtain a performance security in accordance with the Bidding Document.

(g) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract: [1]

Name of Recipient	Address	Reason	Amount
.....	.....	.....	.....
.....	.....	.....	.....

(h) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed.

(i) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

(j) We agree to permit ADB or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by ADB.

Name .....

In the capacity of .....

Signed .....

Duly authorized to sign the Bid for and on behalf of .....

Date .....

[1] **Use one of the two options as appropriate.**

		The Guarantee Test of the Facilities shall be successfully completed within 3 months from the date of Completion.
23.	**Sub Clause 26.2**	**Completion Time Guarantee** Time is the essence of the contract and therefore if the work is delayed on account of the contractor, liquidated damage shall be recovered @ 0.01% of the contract value per one week delay of the individual KD (Key Dates). However the total liquidated damage is subjected to 10% of the contract value. The liquidated damage of 0.01% is for two stations (Choti Chaupar and Badi Chaupar) which will be distributed equally for each station and the same shall be levied only for the station (s) where key date is not achieved". The liquidated damages are recovered by the Employer from the Contractor for delay and not as penalty. The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any **sum** due, or to become due, to the Contractor. In the event of an extension of time being granted, the amount due under this Sub-Clause shall be recalculated accordingly, and any over-payment refunded. The payment or deduction of such damages shall not relieve the Contractor from his obligations to complete the Works, or from any other of his duties, obligations or responsibilities under the Contract. The Contractor shall use and continue to use his best endeavours to avoid or reduce further delay to the Works, or any relevant Stages. **At any time after the Employer has become entitled to liquidated damages, the Engineer may give notice to the Contractor under clause 42 of GCC requiring the Contractor to complete the Works within a specified reasonable time. Such action shall not prejudice the Employer's entitlements to recovery of liquidated damages, under this Sub-Clause and to terminate under clause 42 of GCC.**
24.	**Sub Clause 26.3**	No bonus will be given for earlier Completion of the Facilities or part thereof.
25.	**Sub Clause 27.2**	**Defect Liability and AMC** Defect liability period shall be 24 months from the date of issue of taking over certificate. During the Defects Liability Period the Contractor shall provide, free of cost, competent and skilled personnel and maintain adequate stock of spares so as to promptly fulfil his obligations during the Defects Liability Period as laid down in GCC and Employer's Requirements. A penalty of Rs.10000/- per day in DLP period will be imposed if major equipment (as defined in the contract documents) or any complete system is not working for more than 24 Hrs.

Contract Agreement

THIS AGREEMENT made on the [*insert number*] day of [*insert month*], [*insert year*],

BETWEEN

(1) JAIPUR METRO RAIL CORPORATION LTD., a corporation incorporated under the laws of [*country of employer*] and having its principal place of business at Khanij Bhawan, Tilak Marg, C-Scheme, Jaipur (Rajasthan), India, PIN–302 005 (hereinafter called "the Employer"), and (2) [*name of contractor*], a corporation incorporated under the laws of [*country of contractor*] and having its principal place of business at [*address of contractor*] (hereinafter called "the Contractor").

WHEREAS the Employer desires to engage the Contractor to "Design Verification, Detail Engineering, Supply, Installation, Testing and Commissioning of Environment Control System (ECS), Tunnel Ventilation System (TVS), Electrical and Mechanical System (E&M) and Building Management System (BMS) for two underground Metro Stations at Chhoti Chaupar and Badi Chaupar on East–West Corridor of Jaipur Metro Phase- 1B NCB No. JP/EW/1B/E1:" ("the Facilities") ("the Facilities") and the Contractor have agreed to such engagement upon and subject to the terms and conditions hereinafter appearing.

NOW IT IS HEREBY AGREED as follows:

Article 1 Contract Documents

1.1 **Contract Documents** (Reference GCC Clause 2)
The following documents shall constitute the Contract between the Employer and the Contractor, and each shall be read and construed as an integral part of the Contract:

(a) This Contract Agreement and the Appendices hereto
(b) Letter of Price Bid and Price Schedules submitted by the Contractor
(c) Employer's requirements
(i) BOQ
~~(i)~~(ii) Technical and General Specifications
~~(ii)~~(iii)Drawings
~~(iii)~~(iv) Other requirements
(d) Special Conditions of Contract
(e) List of Eligible Countries that was specified in Section 5 of the Bidding Document
(f) General Conditions of Contract
(g) Other completed Bidding Forms submitted with the Letters of Technical and Price Bids
(h) Any other documents part of the Employer's Requirements
(i) Letter of Technical Bid and Technical Proposal submitted by the Contractor

1.2 **Order of Precedence** (Reference GCC Clause 2)
In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Contract Documents are listed in Article 1.1 (Contract Documents) above.

1.3 **Definitions** (Reference GCC Clause 1)
Capitalized words and phrases used herein shall have the same meanings as are ascribed to them in the General Conditions.

c. If the currency in which the Contract price, Po, is expressed is different from the currency of the country of origin of the labour and/or materials indexes, a correction factor will be applied to avoid incorrect adjustments of the Contract price. The correction factor shall correspond to the ratio of exchange rates between the two currencies on the base date and the date for adjustment as defined above.

d. No price adjustment shall be payable on the portion of the Contract price paid to the Contractor as an advance payment against the equipment if applicable.

e. The price adjustment shall be applicable for the following only:-

S.No.	Item
1	Panels
2	Cables
3	Water Cooled Chillers
4	Air Cooled Chillers
5	Tunnel Ventilation Fans
6	Tunnel Booster Fans
7	Track way Exhaust Fans
8	TVS Damper

f. Price adjustment is applicable for items where Supply price is quoted separately as per BOQ for above items.

Appendix 4 - Time Schedule

Key Dates	Description	Key Date in Weeks
KD-1	Detail Engineering and Submittal of Technical proposals of major equipment to Engineer for Approval	24
KD-2	Submission of Working Drawings/ Shop Drawings	~~30~~ **26**
KD-3	Delivery of Major Equipment to Site	~~56~~ **52**
KD-4	Installation of Majority of Equipment and commence system testing	~~70~~ **68**
KD-5	Completion of Substantial Works (including BMS SCADA Interfacing) to permit Integrated Testing (Completion of System Acceptance Testing)	~~82~~ **75**
KD-6	Completion of Balance Works	80
KD-7	Integrating Testing and Handing over to Employer	90
KD-8	Peak Season Performance Testing	108
KD-9	Integration of system with existing line and Final System Adjustment	110

Note:

a) All the key dates are from the date of commencement.

b) For the part week, full week will be considered for this purpose.

c) The site shall be made available progressively and if some part is not made available then the extension of time shall be allowed only to the work/KD of that particular part.

- To receive digital status such as the "ON/OFF" or alarm status of equipment.
- To directly control the starting/stopping of the TVS equipment and opening /closing of the associated dampers.
- To output analogue signals in the form of voltage or current (0-10V, 4-20 mA) to the transducers in the control device panel of the equipment where they are converted into suitable signals to drive the actuators or other control device such as valves.
- To receive analogue signals in the form of voltage or current (0-10V, 4-20 mA) from field sensors, convert these signals into Engineering units and reporting them to the SCADA.
- To log and report alarms of analogue signals which have exceeded pre-set high/low or rate of change limits.
- To receive set-point information from the SCADA and PM terminals during initialisation or up dating and store these set-point values in the memory for control reference and function.
- To receive operation mode commands from the SCADA and operate the fans and dampers in a pre-set configuration with insertion of time delays and interlocking logic.
- To monitor the activation of the push buttons or switches on the VCP, ~~SCP~~ and LCP and execute priority control.
- To automatically restart the TVS equipment when power to TVS plant is restored after a power failure or interruption, sequentially without causing the MCC circuit breakers to trip.
- To provide the interlocking functions required for the TVS and AHU equipment during operation in the TVS Closed System Mode
- To automatically start the standby TVS equipment and their associated equipment and dampers upon detection of failure of the TVS and ECS equipment.

1.3 Verification and validation of design

Although responsibility for the design service of the Works lies with the Detailed Design Consultants (DDC) the Contractor shall thoroughly satisfy himself that the logics defined or specified herein meet the functional and operational requirements.
The contract price shall add any necessary equipment, equipment of higher capacities and higher ratings for the systems and sub-systems necessary for the complete, safe, reliable and operable BMS providing all clarifications and justifications for the same.

2 Responsibility of the TVS SCADA Contractor

- Any other specification required for completing the above works.

BMS/2.01.30. Design Considerations

The complete installation shall be in strict accordance with the national and local electrical codes. All devices designed for or used in line voltage applications shall be U.L./CE.

A) All system components are to be designed and built to be fault tolerant:

- Satisfactory operation without damage at 110% and 85% of rated voltage and at +3 hertz & - 1.5 Hz variation in line frequency.
- Static, transient, and short circuit protection on all inputs and outputs.
- Communication lines protected against in-correct wiring, static transients and induced magnetic interference.
- Bus connected devices to be a.c. coupled or equivalent, so that any single device failure will not disrupt or halt bus communication.

B) All equipment, cables and wiring shall be designed, manufactured and installed so as to secure a service life as shown below:

- IT Componets 7 Years
- Control Panels 10 Years
- Cables 30 Years
- Tray, trunking and supports 30 Years
- Sub-assemblies and components 10 Years
- All other equipment 10 Years minimum

C) Switchboards, equipment, and other control components shall be rated for operation in ambient temperatures of 40°C and humidity up to 75% and shall have degree of protection IP-65 /54.

In the design of switchboards and local control panels an allowance of 20-25% spare capacity shall be provided for possible future expansion and all panels shall be user friendly, modular and aesthetic design, termite and vermin proof.

BMS/2.01.31. Tender Submittal Procedure

To allow evaluation of vendors and the systems being offered, a detailed technical proposal shall be provided and formatted strictly in accordance to this outline. Vendor's standard literature not complying to this format and content requirement will not be considered or evaluated. Proposal requirements are as follows:

- Proposed system complete with location and block diagram including central computer type and memory, peripherals, communication interfaces, all LAN cards, all active hubs and repeaters, network layout, distributed peer bus connected control/monitor panels with location, listing of equipment directly connected to a peer bus controller, and secondary network drivers and connected systems.
- Provide copies of required UL listing cards.
- Technical Compliance - Provide TYPED responses to each point of Technical Compliance

PLC's shall be supplied and installed for monitoring and controlling equipment that shall consist of:

- A microprocessor based processor (CPU)
- Input and output interface modules suitable for a mixture of digital, analog and pulse inputs and outputs.
- Power supply and internal battery back-up equipment.

BMS/5.01.12. Functionality

The PLC shall perform the following functions:

- Cyclical measurement of the state or value of each input signal.
- Cyclical, uninterruptible execution of software, which performs functions according to a predetermined sequence, or programme.
- Cyclical and regular update of its output according to the results of those computations.

BMS/5.01.13. PLC Processor

The PLC processor shall a multi tasking, multi CPU architecture with capability of solving complex mathematical functions.

The PLC Processor shall have extensive diagnostics, and should have the capability to monitor and detect faults in Individual channels of I/O modules.

All the Modules of the PLC platform should have the capacity to be inserted and removed under fully powered up conditions, including the CPU Module.

The Power Supply Modules of the PLC platform should be able to source the Interrogation Power Supply directly from the In Rack Power Supply.

The PLC processor can either have an 100 MBPS Ethernet Processor or have the ability to configure an Ethernet Interface Module to it, either of which shall conform to all the specifications listed in this document. The protocol used over Ethernet shall be Modbus over TCP/IP or Ethernet IP.

The PLC should have the capacity to be monitored over an Ethernet network.

The PLC processor shall be able to monitor its resident I/O while also being able to communicate with a SCADA network over an Ethernet network.

The processor shall as a minimum should have following on-board memory:

• 2 × ~~2~~ 4 MB flash for the system and application program.

~~• 2 × 512 kbyte SRAM with battery backup (for IO, markers, counters, timers and registers).~~ Processor shall have provision for program back-up during power failure.

~~• 2 × 512 kbyte SRAM for data-exchange with the other Control Processor.~~

The PLC Processor shall have dedicated processing capabilities for deterministic processing of analog loops

The PLC processor shall have a built-in serial port or RS 485 Modbus port and the ability to add additional serial ports that can be configured communication.

The PLC processor shall have the ability to receive and map signals from third party systems but in particular from the Fire Alarm System over Modbus RS 485 protocol/BACnet IP/Ethernet IP.

The processor serial port shall be suitable for connection to any other devices that can send and receive ASCII characters and communicate using MODBUS protocol characteristics.

The processor should be able support data transfer and remote programming for standard applications in addition to peer-to-peer communications between other processors and devices, on the Ethernet network.

It will be possible to connect a single industrial terminal to the port to program the respective PLC processor with either on-line or off-line capabilities.

The PLC processor will have a configurable memory with state of art hardware. (utilize up to 65% of its original capacity)

- < 512 I/O Count 1.0 MB Memory
- up to 1024 I/O Count 2.0 MB Memory
- up to 2048 I/O Count 4.0MB Memory
- up to 3072 I/O Count 8.0 MB Memory

The PLC processor will have the capability to support one of the following language structures:

- Structured Text
- Sequential Function Charts
- Ladder Logic
- Function Block

The processor shall support the Advanced Instruction Set that includes basic and advanced ASCII string instructions, and advanced math functions.

The processor shall support a system protection environment with passwords and privileges and support a form of backup communications module.

The PLC system shall be designed fail-safe, in terms of operating logic. A “1” logic signal is considered to be normal state, and a “0” logic signal is the trip state. Logic output signals are to fail to a “0” state on power failure, or on component failure.

~~The PLC System shall be a Fail Safe Control, Programmable Logic Controller (PLC) based with a Quadruple Modular Redundancy (**QMR**) system architecture.~~

. The system shall not have any time limitations to work under degraded mode. The same shall be demonstrated in TUV report and safety manual.

- Permanent data backup
- RS 485 Modbus master (primary)/Slave (secondary) communication, Control net, Ethernet or Modbus, and interaction with third party devices.
- 24 VDC power supply modules.
- Modular, Expandable I/O modules (24 VDC input, transistor or relay output)
- Modularity: 8, 16, 24.32
- Signal type: discrete, analog or mixed, removable
- High-density connectors
- Easy-to-wire system
- Program capacity of up to 8000 list instructions
- Options shall include a built-in display screen, memory cartridges, a real-time clock and communication adapters.
-

BMS/5.01.18. Not Used.

BMS/5.01.19. Environmental Conditions

The PLC must be able to operate in the following conditions:

Operating Temperature	0 to 55^{o}C
Storage Temperature	-25 to 70^{o}C
Relative Humidity	5 - 90 % (without condensation)
Operating Shock	IEC 60068-2-27
Vibration Resistance	IEC 60068-2-6;

Conforms to the relevant standards for PLC's.

BMS/5.01.20. PLC communications

Although the PLC processor specified above will have the capability of communicating directly with a SCADA system via Modbus over TCP/IP protocol or Ethernet IP, the primary SCADA interface shall be via the SCADA interface termination panels detailed in this Specification. In addition to the above, the PLC shall have the capability to be monitored directly using the Ethernet IP.

The Contractor shall supply a SCADA interface termination panel for each item of mechanical plant and equipment as detailed in this Specification, including mechanical plant and equipment incorporating PLC control systems.

BMS/5.01.21. Not Used.

BMS/5.01.22.

PLC Panel Internal Wiring

Control panel, switchboards and distribution boards wiring shall be clearly identified in accordance with the Definitive Design Drawings using cable core markers. Cable core markers shall read left to right or top to bottom.

Wiring shall be enclosed in metal ducts or neatly loomed with nylon ties or spiral binding as required. Wiring ducts shall be filled to a maximum space factor of 50%.

Where wiring is required to connect to devices mounted on doors it shall be arranged such that opening and closing of the door is not impeded whilst minimising flexing of the wiring loom. The loom shall be effectively fixed at both ends of the door opening with insulated saddles or clamps.

Wire colours shall comply with the following requirements:

~~Phases~~	~~Red, Yellow, Blue~~
~~Neutral~~	~~Black~~
~~AC Control~~	~~Grey~~
~~DC Positive~~	~~Orange~~
~~DC Negative~~	~~Lilac~~

~~Earth Green with Yellow trace~~

Description		Colour
230VAC – Raw Supply	Phase	Red
	Neutral	Black
230VAC – UPS Supply	Phase	Orange
	Neutral	Black
24VDC Supply	Positive (+ve)	Blue
	Negative (-ve)	White
Earth	Power Earth (PE)	Yellow with Green Strip
	Instrument Earth (IE)	Green
Digital Input Signal	Signal	Grey
	AC Phase	Brown
Digital Output Signal	Signal	Grey
	AC Phase	Brown
Relay Contact Signal	24 VDC	Gray Colour
	110VAC	Gray Colour
	220VAC	Gray Colour
	Potential Free	Gray Colour
Analog Input Signal	Power	Blue
	Signal Return	Yellow
	Signal Common	White
Analog Output Signal	Signal Out	PINK
	ALT	Yellow
	RTN	White

Terminals shall be clearly numbered, and shall be rail mounted, adequately sized to suite wiring size and provided with 20% spare rail space. The bridging of terminals shall be provided by the use of terminal bridging links as supplied by the terminal manufacturer.

Control wiring shall be terminated using pre-insulated pin or spade type crimp lugs. Conductors terminating to study type terminals shall be fitted with spade type crimp lugs.

A separate earth bar shall be provided for the termination of all earth wires. Only one wire shall be connected into each termination point.

Minimum conductor size shall be 0.7 sqmm.

Cable glanding plates shall be earthed directly to the control panel earth bar.

Panels shall be fitted with a suitable pocket to contain circuit diagrams and other relevant Definitive Design Drawings. An “as installed” set shall be provided with the panel.

A maximum of two control wires shall be terminated on any control device terminal.

HRC fuse links fittings shall be of the bolt in type and shall be installed in fully shrouded fuse holders. 415V fuses shall be high interrupting capacity type complying with the relevant standards.

All internal wiring shall be neatly run and securely fixed in non-metallic LSZH cleats in such a manner that, wherever practicable, wiring can be checked against diagrams without removal of the cleats. Wiring passing out to fully accessible positions shall be run in non-metallic low smoke halogen free flexible tubes or conduits.

~~Definitive Design Drawings. An “as installed” set shall be provided with the panel.~~
~~A maximum of two control wires shall be terminated on any control device terminal.~~
~~HRC fuse links fittings shall be of the bolt in type and shall be installed in fully shrouded fuse holders. 415V fuses shall be high interrupting capacity type complying with the relevant standards.~~
~~All internal wiring shall be neatly run and securely fixed in non-metallic LSZH cleats in such a manner that, wherever practicable, wiring can be checked against diagrams without removal of the cleats. Wiring passing out to fully accessible positions shall be run in non-metallic low smoke halogen free flexible tubes or conduits.~~

Should a fault occur in the Master/primary processor, control will be transferred to standby processor in maximum 500 ms. During the changeover, PLC outputs shall be maintained in their last state until they come under control of the standby/ Secondary processor. Fault data is sent to workstation for reporting the processor failure. The system shall now recognize earlier standby processor as Master/primary processor.

BMS/6.01.7. Communication Redundancy

The processors communicate with each other and with I/O modules on redundant communication bus. The communication speed between processor and I/Os shall not be less than 5Mbps.

BMS/6.01.8. Power Supply Redundancy

Each TVS PLC outstation has two 24Vdc power supplies arranged in a redundant configuration. These power supplies are used for powering up the processors and I/O modules.

BMS/6.01.9. Network Connections

Each processor provides a ~~serial~~ port for local connection to a programming device. Other network connections such as Ethernet ~~and~~ or serial RS 232 port are also provided for communications to the Workstation. Other communication such as control net or Ethernet shall also be provided to the workstation

One processor of redundant configuration shall be connected to SCR room Switch and the other processor shall be connected to TER room Switch. The two switches are connected to each other via a dedicated LAN. The communication link to PC and OCC are Modbus on TCP/IP or Ethernet IP.

OCC SCADA will interface with both SCR and TER room switch, while workstation will interface only at SCR room switch.

Network links

The system architecture shall use the following communication routes as applicable:

1.	PLC (Master)	-	PLC (standby)	on Modbus Plus/Ethernet/IP/Modbus TCP/IP
2.	PLC	-	I/O	on Modbus Plus /Ethernet/ IP/Modbus TCP/IP
3.	PLC	-	VCP I/O	on Modbus Plus /Ethernet/ IP/Modbus TCP/IP
4.	PLC	-	TVS Repeater I/O	on Modbus TCP/IP /Ethernet/ IP/ControlNet/Modbus TCP/IP
5	PLC	-	SCR Switch	on Modbus TCP/IP/ Ethernet /IP/Modbus TCP/IP

6. PLC - TER Switch on Modbus TCP/IP/ Ethernet /IP/Modbus TCP/IP
7. SCR Switch - Workstation on Modbus TCP/IP/ Ethernet /IP/Modbus TCP/IP
8. TER Switch - Workstation on Modbus TCP/IP/ Ethernet/ IP/Modbus TCP/IP
9. SCR Switch - OCC on Modbus TCP/IP/ Ethernet IP/Modbus TCP/IP
10 TER Switch - OCC on Modbus TCP/IP/ Ethernet IP/Modbus TCP/IP

~~1. PLC (Master) - PLC (standby) on Modbus Plus/Ethernet/IP/Modbus TCP/IP~~

~~2. PLC - I/O on Modbus Plus /Ethernet/ IP/Modbus TCP/IP~~

~~3. PLC - VCP I/O on Modbus Plus /Ethernet/ IP/Modbus TCP/IP~~

~~4. PLC - TVS Repeater I/O on Modbus TCP/IP /Ethernet/ IP/ControlNet/Modbus TCP/IP~~

~~5. PLC - SCR Switch on Modbus TCP/IP/ Ethernet /IP/Modbus TCP/IP~~

~~6. PLC - TER Switch on Modbus TCP/IP/ Ethernet /IP/Modbus TCP/IP~~

~~7. SCR Switch - Workstation on Modbus TCP/IP/ Ethernet /IP/Modbus TCP/IP~~

~~8. TER Switch - Workstation on Modbus TCP/IP/ Ethernet/ IP/Modbus TCP/IP~~

~~9. SCR Switch - OCC on Modbus TCP/IP/ Ethernet IP/Modbus TCP/IP~~

~~10. TER Switch - OCC on Modbus TCP/IP/ Ethernet IP/Modbus TCP/IP~~

Alarm

If a network link fails, the system shall have inbuilt programs within the processors which will generate fault bits available to workstation and OCC. The communications error rate will be logged and stored in the processor. If the error rate exceeds the set point, an alarm will be sent to OCC.

BMS / 23 Energy Management System

BMS/23.1 The specifications mentioned herein are applicable for the energy management system which is to be provided with the station BMS for centralized energy monitoring in OCC

23.1.1 The system shall provide a real-time database incorporating data from analog, logical or pulse inputs.

23.1.2 It should be support up to 1000 TCP/IP addresses for the PLC/DDC controllers in the Enterprise network

23.1.3 Historian of point data shall be configurable as part of the point definition. Historian shall be provided for both snapshots and averages with intervals ranging from 5 seconds to 24 hours

23.1.4 Trend and change of value data shall be stored within the engine and uploaded to a dedicated trend database or exported in a selectable data format via a provided data export utility

23.1.5 The system shall provide a configurable data storage subsystem for the collection of historical data. Data can be stored in SQL or equivalent database format

23.1.6 The system shall be able to store all the events

23.1.7 The operator interface shall be flexible in its connection to the Energy management system server. Both serial wireless, 3G, 4G and LAN connection shall be possible. The operator interface shall provide standard dial-up modem support. Using other packages such as Microsoft Terminal to make the modem connection shall not be acceptable.

23.1.8 Server management level software shall have Unlimited number of user license without any additional cost of license on the OWS.

23.1.9 Energy Management System software shall be web based software shall allow unlimited simultaneous user access.

23.1.10 Server software shall be able to browsed by Microsoft Internet Explorer or equivalent

23.1.11 Energy Management software capable of fetching the energy data from all installed DDC/DCS/PLCs and store the data into separate application database (SQL or equivalent) for analysis. This Software should have the following Key features:

A. SEGMENTATION OF ENERGY INFORMATION AT A GLANCE.
B. CUSTOMISABLE ENERGY DASH-BOARD.
C. ENERGY REPORT GENERATION AGAINST SELECTION OF TIME AND FREQUENCY.
D. CO_2 EMISSION CALCULATION AND REPORTING.
E. WEB BASED TOOL. NO ADDITIONAL SOFTWARE REQUIRED.
F. Automatic Alarm EMAIL / SMS OPTION AVAILABLE

23.1.12 The software shall have Ready Access Portal Architecture, graphics and management software shall be accessible through smart phones.

23.1.13 A minimum of 100 unique passwords shall be supported. Provide a minimum of 100 categories of systems to which individual operators may be assigned.

23.1.14 The system shall provide flexible trending allowing real-time, historical or archived data to be trended in a variety of formats. In addition, trend data types shall be able to be combined to allow for comparisons between data e.g. current real-time data versus archived data

23.1.15 The system shall support a flexible reporting package to allow easy generation of report data. The reports provided should include pre-configured standard reports for common requirements such as Alarm Event reports and custom report generation

~~23.1.1~~23.1.16 It shall be possible to integrate energy management data with standard off- the shelf software packages like MS Excel, crystal point etc.

Part-II E&M Specification

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[L1]

elbows shall be used at changes in the direction of the pipework. Welded tees shall be used for branches of the same size as the main pipe. Long radius reducing elbows shall be used at pumps. Reducing outlet tees shall be used for branches of smaller size than main pipe. Where the branch size is three or more pipe sizes smaller than the main pipe, steel gussets to provide full pipe strength shall be used. Where a branch is connected to screwed piping, a steel welded threaded socket shall be used. Eccentric welding reducing fittings shall be used at changes in pipe size for horizontal piping, with the top level in a horizontal line for water piping.

E17. 3.4 Jointing - General

E17. 3.4.1 All pipe jointing systems used shall comply with the requirements of this clause and the Particular Specification.

E17. 3.4.2 Pipes shall be cut in a neat manner without damaging the pipe. Unless otherwise approved by the Engineer-in-charge, cutting shall be done with an Approved type of mechanical cutter. Wheel cutters shall be used when practicable. Pipe ends shall be reamed to remove burrs.

Joints shall be in accordance with clause 3.2.3 of BS CP 2010 : Part 2 and clause 3.6 of BS CP 2010: Part 3.

E17. 3.4.3 Flanges and bolting for pipes, valves and fittings shall comply with BS EN 1092-1: Part 1 PN 1.6, or to other higher ratings as required by the system for which they are used.

E17. 3.4.4 For special applications in which couplings are required for jointing plain end pipes, grooved joints or slip-on-type couplings BS CP 2010: Part 2 Appendix B or similar couplings shall be used.

E17. 3.4.5 Mechanical Grooved Joints

E17. 3.4.5.1 M.S./ GI pipe for working temperature upto 82^0C. of suitable wall thickness may be jointed by use of mechanical grooved pipe and couplings. Only jointing systems approved by the Loss Prevention Council, Bureau Vertitas or other similar authorities are acceptable.

E17. 3.4.5.2 Installation shall be by operatives trained by the manufacturer. The coupling shall consist of a combination of coupling pieces, water sealing gaskets, special nuts and bolts and grooves in pipe walls and shall be self-centering.

E17. 3.4.5.3 Grooves shall be properly cut or rolled at the pipe ends by machine and fully in accordance with the manufacturer's instructions and recommendations. Grooves shall be dimensionally compatible with the coupling.

E17. 3.4.5.4 Joint assembly, support details and positions shall be made in accordance with the manufacturer's instructions/descriptive leaflets.

E17. 3.4.6 Bellow expansion joints shall be provided for expansion and contraction in the pipework and also provided where the pipes cross construction expansion joints. The expansion joints shall be capable of absorbing axial and lateral movements.

E24. BATTERY

DMES-E-003 Detailed Description and Application in JMRC

1.1 This section specifies the manufacture, testing, installation and commissioning of VRLA, batteries for Uninterruptible Power Supply System. In JMRC these batteries are used in Underground stations.

1.2 2V valve regulated lead acid (VRLA) battery shall be used with UPS for Underground application.

2. Governing Specifications

2.1 The VRLA battery shall comply with the governing specification, as given in the table below:

VRLA BATTERIES	
Electrical vocabulary, secondary cells and batteries	IS-1885 or latest
Specification for rubber and plastic container for lead acid storage batteries.	IS-1146 or latest
IEEE recommended practice for sizing of large lead acid storage batteries	IEEE-485 or latest
Recommended practice for design and installation of storage batteries	IEEE-484 or latest
Stationary Regulated Lead Acid Batteries	IS 15549 (2005) or latest
Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications	IEEE-1188:2005 or latest
Recommended Practice for Installation Design and Installation of Valve Regulated Lead-Acid Storage Batteries for Stationary Applications	IEEE-1187:2013 or latest
IEEE Guide for Selection of Valve-Regulated Lead- Acid (VRLA) Batteries for Stationary Applications	IEEE-1189:2007 or latest
Stationary lead-acid batteries –Part 21: Valve regulated types –Methods of test	IEC 60896-21-2004 or latest
Stationary lead-acid batteries –Part 22: Valve regulated types – Requirements	IEC 60896-22-2004 or latest

3. Requirements

All the requirements from clause 3.1 to 9 shall be as per IS 15549(or latest applicable standard). Further, the additional specific requirements are as follows:-

3.1 Constructional Requirements

3.1.1 Type:

The battery shall be 2V valve regulated lead acid (VRLA) sealed maintenance free type with AGM (absorbent glass mat) technology. Battery shall not require water addition ever and shall suppress generation of hydrogen gas by means of such a system that the oxygen generated at positive plate is absorbed by negative plate by reaction in the battery.

3.1.2 Valves: Valves shall

(i) Have explosion proof vent closure

(ii) Be self-resealing pressure regulating type

(iii) Have flame arrestor to prevent the possibility of external sparks entering the cell.

3.1.3 Seal:

(i) TIG welding shall be done for post sealing

(ii) Additional Epoxy resin sealing be provided for double assurance against leakage.

3.2 Electrical Requirements

3.2.1 Battery shall be suitable for Constant Current Constant Voltage Charging.

3.2.2 Recharging shall be done at normal float voltage.

3.2.3 A fully discharged battery shall be charged to 100% of its rated capacity within 14Hrs under float charge condition

3.2.4 Self-discharge rate shall be less than 0.5 % of C10 capacity per week at 25 deg. C.

3.2.5 Battery sizing will be done as per IEEE-485 (1997) or latest. Design margin of 10%, ageing factor of 25% and temperature correction factor at 25 deg C shall be considered while sizing the batteries.

3.2.6 Load Power factor of 0.8 is to be considered for sizing of batteries.

3.2.7 The batteries should provide power supply backup of rated full load for not less than the duration specified in the BOQ.

4. Additional Requirements

4.1 Service condition:-

The standard battery operating temperature shall be of 25 °C. When the ambient air temperature exceeds 25°C, the charging voltage shall be reduced to prevent overcharge and increased, as the temperature falls, to avoid undercharge.

4.2 Battery rack:-

The battery shall be supplied with-

4.2.1 At least two racks of mild steel with powder coating and anti-corrosive paint including base channel plated foundation nuts bolts etc. be provided for shelving the batteries. The rack shall be designed to provide easy access to all components for maintenance

and to minimize floor space requirements. Batteries shall be mounted on racks to allow access to all terminals. In reaching the terminals, maintenance staff shall not be required to stretch unduly over other batteries, with the risk of shorting battery terminals.

4.2.2 Special tools and fittings required to assemble the batteries.

4.2.3 Terminal shrouds shall be provided on the terminals.

4.2.4 The rectifier/charger shall follow recommendation of battery manufacturer for battery recharge. It shall also be equipped with facilities to carry out in-situ tests for battery (full and partial) discharge.

4.2.5 Each cell shall be marked in a permanent manner to indicate the following information.

(a) Cell number.

(b) A set of loose stickers shall be provided to mark the cells position in the assembled battery bank at site so that a cell removed for maintenance can be put back in original position.

4.3 Batteries shall be supplied in factory-fitted charge and ready-to-use condition. The tenderer shall specify lower optimum voltage to be maintained by charge to maintain battery in fully charged condition for minimum water loss and maximum battery life for the systems. The tenderer shall also specify freshening charge requirement if any, for optimum battery life.

4.4 The manufacturer shall dispatch the batteries after consulting the main contractor or JMRC to ensure their readiness for installation and to reduce the storage period of batteries at site.

5. Safety

5.1 Battery Protection and charge controller

5.1.1 The battery bank shall be protected from internal fault by a circuit breaker. The battery circuit breaker installed at the battery room should be complete with a metal enclosure conforming to an Ingress Protection Classification of IP 54.

5.1.2 The UPS shall be automatically disconnected from the battery bank when the discharge limits of volts per cell are reached, or when signaled by other control functions.

5.1.3 Temperature monitoring equipment shall be incorporated in the UPS system to optimize the charger voltage as a function of battery room temperature, to generate alarm in case of room temperature exceeding the preset permissible temperature and to predict the battery backup time.

6. System efficiency As per IS 15549(or latest applicable standard).

7. Reliability, maintenance, spares & life

The service life of batteries shall be at least 10 years based on the cycle life (not less than 1200 at 25 deg C), when discharged to 80 % of rated capacity in 30 minutes with end cell voltage of 1.75 volts per cell. Design life of the battery shall not be less than 20 years on float mode at 25 deg C.The VRLA batteries shall be maintenance free for the entire service life.

8. Special condition

A representative from the side of battery manufacturer should be present during commissioning of UPS and battery bank so as to ensure that the DC link voltage set by the UPS manufacturer is as per the requirement of battery bank. The battery manufacturer shall also certify that the commissioning done at site is satisfactory.

9. Testing

9.1 The manufacturer of the batteries must have type test certificates, from a third party accredited laboratory or certified bodies, for all the tests specified in IS 15549 and shall not be more than five years old.

9.2 In case, these are not available, manufacturer will be required to get these tests executed from an accredited third party.

9.3 The factory acceptance tests shall be done in accordance with IS 15549. The equipment shall be dispatched after testing in presence of authorized representative of purchaser.

- Field test results

A01.3. Technical and installation requirements

A01.3.1. General

A01.3.1.1. The air handling units shall be of double skin construction, draw through type and shall include separate return air plenum, filter section, fan and coil section. Each AHU have two blowers and partition shall be provided between them.

A01.3.1.2. The units shall be insulated to prevent heat loss, to eliminate panel sweating and to provide a moisture free unit.

A01.3.1.3. The units shall be provided with the access doors with look out glass for fan section and filter section to facilitate easy access to internal components for maintenance and repairs or replacement.

A01.3.1.4. The units shall be provided with drain pan of heavy gauge Stainless steel (SS-316) completely rust and corrosion proof and thermally insulated.

A01.3.1.5. The units shall be of a panelised construction fabricated with galvanised steel suitably welded and reinforced to provide a rigid assembly. The complete units shall be absolutely rust free.

A01.3.1.6. Units ships in sections shall have a minimum of four points of lift. These lift points shall be designed to accept standard rigging devices.

A01.3.2. Fan and Accessories

A01.3.2.1. The fan shall be with backward inclined aerofoil blades, double inlet double width type. Fans shall be of non-overloading design. The wheel & housing shall be fabricated as per manufacturing standard. The fan impeller shall be mounted on a solid shaft supported on angle iron heavy-duty ball bearing. The fan shall be selected for a speed not exceeding 1800 rpm. The impeller & fan shaft shall be statically and dynamically balanced. The fan outlet velocity shall not exceed 12.7 m/s. Fan housing with motor shall be mounted on a common extruded aluminium base or heavy guage G.S.S. mounted inside the fan section on anti-vibration springs mounts. The fan outlet shall be connected to casing with fire retardant double canvass. The fan shall be complete with multi 'V' belt drive and adjustable motor mounting base. The opening for the access of the fan section shall be provided with micro-switch and galvanised iron mesh. The fan outlet shall be provided with a motor operated damper (MOD).

~~A01.3.3. The fan shall be AMCA certified backward curved Direct Driven Centriflow Plug Fan with integrated factory fitted VFD (IP20). The wheel shall be fabricated from heavy gauge steel. The fan impeller shall be mounted directly on motor shaft. The fan shall be selected for a low noise level. The impeller shall be statically and dynamically balanced. Fan impeller with motor shall be mounted on a common extruded aluminum base mounted in side the air handling housing on anti-vibration mounts. The fan outlet shall be connected to casing with the help on fire retardant fabric acting as flexible connection for anti-vibration. The fan shall be selected for a speed not exceeding 1800 rpm. The fan outlet velocity shall not exceed 12.7 m/s. The fan outlet shall be provided with a motor operated damper (MOD).~~

~~A01.3.2.1.~~A01.3.2.2. Coils shall be manufactured by the supplier of the AHU. Coils shall be removable by unbolting the panels in the coils section. The cooling coil shall be of seamless copper tubes, not less than 0.5 mm thick and mimimum 12.5 mm O.D. The bends shall be ready made with solder rings

on both ends. The coil shall have continuous aluminium dual sine wave fins. Having minimum thickness of 0.15 mm and having hydrophilic coating. The fins shall be spaced by collars forming integral part of the fins. The tubes shall be staggered in the direction of airflow. The fins shall be uniformly bonded to the tubes by mechanical expansion/Hydraullic expansion of the tubes. The coils shall be designed to operate at 17.5 kg/cm^2 working pressure and 150 °C temperature and shall be tested against leaks at a pressure not less than 23 kg/cm^2 by pneumatic or hydraulic pressurisation of coil. This pressure shall be maintained for a period of 2 hours. No drop should be observed indicating any leaks. The water headers shall be of copper pipes, to connect all the tubes. The headers shall be complete with water In/Out connections, vent plug on top and drain at the bottom. Drainpipe should be of SS-304. Coil tube water velocity shall not exceed 2.5 m/s. Where water velocities of less than 0.60 m/s are encountered, a method of turbulation shall be provided. The coil size shall be designed at an operating air velocity of 2.8 m/s. The coil frames should be of SS-304.

~~A01.3.2.2.~~A01.3.2.3. The centrifugal fans shall also comply with with section A12.1, A12.2, A12.3.1 and A12.3.4 of the specifications.

~~A01.3.4.~~A01.3.3. Filtration

A01.3.3.1. Each AHU shall have filters conforming to the specifications given under:

- High Efficiency filters of 90% efficiency down to 10 micron particle size

For detailed specification of filters see annexure-A to these specifications.

~~A01.3.5.~~A01.3.4. Drain pan

A01.3.4.1. The drain pan shall be construction of 18 Gauge stainless steel (SS-316) sheets, externally insulated with 12 mm thick closed cell polyethylene/polyurethane insulation with necessary slope to allow for proper condensate removal.

~~A01.3.6.~~A01.3.5. Coil and filter housing

A01.3.5.1. The cooling coils, special and standard filters, etc., shall all be housed in a separate enclosure of suitable size and length. The inspection doors shall have neoprene rubber T-section, rubber seals, hinges and locking arrangements. The gaps between filter frames and housing shall have synthetic rubber/EPDM packing, to eliminate any air leakage. The filter frame shall of aluminium and filter housing frame shall be of SS-304. All filters shall be provided with additional GI rods to provide more strength. The flat filter section shall be suitable for mounting filters vertically.

~~A01.3.7.~~A01.3.6. AHU enclosure/housing

A01.3.6.1. The AHU enclosure shall be double skin design with the mainframe work made of extruded aluminium structural section.

A01.3.6.2. Casing shall be of panel construction; double wall type packed with pressure injected CFC free foam insulation (polyurethane) having minimum 50mm ± 2mm thick body panel. Casing framework shall be of modular galvanized iron, aluminium or Approved equal pentapost double skin construction. Outer skin shall be minimum 1.0 mm galvanized steel sheet while inner skin shall be minimum 1.2 mm galvanized steel sheet. The sheets should have a minimum galvanisation of 275 GSM. The outer

skin and inner skin should be precoated or powder coated on the exposed side.

A01.3.6.3. Each section shall be provided with separate access panel of suitable size. The access panel shall be hinged type with heavy-duty stainless steel / die cast alumminium hinges and handles made of nylon. The handles shall be self-tightening type to ensure leak proof closing. The access door should have provision of look out glass.

A01.3.6.4. The opening for access doors and gaps between sections shall be provided with the neoprene rubber double ripped/T-gaskets fixed in grooves in the extruded sections.

A01.3.6.5. The sandwich panels shall be bolted ~~from inside~~ on to the framework with soft rubber gaskets in between to make the joints airtight. All fasteners used should be of stainless steel.

A01.3.6.6. Details of AHU Access Door, Air Vent, Drain Plug for Coil Header, pulley, belts and door guard to be provided.

~~A01.3.8.~~A01.3.7. Fan motor

A01.3.7.1. Fan motors shall be IE-02 Type, 415±10% Volts, 50 cycles, 3 phase, squirrel-cage, totally enclosed fan cooled with IP-55 protection.

A01.3.7.2. Motor shall comply with IS / IEC-60034.

A01.3.7.3. Motor shall be especially designed for quiet operation and motor speed shall be between 4Pole to 6 Pole. Motor shall be VFD compactable type.

~~A01.3.9.~~A01.3.8. Accessories

A01.3.8.1. Each air-handling unit shall be complete with the following accessories:

- Stem type thermometers at coil inlet and outlet, with tubing and gauge cocks. (Priced Separately)
- Pressure gauge with cock at inlet of the coil, with tubing and gauge cocks. (Priced Separately)
- Butterfly valves at inlet of the coil and balancing valve at outlet of coil. (Priced Separately)
- Drain line from the unit upto floor trap. (Priced Separately)
- Automatic air Vent Valves on pipes. (Priced Separately)
- Damper at inlet and outlet of AHU (Priced Seperately)
- Fire retardant Flexible connection between the fan outlet and duct.
- Metallic plate sandwiched between Neoprene Rubber pad shall be used between AHU and foundation.

~~A01.3.10.~~A01.3.9. Unit paint

A01.3.9.1. Not used

A01.3.9.2. Unit casing exterior shall be provided with standard colour as approved by the Engineer.

~~A01.3.11.~~A01.3.10. Limitations

A01.3.10.1. The air velocity across the cooing coil and filter shall not exceed 2.8 m/sec.

A01.3.10.2. The fan outlet velocity shall not exceed 12.7 m/sec.

~~A01.3.12.~~A01.3.11. Execution

A01.3.11.1. The air-handling unit shall be tested to measure air quantity and coil performance by measuring temperature difference, water pressure drop across coil and then calculating the capacity.

A01.3.11.2. Cooling coils testing

- Identification of materials. The physical & chemical test certificates shall be submitted for consent of the Engineer.
- Checking of mechanical bonding of fins to tubes.
- Pneumatic or hydraulic pressure test on coil 23 kg/cm² for 2 hours.
- Dimensional check.

~~A01.3.13.~~A01.3.12. Filters testing

A01.3.12.1. Test of sample filter elements as per BS-6540/BS EN 779/ASHRAE 52 or latest International governing specification as applicable to ascertain the material quality and filtration efficiency up to the claimed microns size. The detailed testing procedure shall be submitted to the Engineer for consent.

~~A01.3.14.~~A01.3.13. Inspection during assembly of components for quality of workmanship, painting etc. and final check of AHU shall be witnessed by the Engineer.

~~A01.3.15.~~A01.3.14. Cooling capacity shall be computed from measurements of air flow and dry and wet bulb temperature of air entering and leaving the coil. Flow measurements shall be by accurate digital anemometer and temperature measurements by accurately calibrated digital thermometer. Cross checks will be carried out by measurement of water flow rate and temperature differential across the coil with designed full water flow through the coil. The design should be verified by the computed results.

~~A01.3.16.~~A01.3.15. UVC Emitters

A. GENERAL REQUIREMENTS

Supply, Installation, Testing and Commissioning of Emitters System suitable for mounting in AHUs to reduce mold and fungus growth on the coil and keep the coil surface clean eliminating need for coil cleaning programme.

Shall be - Double Ended Type
Each component and product is to be inbound and outbound tested before shipment under Mil Standard 105E and ANSI/ASQCZ 1.4.

tested in accordance with the general provisions of IES Lighting Handbook, 1981 Applications Volume, total output per one inch are length shall not be less than 10μW/cm^2 , at one meter, in a 400 fpm air stream of 45 Deg. F.

B. DESIGN REQUIREMENTS

1. Irradiation – Emitters and fixtures are to be installed in sufficient quantity and in such an arrangement so as to provide an equal distribution of UVC energy on the coil and in the drain pan. To maintain energy efficiency, the

UVC energy produced shall be of the lowest possible reflected and shadowed losses.

2. Intensity – shall be measured by a Solid State Photodiode UV Sensor at the coil. Calibration wavelength is 254 mm. Accuracy is to be ± 10% and be NIST traceable, Operating range shall be 30 Deg. F – 158 Deg. F. Read by a display module with a 3.5 digit LCD screen / panel. Irradiance range shall be 0-1999 (x10) W/ cm^2 with a resolution of 10µW/ cm^2. One metering equipment with display module for metering the intensity of proposed UVC emitter shall be provided.

3. Installation – Emitters and fixtures shall be installed downstream of the cooling coil at right angles to the coil fins, such that UVC energy bathes all surfaces of the coil and drain pan. The wiring kit for emitters shall be supplied by manufacturer / strategic business partner / authorized dealers of manufacturer / business partners only.

C. EQUIPMENT

1. Units shall be high output, HVAC type, germicidal UVC light sources, factory assembled and tested. Components shall include a housing, reflector, high efficiency electronic power source, Emitter sockets and Emitter tube, all constructed to withstand HVAC environments.

2. Double ended Unit housings shall be made of 304 stainless steel with Units having electrical connectors on both ends to simplify gang wiring and wiring to power. They shall include mounting holes to assist in securing the fixtures.

3. DE reflectors shall be constructed of high spectral finished aluminium alloy with a minimum 85% reflectance of 254 mm UVC energy.

4. The Emitters shall be designed to operate at 230 V ac/ 50 Hz with a high p.f. They shall be UL listed to comply with UL Standard 1995 and capable of igniting each Emitter at temperatures from 35 – 170 Def. F in airflow velocities to 1000 fpm. They shall be equipped with RF and line noise suppression.

5. Emitter tube shall be of the high output, hot cathode, T5 (15mm) diameter, and medium bi-pin type. They shall produce 95% of their energy at 254 mm and be capable or producing the specified output at airflow velocities to 1000 fpm at temperatures of 35 – 170 Deg. F. **UVC Emitters shall not produce ozone or other secondary contamination.**

D. INSTALLATION

INSTALLATION OF UVC EMITTERS

A. Sufficient No. of Emitters installed on each coil .
B. An interlock switch shall be provided on each access door to the UVC Emitters to turn the lights off when the access is opened. Also manual switching off the UV lights shall be provided to avoid their turning on in case of closure of door by any mean or maintenance purpose.
C. Proper Caution Labels shall be installed on all accesses to the Emitters when installed.

The transformer rectifier must be protected against weather when installed outdoor and its housing shall meet at least IP44 standard.

Power input to the transformer rectifier shall be single phase 230 V, 50 Hz AC. Supply whereas the continuous DC Output from the transformer rectifier must have the maximum capacity of 30 Volt, 3 Amp. For safety reason, DC voltage higher than 30 volt is not acceptable. However, the transformer rectifier rating must be capable of withstanding the continuous maximum current output of 3 amps.

Copper – Silver ionization system

Essentially, the copper-silver ionization system shall consist of a 30V 3A maximum output transformer rectifier to energize the copper and silver electrodes. The electrode set shall be placed in the cooling water sump to discharge the copper – silver ions and to collect the calcareous at the electrode set.

DC cabling – DC cables from the transformer rectifier to the junction box shall be run in either rigid PVC conduit of galvanized conduit. The positive and negative cable must have different colour for identification. From the junction box to the electrodes, the cables shall be run in either rigid or flexible PVC conduit. It is very important that the electrodes must be connected to the transformer rectifier positive terminal and the DC current return must be connected to the transformer rectifier negative terminal.

Electrodes – The electrode set shall be placed inside a plastic container and positioned at the deep sump area to remain fully submerged at all times. The electrodes shall be located away from the outlet of Cooling Tower.

One set of Digital TDS & pH meter must also be provided with each unit to keep a close check on the TDS and pH level of make – up and Recirculation Water

Annexure-A AIR FILTERS

Scope This specification covers air filters to be provided in environmental control systems at different location inside the station.

Codes and Standards Filters shall conform, where applicable, to the following standards:-

(1) UL900 - Standard for test performance of air filter units.

(2) BSEN779 - Particulate air filters for general ventilation. Requirements, testing, marking.

(3) ASHRAE standard 52-76 - method of testing air cleaning devices use in general ventilation for removing particulate matter.

(4) Other standards as specified.

Fire Properties

Air filters and their enclosure shall be constructed from materials which conform to the fire property requirements of one of the following standards:-

(1) BS476: Pt. 4 - Non-combustibility Test for Materials;

(2) BS476: Pt. 6 - Method of Test for Fire Propagation for products with indices "I" £12 and "i" £6;

(3) Underwriters Laboratories Inc. UL900 - Test Performance of Filter Units, Class 1 or Class 2;

(4) DIN53438: Pt. 3 - Response to Ignition by a Small Flame, Surface Ignition, Class F1.

General

(1) All filters shall be washable type. All filters shall have minimum efficiency of MERV-8 / EU-4.

(2) Filter assemblies shall operate with at least the efficiencies specified in this Section.

(3) Filters shall be complete with robust enclosure, filter frame shall be of aluminium and and filter housing frame shall be of SS304. All filters shall be provided with additional GI rods to provide more strength.

(4) The enclosure shall be constructed and assembled in such a manner that a rigid and durable enclosure for the filter pack is effected.

(5) The periphery of the filter pack shall be continuously bonded to the inside of the enclosing frame thus eliminating the possibility of air bypass.

(6) Filter frames shall be factory fabricated and shall be equipped with gaskets and a minimum of four heavy duty positive sealing fasteners. The gaskets shall be able to prevent air bypass between the filter and frame, between the adjacent frames and between the frames and housing. The fasteners shall be capable of being attached or removed without the use of tools. All gaskets shall have the same fire property requirements as the air filter, as detailed in Clause above.

(7) The housing shall be factory fabricated and assembled. They shall incorporate access doors, extruded aluminium tracks and individual housing frames designed to accommodate standard size filters in efficiency and construction rating specified for the installation.

(8) Type test certificates for each type of filter media intended for use on the installation shall be submitted.

Filter Identification

All filters shall have the following information clearly marked or stamped in a readily accessible location:-

(1) Manufacturer's Name;

(2) Place of Manufacture;

(3) Filter type and model number;

(4) The standard to which the filter has been type-tested.

Washing facilities for washable filters

(1) The Contractor shall provide one set of duplicate cleaning tanks (one to wash, one to rinse). These tanks shall be such as to accommodate all sizes in the Contract.

(2) The filter cleaning tanks shall be constructed of at least 1 mm thick stainless steel and suitably stiffened around the top edges by continuous external turned over inverted `u' sections. The tanks shall be 0.4 m deep. They shall be supplied with 18 mm drain down cock for emptying but shall also have external handles to facilitate turning over to clear sludge.

(3) The contractor shall perform cleaning of filters during DLP.

DATASHEET OF AIR HANDLING UNITS	
AHU Capacity (ECS North and South)	As per BOQ
Reference Code / Standard	Fan AMCA-210 & AMCA300, Eurovent certified AHU – EN 1886 & EN 13053
Flow Rate	As per BOQ
Total Quantity	As per BOQ
Noise Criteria	Refer to Specification (85 dBA at 1 m distance in plant room)
Tag No	Tag No To Be Marked On AHU With Black Letter. SS Tag To Be Firmly Attached
Thermal Break Profile	As per mfg. Standard
Construction	Sectionalized / Modular Double Skin Type 50mm ± 2mm thick panel
Casing	
Out side	1.0mm
Inside	1.2mm
Insulation	As per specifications
Height of the unit	As dictated by plant room layout – refer to drawings
Number of Sections (functional – not necessarily physical)	1. Fan Section 2. Coil Section 3. Filter Section 4. Mixing box Section 5. Any other section if required
Access Door	Access door to be provided in fan section & mixing box.
Damper	
Type	Non Fire Rated Parallel Blade (Refer the Data Sheet For Damper)

Inlet	One at the suction side (MD)
Outlet	One at the discharge of each fan Motor Operated Damper (MOD)
Modular Frame	Aluminum Alloy
Base Frame	GSS
Drain	
Pan	Stainless Steel 316 (18G) with Insulation
Insulation	Polyurethane Foam / Polyethylene foam
Thickness And Density	12 mm Thick Density 38-40 kg/m^3
Connection	40 mm Connection On One Side
Fan Section	
Fan	
Type	Centrifugal ~~Plug~~ type - Backward Curved Aerofoil Construction statically and Dynamically Balanced
Characteristics	Non Over Loading
Number	Two per AHU
Total Pressure	As per BOQ
Blade	As per specifications
Fan Section	
Fan	
Shaft	As per specifications
Outlet Velocity	12.7 m/s (Max) or as per manufacturer standard.
Housing	As per manufacturers standard
Hub	As per manufacturers standard
Mounting	As per Mfg. Std.
Bearings – Shaft	As per Mfg. Std.
Connection	Flame Proof Flexible Connection
Vibration Isolator	Spring Isolators
Accessories	With access door, drain plug spring vibration isolator
Motor	
Type	TEFC Induction Motor IP-55 Protected,IE-2 Efficiency Class
Reference Code / Standard	***As per IEC 60034***
Electric Supply	Three Phase, 415 V, 50 Hz, AC Supply
RPM	1495 (Max)
Mounting	Slide Rails
Coil Section	
Coil	
Valve	2-Port Motorized Valve Each/coil

Entering Water Temperature	8 °C
Leaving Water Temperature	15 °C
Velocity Air	2.5 m/s/or as per manufacturers standard
Air Entering Temp	As per design requirement
Air Leaving Temp	As per design requirement
Test Pressure	23 kg/cm^2 pneumatic or hydraulic
No of Rows	Minimum 6 ROWS deep
Tube	Copper, 0.5mm thick, 12.5 mm OD
Coil Mounting	Stainless Steel
Fins	Aluminium 0.15mm thick, Maximum 10 FPI
Type Of Fins	Sinusoidal Wave Pattern with hydrophilic coating
Fin Bonding to Tubes	Mechanical Expansion / Hydraulic Expansion
Filter Section	
Filter	
Frame	Filter frame – Aluminium Filter Housing – SS304
Type	Panel Type.
Media	Non flammable, Non toxic, Low smoke synthetic resign media confirming to UL900, EN-779.
Sealing of Media	By means of epoxy
Efficiency	90% down to 10 micron particle size.

1) Air Handling Units shall be as per specifications, data sheets and drawings.
2) All accessories as per data sheets shall be provided
3) Pressures and Motor ratings are approximate. Vendors shall do their own calculations & offer the equipments as required.
4) Each centrifugal ~~plug~~ fan shall be provided with access panel and drain plug.
5) AHU's Shall be fitted with UVC emitters minimum 20 Tubes

A03.3.2. The chillers shall fit into the space provided and shall be made readily serviceable including where applicable, the provision of marine water boxes and other necessary accessories, etc., to complete the system.

Compressor

A03.3.2.1. Each unit shall have a rotary twin-screw or centrifugal compressor serviceable bolted semi-hermetic type.

A03.3.2.2. The twin rotary screw shall be manufactured from forged steel with precision cast male and female profiles, which are asymmetrical. The profile of screws shall permit safe operation upto a speed of 3000 RPM for 50 Hz operation.

A03.3.2.3. The compressor shall unload from fully loaded to the minimum capacity by means of hydraulically actuated slide valve positioned over both the male and female rotors.

A03.3.2.4. The compressor housing shall be of high grade cast iron, machined with precision, to provide a very close tolerance between the rotors and the housing.

A03.3.2.5. The rotors shall be mounted on antifriction bearings designed to reduce friction and power input. There shall be multiple cylindrical bearings to handle the radial and axial loads.

A03.3.2.6. There shall be built in oil reservoir to ensure full supply of lubricants to all bearings and a check valve to prevent back spin during shut down.

A03.3.2.7. There shall be oil pump or other means of differential pressure inside the compressor for forced lubrication of all parts during start-up, running and coasting for shut down. An oil sump header shall be provided in the casing.

A03.3.2.8. The units shall be complete with automatic capacity control mechanism, to permit modulation between 20% and 100% of capacity range. The Compressor will be designed to operate both on full capacity as well as part capacity without effecting the operating efficiency. The chiller units should be able to modulate cooling capacity to precisely match the load and minimise energy consumption. Chilled water temperature control setting capability will be to 0.1 °F or less

A03.3.3 **Compressor motor**

A03.3.3.1. The driving motor shall be double squirrel cage type or suitable hermetic type as required, protected against damage by means of built in protection devices.

A03.3.3.2. In case of hermetic type, motor shall be liquid refrigerant cooled with internal ~~thermal overload~~ protection devices embedded in the winding of each phase.

A03.3.3.3. If open type motors are used, the Contractor shall ensure that the motor heat loss will not result in excessive increases in temperature of the plant rooms affecting the operation and performance of the chillers and other equipment. The Contractor shall provide at his own expense any additional ventilation/cooling equipment. In addition, the Contractor shall also bear all direct, indirect and associated costs to provide a mechanical room safety alarm, wiring and chiller emergency shutdown shall be included to prevent chiller operation if the room temperature exceeds 40°C.

A03.3.3.4. Motor shall be compatible with the specified starting method.

Panel	
Material	M.S Heavy Gauge
Door	Control Interlock
Paint	Anti Corrosive – Powder Coating Duly Treated For Corrosion
System Protection	
Anti-Fouling Device (AFD)	At the Condenser Inlet of Chillers
Low Pressure	Alarm And Tripping
High Discharge	Alarm And Tripping
Freeze Protection	Alarm And Tripping
High Oil Temp	Alarm And Tripping
Lubrication Failure	Alarm And Tripping
Low Oil Level	Indication
Low Differential Pressure In Condenser	Alarm And Tripping
Low Differential Pressure In Chiller	Alarm And Tripping
Compressor Failure	Alarm And Tripping
Anti Recycle	Tripping
~~Winding Temp. Sensor~~	~~Tripping~~

Notes:

1. Chillers shall be as per ~~D~~DJMRC specifications. Any deviations to the specifications should be pointed out at tendering stage.
2. Condenser shall be provided with marine boxes made of steel or cast iron for ease of cleaning.
3. Chiller Motor starter shall be Soft starter without transient type.
4. Above data is not by way of limitation. Whatever is required for making the unit complete to meet the intent of specifications shall be deemed to have been included in the scope of work.
5. Flexible Connections at chiller and condenser shall be provided.
6. Chillers shall be equipped with the antifouling devices.
7. Over current, phase reversal, single phasing protections and KW meter shall be provided.
8. Refrigerant sensor shall be installed.
9. Performance rating.
10. The unit shall be selected for the lowest operating power consumption and noise level. Computer selected capacity rating and power consumption with operating points clearly indicated, shall be submitted with the tender as per technical data specified in the tender on full and partial load and shall be verified at the time of testing and commissioning of the installation. The gear losses should be included in the IKW/TR figures indicated by the bidders
11. Capacity and power consumption shall be computed from the measurements of incoming voltage, input current, temperature (inlet & outlet) and water flow rate. Necessary provision shall be kept for providing flow meter and transducers required for computing capacity.
12. The supplier has to confirm that the IKW/TR data for the chilling unit submitted by

Low Differential Pressure In Chiller	Alarm And Tripping
Compressor Failure	Alarm And Tripping
Anti Recycle	Tripping
~~Winding Temp. Sensor~~	~~Tripping~~

Notes:

1. Chillers shall be as per specifications. Any deviations to the specifications should be pointed out at tendering stage.
2. Condenser & cooler shall be provided with marine boxes made of steel or cast iron for ease of cleaning.
3. Chiller Motor starter shall be Soft starter without transient type.
4. Above data is not by way of limitation. Whatever is required for making the unit complete to meet the intent of specifications shall be deemed to have been included in the scope of work.
5. Flexible Connections at chiller and condenser shall be provided.
6. Over current, phase reversal, single phasing protections and KW meter shall be provided.
7. Refrigerant sensor shall be installed.
8. Performance rating.
9. The unit shall be selected for the lowest operating power consumption and noise level. Computer selected capacity rating and power consumption with operating points clearly indicated, shall be submitted with the tender as per technical data specified in the tender on full and partial load and shall be verified at the time of testing and commissioning of the installation. The gear losses should be included in the IKW/TR figures indicated by the bidders. ~~As energy conservation is today's theme, it is expected from each bidder to offer highly energy efficient machines. Necessary credit of preference will be given on this account. Power consumption shall be computed from measurements of incoming voltage and input current.~~
10. Capacity and power consumption shall be computed from the measurements of incoming voltage, input current, temperature (inlet & outlet) and water flow rate. Necessary provision shall be kept for providing flow meter and transducers required for computing capacity.
11. The supplier has to confirm that the IKW/TR data for the chilling unit submitted by him has been selected at the specified operating parameters and at constant condenser entering water temperature.
12. Also the machine shall be rated for actual capacity at specified conditions.
13. Only ARI / Eurovent certified chilling machine shall be acceptable and the computer performance sheet. duly certified as per ARI / Eurovent shall be submitted along with the technical submittal.

(3) Manufacturer's Quality Assurance Program

(4) Total head to be overcome by the pump listed in a tabular form including but not limited to the following:

- Pressure loss in the connected equipment at the operating/duty conditions
- Pressure loss in the piping with piping length measured from working drawing to be performed during final design stage
- Pressure loss in all pipe fittings like elbows, reducers and tees
- Pressure loss in piping accessories like regulating and controlling valves, flexible connections, sensor wells and probes
- Head due to change in elevation

A05.3. Technical and installation requirements

A05.3.1. The pump sets shall be split case type with flanged connections directly mounted on TEFC squirrel cage induction motor and suitable starter as specified. The pumps should have anti corrosion coating, Efficiency enchancing coating/ investment casting on the inside of the casing and exterior (colour) finish should be same as that of the chillers.

A05.3.2. The impeller shall single entry shrouded design. The minimum pump efficiency shall be ~~80~~70% ~~minimum~~ for Primary pumps, 80% for secondary pumps and 80% for condenser water pumps. For monoblock ~~the~~ pumps efficiency shall be minimum 55%~~65%~~.

A05.3.3. Water seal shall be of mechanical type to minimise water leakage and should be easily serviceable in the field.

A05.3.4. Motor and starter shall conform to relevant specifications and of ratings given in "Bill of Quantities".

A05.3.5. The pump set shall be with horizontal/vertical split case type as per the data sheet/Bill of Quantities.

A05.3.6. The pump casing shall be high density cast iron or cast steel volute design machined to a close tolerance.

A05.3.7. The shaft shall be of high tensile Stainless steel mounted in generously sized bearings.

A05.3.8. The impeller shall be of Bronze and should be properly balanced.

A05.3.9. The shafts seal shall be of mechanical type to withstand leakage at high working pressure .suitable to operating pressure.

A05.3.10. A suitable flexible coupling shall be provided to connect the pump and the motor

A05.3.11. The base plate shall be suitable for mounting the motors and the pumps.

A05.4. VARIABLE SPEED SECONDARY CHILLED WATER PUMPING SYSTEM

A05.4.1 **General**

The scope of this section comprise the supply, erection, testing and commissioning of variable speed secondary chilled water pumping system conforming to these specifications as per Equipment Schedule.

System shall consist of the following:

1 Secondary pumps of type and capacity as specified in Equipment Schedule.

2 Programmable logic pump controller.

3 Adjustable frequency drives ~~with manual by pass.~~

4 Remote sensor / transmitter.

5 Other items as required to properly execute the sequence of operation.

A05.4.**2 SECONDARY PUMPS**

A05.4.2.1 The capacity of secondary chilled water pumps shall be in accordance with Equipment Schedule and Schedule of Quantities.

A05.4.2.2 The pumps shall be of split casing/Inline type. Pump casing shall be close-grained cast iron of heavy section, horizontal/vertical split, making possible complete servicing of rotating parts without breaking piping or motor connections. Motor to pump connection shall be of the smooth entry to impeller and increased efficiency. Impeller shall be bronze or gun metal, double suction, enclose type, hydraulically balanced and passages smooth-finished for minimum friction and maximum efficiency. Shaft shall be stainless steel, protected by gunmetal sleeves extending through stuffing boxes. Stuffing boxes shall be supported in ball/journal bearings, grease lubricated, contained in easily removable housing. Pumps shall be fitted with an air valve, two grease lubricators, drain plug and water seal connections. Mechanical seals shall be provided with all pumps.

A05.4.2.3 Pump motor shall be energy efficient having the efficiency class of IE-2, totally enclosed, fan-cooled, class-F insulation and suitable for operation on AFD. Motor shall be specially designed for quiet operation and its speed shall not exceed 1495 rpm. The motor rating shall be such as to ensure non overloading of the motor throughout its capacity range. Motor shall be suitable for 3-phase 415 + 10% volts, variable frequency power supply.

A05.4.2.4 Pump base shall be of size suitable for the pump, motor and shaft and shall be constructed of cast iron or welded steel. Flexible coupling shall be protected by a guard mounted on the common base.

A05.4.2.5 The pump shall be installed on a concrete inertia base as per section A14.

A05.4.2.6 Each pump shall be provided with certified performance curves showing power absorbed and corresponding flow rates by varying the speed. The tests shall be done at factory and may be witnessed by Consultant/Owner.

A05.4.2.7 Split casing pumps, prior to testing shall be aligned with a dial indicator within 0.05mm.

A05.4.2.8 Pump performance curves and power consumption with operating points clearly indicated shall be submitted and verified at the time of testing and commissioning of the installation.

A05.4.2.9 Pump performance shall be computed from the pump curves provided by manufacturer. All pumps shall be tested at factory as per relevant codes.

Notes

1. Pumps shall be provided with common base frame, inertia base, spring vibration isolation pads, suction & discharge pressure gauges with isolation valves, test and / or air vent cocks, gland drain & other accessories as required.
2. Pumps starters shall be star delta air break type
3. Pump head given is approximate and vendor shall do their own calculations and offer the pumps accordingly.
4. Pump motor shall be IE2, non-overloading over the entire operating range.
5. The pumps shall be provided with suitable coupler sleeves. The coupling shall be shielded by a dual rated complaint coupling guard and contain viewing windows for inspection of the coupling.
6. Each pump shall be factory hydrostatically tested per hydraulic institute standards.
7. The pumps shall be manufactured, assembled and tested in an ISO 9001 approved facility.
8. Each pump set shall be provided with variable frequency drive suitably interfaced with other system components for manual/auto operation.
9. The pump logic controller suitable for controlling three pumps in parallel shall be provided.
10. Pump Motor shall be non overloading over the entire operating Range.

DATA SHEET FOR CONDENSER WATER PUMP	
Type	Horizontal / Vertical Split Casing Condenser water pump
Reference Code / Standards	ISO : 9906 IS :1520 IS : 9137 & 10596
Tag No	Tag No To Be Marked On Pump With Black Letter. SS Tag To Be Firmly Attached
Total Number	As per BOQ
Service	Continuous Duty
Capacity LPS	As per BOQ
Operating Head KPa	As per BOQ
Noise Criteria	85 dbA at 1.5 meter. Distance
Acoustic Treatment	As required to achieve the above
Number Of Stages	Single Stage
Impeller	
Material	Bronze
Casing Material	Cast Iron ASTM AI59 43000
Balancing	Statically & Dynamically Balanced
Lock Nut	Bronze(ASTM A276 Type)
Pump Speed (nominal)	1495 RPM (Maximum)

A06.3.4. Paint/Covering and Fire Rated Ductwork

A06.3.4.1. Where shown on the Drawings, fire rated ductwork or equipment enclosure shall be fabricated from fire rated material to the requirements of BS 476 Part 24 or ISO 6944.

A06.3.4.2. Not used

A06.3.4.3. The construction of the ductwork or enclosure shall take into account the structural strength, noise isolation as required and the requirements of **Class C** duct in accordance with DW/144. Testing of the ductwork shall be as per DW144 Class B. The galvinization on ductwork shall be 275 GSM.

A06.3.4.4. ~~All necessary supports, and other accessories required f~~For ~~the complete~~ installation of fire rated ductwork~~,~~ the Sealent, Gasket, and fire rated paint ~~including additional material for fire stopping at wall/ceiling penetration,~~ shall be supplied by the same manufacturer ~~as the fire rated duct material~~ and shall be assembled in accordance with ~~all~~ the manufacturer's recommendation regarding all aspects of construction and installation shall be certified by the manufacturer.

A06.3.4.5. The applicable smoke temperature shall be 250 deg C. The ductwork system shall be fire-rated for two hours and shall maintain mechanical stability, fire resistant integrity, and thermal insulation criteria to BS 476: Part 24 as per the ISO Cellulosic Fire Curve at temperature of 1029 °C, for both vertical and horizontal duct arrangements, for both inside and outside fire exposures. Restriction of the duct due to twisting or buckling after the fire test shall not cause 25 % or more reduction in cross-sectional duct area.

A06.3.4.6. The performance shall not be affected by moisture absorption. Mechanical strength shall be maintained and the fire resistance material shall not de-laminate or the fire resisting properties shall not deteriorate even under water saturation. The material shall also be "Class-One" surface spread of flame as defined in BS 476: Part 7. Additional insulation, if required, shall be used as per the manufacturer's recommendation.

A06.3.4.7. Whether BS 476 thermal insulation criterion is applicable or not, fire rated air-conditioning supply, return, and exhaust ductwork shall be complete with thermal insulation and vapour barrier.

A06.3.4.8. The fire resistant material shall not attract pests and shall not rot or support the growth of mould.

A06.3.4.9. All fire resistant ductwork or enclosure, apart from its fire resisting quality, shall be capable of resisting accidental damage and shall require to pass the hard body impact test section of BS 5669: Part 1 / BS EN 1128 with the weight being dropped through not less than 1m.

A06.3.4.10. Smoke extraction system ductwork shall be made from suitable material with adequate thickness. Rivets or self sealing screws used shall not be of aluminium. Where ductwork (including sealant, flexible connection, gasket and accessories) for smoke extraction / purge systems penetrate the fire compartment walls or floors of the room which they serve, the portion of the ductwork that traverses outside of the compartment wall or floor shall have a fire rating equal to the fire rating of the compartment wall or floor

Flexible Connection Rectangular Ducts	Fire Proof Material To Be Flanged And Bolted With Backing Flat Or Bolted To Mating Flange With Backing Flat
Flexible Connection	150 mm Length Between Two Faces (Minimum)
Duct Material	Fire Rated To Comply With BS – 476 Part 24 And ISO – 6944
Reference Standard	BS 476 Part 24, ISO – 6944
Flame And Fire Spread	Class O (BS 476 Part 6 & 7)
Fire Duct Work	Manufactured to HVCA Standard DW-144
Function	Smoke Extraction
Duct Material	Resistant to Water Impingement From Any Sprinkler System
Impact Resistance	BS EN 1128
Stability And Integrity	Must Retain at least 75% of its overall Cross Sectional Area (BS – 476 Part 24 (1987)
Leak Test	HVCA Specification DW – 143
Sealant	Flame Retardant
Duct Accessories	
Supports And Angle	Should Have 800^0 C Melting Point And Tensile Stress as per manufacturer recommendation or as per typical arrangement drawing whichever is stringent ~~is 15 N / mm2 For min 2Hour~~ Each duct piece of fire rated ductwork shall have supports
Hangers And Stiffeners	
Flanges	
Gasket And Nut / Bolts	
Duct Work Seals	As Per BS – 476 Part 24, ISO – 6944

A06.3.5. Motor Operated Dampers (MOD)

A06.3.5.1. All motor operated dampers shall be suitable for installation in either a vertical plane or a horizontal plane.

A06.3.5.2. The dampers shall be operated by electric actuators and shall be readily assembled on Site from modular panels. Each motor operated damper panel shall be of the multiple-parallel-blade type, with an independent channel frame; and shall be factory-assembled complete with frames, blades, shafts, bearings, seals, linkage, and all accessories required to erect the panels into composite dampers. Motor operated dampers shall be provided with all structural support members and hardware required for installation with additional framing or trims as required to complete the installation.

A06.3.5.3. Motor operated damper actuator shall be mounted outside of the damper frame.

A06.3.5.4. Spring-return type damper actuator shall be provided either to open or close damper as required in the event of power failure.

A06.3.5.5. All motor operated dampers shall be the product of a single manufacturer; and all like components shall be provided by a single supplier.

A06.3.5.6. Motor operated damper module assembly shall have a net free face area of not less than 75% measured to the inside of the frames.

A06.3.5.7. Dampers shall be based on standard air having a density of 1.20 kg/m^3. This shall apply to MOD and MSFD/MFD.

Service	Continuous Duty
Mounting	Horizontal Or Vertical
Construction	Each module With Dedicated Motor Actuator
Differential Pressure	1500 Pascal
Damper Free Area	75 % Of Damper Face Area
Damper Operating Mounting Bracket	As per Manufacturing standard complying UL555 & UL555S
Open / close Indication	Limit Switch With Each Module
Leakage	Leakage as per Class 1 of UL555S
Frame Construction	As per Manufacturing standard complying UL555 & UL555S
Blade	
Pressure Drop	38 Pascal @ 10 Mtr. / sec. Air Velocity (As per size)
Construction	Material - As per Manufacturing standard complying UL555 & UL555S Design – Aerofoil Design OR 3V Design
Type	Parallel/ Opposed Blades
Blade Thickness	For Aerofoil Design – Min 1.6mm For 3V-Type Design – Min 1.5mm Both complying UL555 & UL555S
Linkages	As per Manufacturing standard complying UL555 & UL555S
Shaft	As per Manufacturing standard complying UL555 & UL555S
Bearing	Self Lubricated Sleeve Bearing
Bearing Rating	~~One~~Two Hour @ 250^0 C
Crank Arms	As per Manufacturing standard complying UL555 & UL555S
Actuator Assembly	
Capacity	50% In Excess Of The Rated Capacity
Differential Pressure	1500 Pascal
Temperature Rating of actuator assembly	Two Hour @ 250^0 C
Motor Type	Single Phase, 220 V, 50 Hz, AC Supply
Accessories	Space Heater
Indication	Power On – Off
1. Sleeve thickness of dampers shall be same as the frame thickness	

A06.3.7. Guide Vanes

A06.3.7.1. Guide vanes shall be provided as required to maintain an acceptable system pressure loss.

A06.3.7.2. All blanking plates and sealing plates shall be provided for a complete installation.

A08.1. General

A08.1.1. This section specifies the requirements for furnishing, installing, testing and commissioning cooling towers complete with all accessories as specified herein.

A08.1.2. The cooling towers shall be the product of a single Manufacturer whose name shall appear on all submittals.

A08.2. Quality control

A08.2.1. The following codes, regulations, reference standards and specifications apply to the work of this section.

ISO 9001:2008

Cooling Technology Institute (CTI)

Cooling Towers should be CTI certified as per latest CTI STD 201 Certification standard for cooling towers and shall demonstrate the performance test on selected sample in factory or at site.

A08.2.2. **Submittals**

A08.2.2.1. Submit certificate of compliance that the design and fabrication of various components of the cooling towers meet the requirement of the Contract.

A08.2.2.2. Include data substantiating that materials comply with the requirements of the various standards as specified.

A08.2.2.3. Submit complete selection sheet, sound datasheet, performance curve, detailed unit drawing, load point analysis as supporting documents tocomply on various standards.

A08.3. Technical and installation requirements

A08.3.1. General

A08.3.1.1. The cooling towers shall be induced draft, Counter Flow/Cross flow type with vertical discharge complete with FRP basin, FRP body, fan and motor assembly, fill media, distribution pipes, etc.

A08.3.1.2. The Cooling tower shall be constructed with a sturdy structural Hot dipped Galvanized/ FRP frame designed to transmit all wind, seismic and mechanical Load to the equipment anchorage. The body shall be made of FRP sections of equal segments, all bolted together. The surface on both inside and outside shall be smooth, for minimum air resistance. The fan deck shall form an integral part of the body. The Casing panels shall be constructed of corrosion resistant and UV resistant fibre glass reinforced Plastic (FRP) with smooth finish to minimize air resistance and ensure prolong equipment life as per CTI Standard.

A08.3.1.3. The water basin shall be constructed of mimimum 4 mm thick Fibre glass reinforced plastic (FRP), having an auxiliary cylindrical suction tank, wherever required. The basin shall be completed with connections for drain, overflow, make up-water, quickfill and float valve, plus hot dipped galvanised suction strainer.

A08.3.1.4. The support structure for the tower shall be of mild steel duly sturdy structural hot dipped galvanised frame (750GSM) or FRP.

A08.3.1.5. The water diffusion deck shall be of rigid PVC fill as per manufacturer's standard, arranged in a suitable pattern for ease of replacement. The fill shall be rated and certified by the cooling tower manufacturer.

A08.3.2. Water distribution system

A08.3.2.1. The hot water distribution basin shall be open gravity type for easy cleaning and constructed with FRP and shall be distributed through a sprinkler system consisting of PVC sprinkler pipes, which shall be mounted on top of the main supply stand pipe. Alternately, the water distribution could be with a water diffusion deck. Hot water distribution can also be through header and branch pipe arrangement consisting of spray nozzles.

A08.3.3. Fan assembly

A08.3.3.1. The Fans shall be heavy duty, axial flow with aluminium alloy blades selected to provide optimum cooling tower thermal performance with minimum sound levels.The fan blades shall be of aerofoil design and adjustable pitch. The fan assembly shall be statically ~~and Dy namically~~balanced.

A08.3.3.2. The cooling tower shall be such that the exit air does not re-enter the cooling tower therby reducing the capacity of the tower.

A08.3.3.3. The Fans shall be driven by either by speed reduction gears or multigrooved V type belts with taper lock sheaves or direct driven type designed for 150 % of the motor nameplate horsepower. In case of Belt driven assembly, Belt shall be of proven design(already in service for moore than 5 years) and be specifically designed for cooling tower application. Fans and shafts shall be supported by heavy duty, self aligned, lubrication type or totally seal type bearings.One set of additional V belt set for one cooling tower shall be supplied with each cooling Tower.

A08.3.3.4. The fan motor shall be shall be of high efficiency class IE-2, totally enclosed fan cooled for gear and belt driven or TEAO in case of direct driven squirrel cage type conforming to I.P. 55 protection for outdoor operation designed specifically for cooling tower services. The motor shall be furnished with moisture protection on the windings, shafts and bearings and have watertight terminal box.

A08.3.3.5. The fan guard shall be hot dipped galvanised (min 750 GSM) with wire mesh screen to prevent bird nesting during idling period.

A08.3.3.6. All fasteners shall be of Stainless steel (SS-316).

A08.3.3.7. The air inlet area is to be provided with Stainless steel (SS-304) wire mesh and SS-304 louvers.

A08.3.4. Ladder

A08.3.4.1. All towers shall be provided with a ladder, made out of hot dipped galvanised M.S. (min. 750 GSM) to access the fan Deck. Handrails shall be provided along the ladder or the ladder shall be cage type. Handrails shall also be provided on the top of cooling tower along the perimeter of the cooling tower cells. The ladder design shall be submitted for approval by Employer's representative.

A08.3.5. Noise level

A08.3.5.1. The noise emanating from the cooling towers, shall not exceed 85 dBA from the distance of 1 meter. Sound data sheet showing complete octave band should be submitted by the manufacturer.

A08.3.6. Installation

A08.3.6.1. Installation shall be carried out in a manner which shall fully comply with the Manufacturer's recommendations.

A08.3.7. Field tests

A08.3.7.1. General requirements are the following:

- Perform all tests in the presence of the Engineer
- Furnish all field test instruments. The Contractor may remove test instruments only after testing is completed.
- Provide labour, materials and appurtenances required to complete the specified field tests.
- Submit all testing standards and procedures for approval prior to proceeding with any of the tests.

A08.3.7.2. Not used

A08.3.7.3. Not used

A08.3.8 Access Door

A08.3.8.1 Suitable arrangement shal be provided for easy access into the plenum section for maintenance purpose.

DATASHEET FOR COOLING TOWER	
Type	Induced Draft,Cross/Counter Flow Type with Vertical Discharge, CTI CERTIFIED
Reference Code / Standard	CTI – STD 201-1991
Tag No	Tag No To Be Marked On Cooling tower With Black Letter. SS Tag To Be Firmly Attached
Total Number	As per BOQ
Heat Rejection Capacity	As per BOQ
Fluid	Water
Condenser Inlet Temp.	34.4 °C
Condenser Outlet Temp.	30.0 °C
Designed WBT	27.4 °C
Noise Criteria	85 dBA at 1 m

Water Flow Rate	as per BOQ of condenser water pump
Construction Material	Fiber Reinforced Plastic orsturdy Structural Hot Dipped Galvanized
Total Water Loss	1 % Max (combined drift and evaporative losses).
Water Basin – Material	Fiber Reinforced Plastic
Connections	
Size	As per manufactures standard
Inlet And Outlet	As per manufactures standard (Flanged)
Make Up	Regular Arrangement Suitable For Level Switch Controller And Ball Valve With Quick Fill Arrangement
Drain And Overflow	With Valve Arrangement In Drain
Fan	
Type	Aerofoil Design, Statically ~~and Dynamically~~ Balanced
Static	As per manufactures standard
Number of fans	Minimum Two Numbers
Blade / Hub	Blade - Cast Aluminum Alloy~~, EN-8~~ Hub - Cast Iron with aluminium paint and epoxy coating or Cast Aluminum Alloy
Bearing (as applicable for fan or motor)	Heavy Duty ,Self Aligned Grease Packed Bearing with moisture proof seals and integral slinger collars.
Guard	16 SWG Wire Mesh With Frame
Drive Arrangement	Direct driven or Speed reduction gears or V Type Belts
Motor	
Type	TEAO/TEFC – Induction Motor (IP– 55), With Weather Protection, IE-2 Class with service factor of 1.15
Design	IS 60034
Power Connection	Three Phase, 415 V, 50 Hz, AC Supply
RPM	1400 (Max)
Nozzles Design	As per mfg. Design
Nozzles Material	Poly Propylene / HDPE
Cells	As per manufacturers Standard
Number Of Cells	Two Cell

Accessories	Mounting Legs And Ladder With Hand Rails / cage type ladder Minimum 300 mm Wide, Duly Treated For Corrosion, Inspection window
Header / Fittings	Galvanized Steel / PVC / HDPE
Base Frame and ladder	GSS/MS Hot Dipped Galvanized
Paint on base frame and ladder	Hot dipped Galvanized(minimum 750 GSM)
Thickness	Casing as per CTI standard and Basin-4mm (Minimum)
Height of cooling tower	As per manufactures standard

1. Cooling towers shall conform to specifications.
2. Local push buttons for C.T. motors shall be provided.
3. All hardware used for fixing of cooling tower shall be of SS 316
4. Level switch shall be provided for each cooling tower

700-800	12.5

A09.3.1.2. Condensate drain and vent piping system: Nominal bore 15-150: Galvanised steel to IS 1239 medium grade.

A09.3.1.3. Pipes shall bear the BIS standard mark indicating the relevant IS and manufacturer's name.

A09.3.2. Pipe fittings – Materials

A09.3.2.1. Chilled water system/Condenser water system: Galvanized steel fittings complying IS 1239 Part 2.

A09.3.2.2. Condensate drain and vent piping system: Galvanized steel fittings complying IS 1239 Part 2.

A09.3.3. Flanges

A09.3.3.1. Welded piping: Steel, welding neck pattern / Raised face flange shall be used.

A09.3.3.2. Screwed piping: Galvanised steel screwed boss flanges or galvanised malleable cast iron screwed boss flanges.

A09.3.3.3. Copper tubing: Copper slip-on flanges for brazingshall be used. Galvanised iron bolts and nuts shall not be used for fixing copper flanges.

A09.3.4. Gaskets

A09.3.4.1. Gaskets shall be suitable for the temperature, service and pressure of the system and shall be installed in accordance with the Manufacturer's recommendations after obtaining approval for engineer in charge. Made-up flanged joints shall be fabricated from one-piece ring gaskets, 3mm thick, neoprene rubber.

A09.3.4.2. For flanged joints between dissimilar metals or insulating flange joints: insulating gaskets, sleeves and washers between flanges, bolts and nuts respectively shall be used. Insulating material shall be "Teflon" or approved equal.

A09.3.5. Jointing

A09.3.5.1. Chilled water/Condenser water systems: screwed sockets or welded joints for sizes up to 50mm; butt-welded joints for sizes 65 mm and above.

A09.3.5.2. Condensate drain and vent piping systems: screwed sockets joints for sizes up to 50mm; screwed flanges for pipe work 65mm and above.

A09.3.5.3. Chilled water/Condenser water systems: black malleable iron, bronze to iron spherical seat unions for pipework up to 50 mm diameter. Black mid steel welding flanges in accordance with the specified working pressure for pipework above 65mm diameter.

A09.3.5.4. For condensate drain and vent piping systems: Galvanised malleable iron, bronze to iron spherical seat unions for pipework up to 50 mm diameter. For pipes of 65 mm diameter and above, galvanised malleable iron, bronze to iron spherical seat unions or galvanised steel screwed boss flanges.

A09.3.5.5. For fan coil unit connections: Union or flange joints

A09.3.6. Supports and hangers

BSEN 593 : Butterfly Valves
BS 7350: Double Regulating Globe Valves and Flow Measurement Devices for Heating and Chilled Water Systems
IS 210: Grey iron castings-specification
IS 318: Specification for leaded tin bronze ingots and castings
API 594: Check valves-Flanged, Lugged, Wafer and Butt-welding
API 598: Valve inspection and testing
API 609: Butterfly valves – Double-flanged, Lug-and-Wafer type
JIS B302:
BS4504 : Circular Flanges for Pipes, Valves and Fittings(PN Designated)
BS10 Table E: Specification for Flanges and Bolting for Pipes, Valves, and Fittings

A10.3. Technical and installation requirements

A10.3.1. Globe Valves

A10.3.1.1. Generally, globe valves shall be used on service pipelines where regulation is required, and shall be supplied and fitted in positions indicated on the Definitive Design Drawings.

A10.3.1.2. The bodies shall be of an even thickness throughout, clean and free from scale and flaws. Valves up to and including 50 mm nominal bore shall have bronze bodies and valves of 65 mm bore and larger shall have cast iron bodies. No material used shall be susceptible to dezincification.

A10.3.1.3. Globe valves are used for circuit regulation and shall have characterised plug discs. The discs shall be free to rotate, readily removable from the valve stem and renewable. Discs may be manufactured proprietary composition type materials if approved by the Engineer.

A10.3.1.4. Valves may have packed stuffing boxes or be fitted with 'O' rings.

A10.3.1.5. Valves up to and including 50 mm nominal bore shall have taper screwed ends, valves of 65 mm nominal bore and larger shall have flanged connections.

A10.3.1.6. Regulating valves shall be fitted with a lockable spindle to limit the proportion open once regulation is complete.

A10.3.1.7. Bronze globe valves shall be rising stem pattern. Cast iron globe valves shall be outside screw rising stem type.

A10.3.2. Gate Valves

A10.3.2.1. Generally, gate valves shall be used on service pipelines where isolation of plant, equipment and system circuits is required and shall be fitted in the locations indicated on the Definitive Design Drawings.

A10.3.2.2. The bodies shall be of an even thickness throughout, clean and free from scale and flaws. Valves up to and including 50 mm bore shall be bronze, 65 mm bore and larger shall be cast iron. No material used shall be susceptible to dezincification.

A10.3.2.3. Valve wedges may be of cast iron, bronze, nickel alloy or stainless steel. Cast iron wedges shall have bronze trims and seating. Wedges shall be renewable and free to rotate on the valve spindle.

A10.3.2.4. Valves may have packed stuffing boxes or alternatively may be fitted with 'O' rings.

A10.3.3.1. Bronze gate valves shall have non-rising spindles. Cast iron body gate valves shall be outside screw rising stem type.

A12.3.1.4. All fans shall be capable of withstanding the pressures and stresses developed during continuous operation at the selected duty. Additionally, all belt driven fans shall be capable of running continuously at 15% in excess of the selected duty speed (As applicable).
A12.3.1.5. Lifting eye/Flanges shall be provided on all centrifugal and axial fans.
A12.3.1.6. All fans shall be statically and dynamically balanced.
A12.3.1.7. All centrifugal fan shafts shall have the ends drilled to receive a tachometer.
A12.3.1.8. Motor speed shall not exceed 1495 rpm unless otherwise specified.
A12.3.1.9. Nominal motor nameplate rating shall be higher than the peak operating power of the selected fan curve for non-overloading characteristic. The motor rating shall be a minimum of 15% higher than the motor operating point at design conditions unless otherwise specified.
A12.3.1.10. All fans and motors offered shall be of minimum vibration and noise level during operation. Should the vibration and noise level be excessive and not within acceptable standards, additional vibration isolation and sound attenuation shall be provided at no extra cost to the Employer to the satisfaction of the Engineer.
A12.3.1.11. All fans are required to be hot dip galvanised/ galvanised.

A12.3.2. Propeller Fans

A12.3.2.1. The impeller shall be designed to give maximum volume with minimum noise level and minimum power consumption and shall be made of steel or aluminium alloy. The hub shall be steel with grey stove epoxy finish or aluminium alloy. The fan shall be complete with anti-vibration mount.
A12.3.2.2. The motor shall be dust and moisture protected to IP54 and of a totally enclosed construction with permanently lubricated ball bearings suitable for running in ambient temperatures of up to 50°C and relative humidity of up to 100%.
A12.3.2.3. Wire guards made of heavy gauge steel wire or rod with all joints and crossings welded and shall be fitted to impeller side or motor side or both where appropriate.
A12.3.2.4. Propeller fans shall be diaphragm mounted on not less than 1.2~~3~~mm thick steel mounting plate with ~~stove~~ epoxy ~~grey~~ finishes.
A12.3.2.5. Provided with seal permanently lubricated bearings.
~~A12.3.2.6. With tip speed not exceeding 17.5m/s~~

A12.3.3. Axial Flow Fans (Vane/Tube axial)

A12.3.3.1. Provide axial flow, direct drive aerofoil fans as specified on the Equipment Schedules and/or Drawings.
A12.3.3.2. Fan Casing

- Casing shall enclose the motor and impeller.
- Fan casings shall be fitted with matching flanges on the inlet outlet ends with spigots for attachment of flexible connections.
- Inspection doors or sight ports to enable direction of rotation to be established shall be provided.
- Terminal boxes welded/screwed to the casing shall be provided for electrical connection using metallic flexible conduits to fan motor complying with BS 4999: Part 20 for dust and weatherproof conditions.
- Grease nipples shall be brought to the outside of the casing in the most accessible position and fitted with lubrication tube made of copper or other Approved material.
- Gasketed access doors shall be provided in each fan housing or connecting ductwork, suitable for access to adjust or replace blades. For smoke extraction fans, the gaskets shall be suitable for continuous

Capacity	As per BOQ
Flow	Unidirectional
~~Noise~~	~~85 dBA at 1 meter~~
Total Pressure	As per BOQ
FAN	
Blade	Aerofoil Construction, Dynamically Balanced
Material	Aluminum alloy
Bearings	Totally sealed type Ball Bearing
Hub	Cast Aluminium Alloy
Casing	Rolled Steel Sheet, Heavy Gauge
Shaft	Solid Steel
Mounting	Shaft Key And Positive Locking Device
Drive Arrangement	Direct Drive
Motor	
Type	TEFC, IE-2, Induction Motor, Continuous Duty
Design	As Per IEC 60034
Power Supply	Three Phase, 415 V, 50 Hz, AC Power Supply IP 55 Protected
Mounting Arrangement	Suitable Bracket For Ceiling Suspension
Lifting Arrangement	Lifting Eye At Suitable Location And Number or as per manufacturer standard.
Paint	Synthetic Paint (Not required in case of 275 GSM or above, as per standard)

1. Lifting eyes / Flanges shall be provided for the lifting of fans.
2. Should be provided for spring isolators & to install fans as per manufacturer standard.
3. Flanges on the fans have sufficient strength to lift the fans.
4. Fans shall be provided with Flexible connections(Fire Rated in case of Fire Rated) with spring washers on both the side.

micro switches. The micro switches shall be protected with smooth polypropylene. No toxic material shall be used.

A13.3.14.2. The water level controllers shall be of submersible maintenance-free type.

A13.3.15. Modulating Damper Actuators

A13.3.15.1. Modulating damper actuators shall be spring return and electronic direct-coupled types, which require no crank arm and linkage.

A13.3.15.2. Modulating damper actuators shall be suitable for operation between 2 to 10 V DC. A 2 to 10 V DC feedback signal shall be provided for position indication.

A13.3.15.3. Modulating damper actuators shall provide clockwise or anti-clockwise fail safe operation as required by the Engineer.

A13.3.15.4. Modulating damper actuators shall use brushless DC motor and shall be protected from overload at all angles of rotation.

A13.3.15.5. Modulating damper actuators shall have a manual positioning mechanism and readily accessible.

A13.3.16. Installation

A13.3.16.1. Fit equipment and appurtenances to the space provided and make readily serviceable.

A13.3.16.2. Install the entire automatic control system, including control equipment and wiring under the supervision of the automatic control equipment manufacturer.

A13.3.16.3. Mount damper operators outside of the duct with support plates that are completely outside the insulation or covering. Install support plates in a manner that will prevent condensation on damper operator or on supports.

A13.3.16.4. Support valves and damper operator motor mountings so that the operator does not deflect from its normal path when operating under load.

A13.3.16.5. Locate sensing elements and duct sensors where they will respond to representative temperature within the duct or casing.

A13.3.16.6. Install duct sensors and remote transmitters outside of ducts and casings.

A13.3.16.7. Where ducts or casing are insulated, mount sensors flush with outside insulation so that moisture will not condense on sensors or on supports.

A13.3.16.8. Install duct sensor capillary tubes and wires to pierce the thermal insulation at the least practicable number of points

A13.3.16.9. Seal insulation properly where wiring passes through.

A13.3.16.10. Protect control wires by conduit or use flexible armoured cables. Coil control wires and fasten excess lengths to provide a tidy installation.

A13.3.16.11. The buttons side of control panel shall be mounted at 1200 mm above the finished floor level.

A13.3.16.12. Provide 100 mm clearance between rear of panel and wall by a bracket mounting.

A13.3.16.13. Mount controls, instrument gauges, thermostats and relays flush on the front of the panel.

A13.3.16.14. Mount framed schematic control diagram adjacent to each control panel or cabinet.

A13.3.17. Pressure Independent Control valve (AHU and FCU) – Refer Section A10

A13.3.18. CARBON DI OXIDE ~~& Air quality monitor~~ SENSORS

CO2 ~~& air quality~~ sensors shall be installed to monitor air quality in the public area during operational hours. CO2 ~~& air quality~~ sensors shall be connected with FAF fans in the ECS plant room through in built controller (VSD) which syncronise the freash air flow as per the requirement guided by CO2 ~~& air quality~~ level in the public~~punlic~~ area.

- CO2 ~~& air quality monitor cum~~ sensor shall be provided for the occupied areas to monitor the CO2 ~~& air quality~~ level.
- Lowest detection of the monitor shall be 0 to 2000 PPM with a resolution of less than 30 PPM.
- The sensing element for CO2 ~~& air quality sensor~~ shall be dual beam infrared absorption type.
- The sensor shall have a relay output with programmable selection to control CO2 ~~& air quality~~ .
- The communication interface shall be RS port.
- Visual digital display shall be provided which shall read CO2 ~~& air quality~~ level in PPM.
- The sensor, monitor and all components shall be mounted in one neat and compact case, suitable for wall mounting. The indication light shall be mounted on the cover of the case, if surface mounted. All components shall be factory mounted.
- The monitor shall provide 4 to 20 mA or 0 to 10 volts DC output signal.
- The monitor shall be capable of interfacing with BMS.

SECTION A.25 CHILLER PLANT MANAGER

Chiller Plant Manager

General

A. The Chiller Plant ~~Optimizer~~Manager system shall be as indicated on the drawings and described in the specifications.

B. ~~Network Automation/Control Engine~~ Supervisory Controller (SC) and Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems on this project.

C. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by operator password. Multiple users shall have access to all valid system data. An operator shall be able to log onto any work-station on the control system and have access to all appropriate data. The system shall be fully web enabled as shown on the drawings and as specified in this specification.

D. The control system shall be designed such that each mechanical system will be able to operate under stand-alone control. As such, in the event of a network communication failure, or the loss of any other controller, the control system shall continue to independently operate under control.

E. Communication between the control panels and all work-stations shall be over a high speed TCP/IP network. All nodes on this network shall be peers. The operator shall not have to know the panel identifier or location to view or control an object. Application Specific Controllers shall be constantly scanned by the network controllers to update point information and alarm information.

F. The equipment to be monitored and controlled include the following:
   a. Control of Chillers with Primary, Secondary Chilled Water Pumps, Condenser Water Pumps ,Cooling Towers and Motorized Butterfly Valves.
   b. Measurement and monitoring of the chilled water temperatures and flows.
   c. IkW/TR measurement of each chiller.
   d. ~~Energy metering using special Energy Software with dashboard and customized reporting tools for DMRC stations.~~
   e. Automatic Alarm routing through e-mail and SMS to user

Worl Included

A. Provide a Chiller Plant ~~Optimizer~~Manager incorporating Supervisory Controller (SC) ~~Network Automation/Control Engine~~ and Direct Digital Control (DDC), equipment monitoring, and control; Advanced DDC Controllers (DDCs) interfacing directly with sensors, actuators and environmental delivery systems (i.e. chilled water distribution, etc) and

mechanical devices for all items indicated on drawings described herein including motorized butterfly valves, VFDs, panels; a primary communication network to allow data exchange from DDC to DDC; terminal equipment, DDC Controllers interfacing with sensors, actuators, terminal equipment devices; a secondary BACnet MS/TP communication network interfacing DDCs to Supervisory Controller (SC)~~network automation controllers~~; hardware and software interfaces to third-party control equipment.

B. The Chiller Plant ~~Optimizer~~Manager System (~~CPO~~CPM) shall be a state of the art technology, freely expandable for any future expansion plans. The system (~~CPO~~CPM) shall have a minimum controlling capacity of 10,000 physical points without upgrading the data server software or related hardware. In general the system shall support "Open Architecture Concept" with capability to Dynamic Data Exchange (DDE) Link. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.

The ~~CPO~~CPM as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions.
2. Enterprise-level information and control access.
3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
4. Seamless integration of third party system protocol such a MODbus-RTU, BACnet IP
5. Diagnostic monitoring and reporting of ~~CPO~~CPM functions.
6. Offsite monitoring and management access.
7. ~~Energy management / Reports / Dashboards~~

~~CPO~~CPM System Architecture

The system architecture shall be as follows:

The Chiller Plant ~~Optimizer~~Manager (~~CPO~~CPM) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the ~~CPO~~CPM shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

The system shall be designed into three tiers and contain a field tier (the tier that contains all of the field level controllers, and application specific controllers), an automation tier (this is the tier that connects all of the field tiers), and an enterprise tier (this is the tier that connects all of the automation tiers). No two-tier design is acceptable.

The ~~CPO~~CPM shall consist of the following hardware and software:

1. Standalone Network Automation/Control Engine(s)

2. DDC Field Equipment Controller(s) and Input/Output Module(s)
3. Workstation and ~~Energy Management~~CP~~O~~CPM ~~-~~Software

1. Standalone Supervisory Controller~~Network Automation/Control Engine~~

A. Controller shall provide supervisory control over the control network and shall support all three (3) of the following communication protocols:
1. BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9
2. The ~~NAE~~ SC shall be BACnet Testing Labs (BTL) certified. ~~and carry the BTL Label~~.
3. The Supervisory Controller (SC) ~~NAE~~ shall be tested and certified as a BACnet Building Controller (B-BC).

B. Control networks shall provide either "Peer-to-Peer," Master-Slave, or Supervised Token Passing communications.

C. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.

D. Supervisory Controller (SC) ~~Network engine~~ shall have Unlimited number of user license without any additional cost of license on the OWS.

E. Supervisory Controller (SC) ~~Network engine~~ shall be able to access by 4 simultaneous user.

F. Supervisory Controller (SC) ~~Network engine~~ shall I be browsed by Microsoft Internet Explorer and ~~Netscape Navigator~~Mozilla , Crome.

G. Supervisory Controller (SC) ~~Network engine~~ processor should be of 32 bit configuration

H. Supervisory Controller (SC) ~~Network engine~~ should have inbuilt/externally attached display and keys to operate in absence of PC

I. ~~Network engine should have inbuilt IO points , functionally able to act as a DDC controller as well as a Supervisory controller.~~

J. Supervisory Controller (SC) ~~Network engine~~ should support AHARAE standard BACnet MS/TP protocol , Proprietary Protocol shall not be accepted

K. Supervisory Controller (SC) ~~Network engine~~ should support integration of third party protocol (eg MODbus-RTU) seamlessly without adding additional hardware

L. For BACnet MS/TP or IP integration, the Network engine should be support auto discovery to discover the field devices and field points

M. Supervisory Controller (SC) ~~Network engine~~ should support DHCP function for IP addressing

~~2.~~ Workstation and ~~Energy Management~~ ~~CP~~O~~CPM~~ Software ~~(To be integrated with~~

~~station BMS)~~

~~The specifications mentioned herein are applicable for the energy management system which is to be provided in the station BMS and OCC for central monitoring.~~

~~CPO~~CPM shall interface for transferring all energy /performance related data on open network/protocol to the BMS .

A. The system shall provide a real-time database incorporating data from analog, logical or pulse inputs.

B. It should be support up to 1000 TCP/IP addresses for the supervisory controllers in the Enterprise network

C. Historian of point data shall be configurable as part of the point definition. Historian shall be provided for both snapshots and averages with intervals ranging from 5 seconds to 24 hours

D. Trend and change of value data shall be stored within the engine and uploaded to a dedicated trend database or exported in a selectable data format via a provided data export utility

E. The system shall provide a configurable data storage subsystem for the collection of historical data. Data can be stored in SQL or equivalent database format

F. The system shall be able to store all the events

G. The operator interface shall be flexible in its connection to the ~~CPO~~CPM work station ~~server~~. Both serial wireless, 3G~~-~~ and LAN connection shall be possible. The operator interface shall provide standard dial-up modem support. Using other packages such as Microsoft Terminal to make the modem connection shall not be acceptable.

H. ~~CPO~~CPM management level software shall have Unlimited number of user license without any additional cost of license on the OWS.

I. ~~CPO~~CPM software shall be web based software shall allow 5 simultaneous user access.

J. ~~CPO~~CPM ~~Server~~ software shall be able to browsed by Microsoft Internet Explorer or equivalent.~~and Netscape Navigator~~

~~K. Energy Management software capable of fetching the energy data from the BMS and store the data into separate application database (SQL) for analysis. This Software should have the following Key features:~~

- ~~SEGMENTATION OF ENERGY INFORMATION AT A GLANCE.~~
- ~~CUSTOMISABLE ENERGY DASH BOARD.~~
- ~~ENERGY REPORT GENERATION AGAINST SELECTION OF TIME AND FREQUENCY.~~

- ~~CO2 EMISSION CALCULATION AND REPORTING.~~
- ~~WEB BASED TOOL. NO ADDITIONAL SOFTWARE REQUIRED.~~
- ~~Automatic Alarm EMAIL / SMS OPTION AVAILABLE~~

~~L.~~K. The software shall have Ready Access Portal Architecture , graphics and ~~management~~ software shall be accessible thru smart phones.

~~M.~~L. ~~A minimum of 100 unique passwords shall be supported. Provide a minimum of 100 categories of systems to which individual operators may be assigned.~~

~~N.~~M. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of 5 years in advance.

~~O.~~N. Alarms & Events shall be routed directly from ~~Network Automation Engines~~ SC to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers.

~~P.~~O. The system shall provide flexible trending allowing real-time, historical or archived data to be trended in a variety of formats. In addition, trend data types shall be able to be combined to allow for comparisons between data e.g. current real-time data versus archived data

~~Q.~~P. The system shall support a flexible reporting package to allow easy generation of report data. The reports provided should include pre-configured standard reports for common requirements such as Alarm Event reports and custom report generation

~~R.~~Q. ~~The system shall provide up to six levels of security providing varying degrees of access to system operation and configuration functions.~~

~~3.~~2. DDC Field Equipment Controller(s) and Input/Output Module(s)

A. General purpose DDC controllers shall be minimum 32 bit microprocessor based with FLASH base of operating system.

B. The devices shall be programmable and capable of extensive measuring, control and monitoring functions.

C. All DDCs shall support modular architecture with the following:
1. A CPU with Power Supply Module
2. Distributed I/O modules to accommodate Input/Output points.

D. Energy management programs such as optimum start/stop, load reset, duty cycling, night purge, distributed demand control and others must be resident on each DDC.

E. As a back up, DDC's shall store DDC programs and data files on non-volatile EEPROM or flash memory to allow simple and reliable additions and changes. Each DDC shall have a 72 hours battery backed real-time clock.

F. Each panel shall be provided with a socket for a Portable Operators

Terminal (POT) which can be connected via Bluetooth/USB communication for easy access for testing & trouble shooting ~~and no need to open the panel, and a port for network communications In max. speed of 76Kbps~~

The DDC I/O modules should communication within the ~~CPO~~CPM network by ASHARE BACnet MS/TP protocol, no other proprietary protocol is accepted protocol

H. All the DDC should be BTL listed.
I. DDC shall support PRAC and PID logic
J. The DDC software configuration tool shall use be GUI based logics

Immersion Temperature Sensors:

a. Immersion sensors shall be provided with a separable stainless steel/brass well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.

b. Operating range shall be -20 to 70 deg C; pressure rating shall be min. PN 16, IP 54 protection, 1000 ohms platinum at 0 deg. C, . To meet UL 1995 plenum requirements if necessary. Accuracy to ±0.73F° at 70°F (±0.41C° at 21°C), DIN Class B

c. Standard of Acceptance: Johnson Controls TE-6300 series or approved equal.

Outside Air Temperature Sensors:

Chilled Water Flow Meters: (To be quoted separately)

1. Flow meter shall be a single paddle/ electro-magnetic / insertion flow meter.

2. The wetted material shall be constructed of stainless steel or brass

3 . Provide output to ~~CPO~~CPM.

4. Install flow meters according to manufacturer's instructions paying particular attention to the upstream and downstream piping requirements.

5. Standard of Acceptance: Kele/ABB/Sanitech

Local Control Panels:

1. The control panel should be lockable and IP 55 rating
2. Standard of Acceptance: BCH

PART 3 Executions

The ~~CPO~~CPM shall be designed, installed, and commissioned in a turnkey operational manner; including all labour not noted in Work by others paragraph of PART I of this section of these specifications, and not noted in other sections of these

DATA SHEET FOR CHILLER PLANT MANAGER	
Unit Type	DDC Type

List of Equipments:	
No of Water cooled chillers	As per BOQ
N of Air cooled chillers	As per BOQ
No of Primary Chilled water pumps	As per BOQ
No of Secondary Chilled water Pumps	As per BOQ
No of Condenser water Pumps	As per BOQ
No of Cooling towers	As per BOQ
Control:	
DDC / IOM CONTROLLERS for equipment control	32 bit, UL Listed BACnet (BTL certified)
Supervisory controller	32 bit, UL Listed BACnet (BTL certified)
Supervisory controller features	A) The Network supervisory Controller shall have imbedded graphic capability for generating web based user graphics and support Multi user with simultaneous minimum 5 user login facility B) Unlimited user without additional license (C) Shall be browsed by Microsoft Internet Explorer and Netscape Navigator (D) BTL certified (E) Web engine should be 32bit configuration (F) Should have inbuilt display and keys to operate in absence of PC (G) Should have desired inbuilt IO points (H)Functionally able to act as a DDC controller also apart from Supervisory controller function (I) Web engine should support AHARAE standard BACnet MS/TP protocol , Proprietry Protocol shall not be accepted (J) Web engine should support integration of third party protocol (eg MODbus-RTU) seamlessly without adding additional hardware (K) Web engine should support DHCP function for IP addressing

4.20 **Historical Data Management**

4.20.1 An historical database shall be maintained which shall be supported by the same facilities as provided for current data, except that the time period shall be user definable. Displays generated from historical data from different time periods shall be able to be overlaid on one another and overlaid on displays of current data.

4.20.2 Historical data shall have multiple representation ~~shall be able to be manipulated~~ as if it were current data, namely be usable in calculations and on tabular, trend, graphic, spread sheet and bar chart displays. Data stored on multiple bulk storage media cartridges shall be able to be analysed, with the system providing prompts for cartridge changes.

4.20.3 The Control Centre operator shall be able to define the signals assigned to the historical database. It shall be possible for the operator to set up calculations based upon historical data e.g. averages, maximum values, minimum values, totals etc., over a defined time period.

4.20.4 The ability to display formatted current data alongside independently formatted historical data shall be provided.

4.21 **Communication System**

4.21.1 OCC to Field Communications

4.21.1.1 Communications between the OCC TVS SCADA main server and the RTUs to be provided The Contractor shall supply and install as part of this system suitable interfaces to the termination points provided at each station.

4.21.1.2 The communication systems shall comprise dedicated communication cables (except for the main communication bearer) and interfaces, suitable for the environment, run locally in the OCC and within each station and run to all RTUs, workstations and to the main FOTS communications link.

6. List of technical support items specified and list of any additional support items required.
7. Fan-motor unit disassembly and reassembly instructions.
8. Procedures for separately removing and replacing motor, rotor and blades, as well as procedures for removing a complete fan-motor unit without disassembly.

V01.2.3.3. Within 14 days after successful completion of tests specified herein and of any additional tests conducted at the Contractor's own option, Contractor shall submit the following:

1. Certified test results for all fan and motor factory tests conducted. All test data shall be bound in one report. The test report shall be indexed and cross-referenced in an easily understood manner.
2. All records and results of non-destructive examinations made at completion of each examination.
3. Field test results
4. Radiographic inspection films.

V01.3 Technical and installation requirements

V01.3.1. Description

V01.3.1.2. Fans shall be axial flow type with reversible operation. Emergency fan-motor units shall be required to operate in the forward or reverse direction of airflow, with a capability of starting, stopping, or reversing the direction of flow at any time. The trackway exhaust fans, those connected to the underplatform and overtrack exhaust ducts, are not reversible fans.

V01.3.1.3. Fan-motor units shall be direct-driven by internally mounted electric motors, with provision for manual adjustment of the pitch of the individual blades. Fan-motor units shall be statically and dynamically balanced and shall have non overloading characteristics.

V01.3.1.4. Motors ~~shall be the product of a single~~ manufacturer~~, whose~~ name shall appear on the motor performance curves and other data submitted. The motors shall conform to ~~all~~ applicable ANSI, IEEE, ISO, IEC and NEMA. Motors shall not be provided with self-contained thermal protective devices.

V01.3.1.5. Motors shall be of the totally enclosed, air-over, cast iron or steel round frame, induction type, continuous duty, variable torque, and shall be flange, pad, or foot mounted.

V01.3.1.6. Nameplate kilowatt shall be actual continuous brake kilowatts developed without any consideration of the "air over" factor.

V01.3.2. Operating Environment

V01.3.2.1. Fans and all parts thereof shall be capable of withstanding the effect of all stresses and loads under starting, operating, and reversing conditions specified. Fans and all components shall be capable of operating for two hour in an ambient temperature of 250 degrees C. Fans, motors and components shall be capable of withstanding sudden temperature changes as a result of fire between the extremes of zero and plus 250 degrees C or vice versa in a time frame of 20 seconds. Contractor shall submit maximum design stress of rotating components at maximum fan speed and 250 degrees C Temperature

and shall designate types of materials to be used in design by their ASTM designations or approved equal. Fan motor unit shall be capable of withstanding 250 degree Celsius for two hour.

V01.3.2.2. Fans shall be designed and built to serve an underground subway environment and to function under conditions of high humidity and high temperature and the inlet and outlet conditions indicated.

V01.3.3. Fan-Motor Unit Design Requirements

V01.3.3.1. Fan-motor unit performance shall be rated for the airflow and total pressure specified per the Contractors Drawings at a maximum air density of 1.2 kilograms per cubic meter.

V01.3.3.2. Fan performance curves for either direction shall rise continuously with decreasing flow between free delivery and 60 percent of free air delivery or to maximum kilowatt rating. Fans shall be capable of operating continuously at specified design points for forward and reverse flow.

V01.3.3.3. ~~Emergency fan-motor units~~TVF shall have a total efficiency of not less than 60 percent in forward flow and not less than 50 percent in reverse flow, when operating at the specified nominal flow rate. TEF shall have a total efficiency of not less than 70%.

V01.3.3.4. Fans shall be capable of starting from a standstill to full speed, in not more than 30 seconds as per NFPA 130, without failure of any part of the unit. Fans shall be capable of reversing and attaining ~~reversing to~~ full speed from either direction of airflow within 60 seconds ~~and rotation~~ during an emergency ~~within 20 seconds, after a 10 second delay between power interruption and the energising of the motor for the reversed rotation~~, without failure of any part of the unit.

V01.3.3.5. Emergency fan performance, when operating in the reverse direction of airflow and against a constant equivalent orifice, shall not deviate by more than ten percent in airflow delivered from the fan-motor unit performance curves for operation in the forward direction of airflow at any point between 60 percent of the nominal airflow rate and free delivery.

V01.3.3.6. Brake kilowatts shall not exceed the nameplate kilowatts of the fans when operating in either direction of airflow.

V01.3.3.7. Pressure variations of plus or minus ~~300~~200 Pa induced by external causes shall not result in movement of the fan operating point along the fan operating curve into the region of unstable operation. This requirement does not affect the kilowatt requirement for the design operating point.

V01.3.3.8. Fans shall not operate in stalling range of fan performance curve during parallel operation (forward or reverse direction).

V01.3.4. Fan fabrication

V01.3.4.1. Impeller hub and blades shall be of rating for 250 degreeC for 2 hours fabricated of aluminium alloy castings (ASTM B686) or forgings (ASTM B247) or steel (ASTM A-588, Grade A and A-151, 1020 hot rolled) or equivalent BS, EN, & DIN Std., suitable for the specified performance and environment. Fan rotating components shall be designed such that no measured or calculated stress level shall exceed 60 percent of the components materials yield strength at design temperature. Fan blades shall not vary in weight by more than 2 percent. Blades shall be manufactured of a homogeneous material as

specified herein and shall have no cast-in or embedded materials of any kind. Individual blades shall be secured to the hub by not less than four bolts per blade, or shall be clamped securely between the two halves of a split hub or between suitably designed and manufactured clamp plates or by suitable number of studs. Blade bolts, hub bolts or clamp plate bolts shall be readily accessible. The pitch of the blades shall be manually adjustable without removing impeller from fan unit. (Pitch is defined as the angle formed by the chord line of a blade root cross-section and a line parallel to the direction of rotation.) The ratio of the hub diameter to the fan-housing diameter shall not be less than 0.35. The hub shall have index marks embossed or engraved to show the design operating blade setting and the blade settings for a minimum of five additional increments of stagger angle with not less than two on each side of design setting. In addition, the Contractor shall provide metal templates or other approved devices to facilitate settings of blade angles in the field. One template shall be provided for each type of fan for each station that is subject to the Authority's approval. One template shall also be provided with each maintenance manual.

V01.3.4.2. Emergency fan housings, including motor mounts and motor supports shall be fabricated of hot-rolled steel not less than 6 mm thick. Clearance between housing inner diameter and blade tips shall be sufficient to allow for thermal growth difference between blades and steel housing at temperature of 250 degrees C. Welds located in the air stream shall be ground smooth. Flanged rings shall be continuously welded to the outer periphery at each end of the housings, or flanges may be rolled as part of the housing. Provide remote lubrication fittings for lubrication of fan and motor bearings from easily accessible location.

V01.3.4.3. The rotor assembly shall be fastened to the motor shaft by means of an approved-keyed positive locking device. The rotor assembly shaft shall be an extension of the drive motor shaft. Rotor assembly fastening to shaft shall be designed to prevent looseness during temperature of 250 degree C.

V01.3.4.4. Motor mounts and motor supports shall be designed to support the entire weight of the impeller and the motor, and to maintain the alignment of the fan-motor unit assembly in the specified mounting position and to maintain vibration levels within the specified limits. Motor supports shall be sufficient in number to provide the required strength and rigidity and shall be continuously welded to the motor mount and to the housing. Fan motor and fan rotor assembly shall be totally enclosed within the fan housing and not protrude at either end of the fan housing.

V01.3.4.5. Nosepiece coverplates, access doors, hatch covers, and aerodynamic separation plates, where provided, shall be secured by means of positive fastening devices which are fully effective for both directions of impeller rotation, for all blade settings, and for all conditions of operation specified herein.

V01.3.4.6. Emergency fan-motor unit assembly supports shall be of carbon steel not less than 10 mm thick for TVF and 6mm thick for TEF. Supports for horizontally floor mounted fans shall include fan-motor unit structural steel base with vertical supports extending from the base to the fan housing centreline flange and with horizontal thrust plates extending over the full length of the fan housing. Vertical supports and thrust plates shall be welded continuously to the surfaces with which they come into contact.

V01.3.4.7. Contractor shall provide a 6-mm thick ~~silicone~~ fire rated gasket between all adjacent companion flanges and~~;~~ width of gasket shall be as per recommendation of approved fire rated ductwork manufacturer~~same as flange width~~. Gaskets shall be capable of withstanding an ambient temperature of 250-degree C for two hour without degradation of sealing ability and without emitting toxic or noxious fumes.

V01.3.4.8. Sufficient lifting eyes shall be provided on each fan assembly to facilitate on-site installation and removal of the fans.

V01.3.4.9. Bolts shall be not less than 12 mm diameter. Bolts, nuts, washers and lock washers used on the fans and components shall be Type 316 stainless steel, silicon bronze, or other corrosion-resistant material as approved.

V01.3.5. Shop finishes

V01.3.5.1. After fabrication and prior to assembly, all inside and outside surfaces of all fan housings, fan housing extensions, supports and fan-motor unit bases shall be prepared in conformity to the requirements of SP-10 New White Blast Cleaning and shall be given a rust-inhibiting coating, which may consist of an approved plastic coating, or bonderizing, or phosphatizing, followed by the application of a suitable rust-inhibiting primer and finish paint that is resistant to abrasion and to exposure to elevated temperatures. Surface finish shall be capable of withstanding for one hour in an ambient temperature of 250 degree C without degradation of its protective quality, and without emitting toxic or noxious fumes.

Contractor may also provide Hot dip Galvanised fan housings, fan housing extensions, supports and fan-motor unit basesetc with minimum of 275 GSM galvanisation.

V01.3.5.2. Surface finishes damaged during transport or assembly shall be restored to their original condition and colour by the installing Contractor.

V01.3.6. Motor components and construction

V01.3.6.1. The motors shall be designed for continuous operation for a period of at least two hour at a maximum ambient temperature of 250 degree C.

V01.3.6.2. Motors shall be equipped with factory installed resistance space heaters within the motor enclosure to prevent condensation of moisture in the motor windings. The heaters shall be energised whenever the motor is not in operation and shall be automatically de-energised whenever the motor is in operation. The heaters shall be provided with leads terminated in a terminal box external to the fan housing. Motor space heaters shall be energised within 24 hours of the time when the unit is installed at site.

V01.3.6.3. Nameplate kilowatt of the motors shall be as indicated. Kilowatt input required by the fans shall not exceed the nameplate kilowatt of the motors at any point on the fan performance curve in either direction of airflow. Motors shall have a minimum overall efficiency of 90.0 percent at the rated load. .

V01.3.6.4. Motors shall be capable, under the specified operating conditions, of accelerating the impeller from a standstill to rated rotational speed in not more than 3015 seconds after being energised. Motors shall also be capable of decelerating the impeller and accelerating to rated rotational speed in the opposite direction in not more than ~~30~~60 seconds after being energised for reverse rotation.

V01.3.6.5. Motors shall be rated in accordance with NEMA/IEC Standards for the locked rotor input (kilovolt-amperes per kilowatt) required to meet the specified

TUNNEL VENTILATION FANS		
Type		Tubular Reversible Axial Flow
Noise Criteria		Refer to Notes
Reversibility		100% of nominal capacity in each direction
High Temperature Operation		2 Hour @ 250 °C
Capacity		as per BOQ
Fan	Blade	Aerofoil Construction, Dynamically Balanced
	Material	Alloy Aluminum
	Bearings	Spherical roller (single row)
	Hub	Cast Aluminum
	Casing	Rolled Steel Sheet, Heavy Gauge
	Shaft	Solid Carbon Steel
	Mounting	Shaft Key And Positive Locking Device
Drive Arrangement		Direct Drive (mounted on motor shaft)
Motor	Type	TEFC Induction Motor,EFF-1 / IE-2, Continuous Duty
	Design	As Per Relevant IEC
	Connection	Three Phase, 415 V, 50 Hz, AC Power Supply
Mounting Arrangement		Base frame for floor mounting
Lifting Arrangement		Lifting Eye At Suitable Location and number.
Paint		Fan structure Hot dip galvanized.
Fire Rated Enclosure		Fire rated demountable enclosure is required only on fan and not on attenuator and transition piece.
NoiseAttenuator	Type	Square, Rectangular Flange Type
	High Temperature Operation	2Hour @ 250 °C
	Construction	To Comply with DW 142 Class B Code
	Casing	1.6 mm thick Hot Dipped Galvanized Sheet Steel
	Casing Material	Galvanized steel sheet
	Acoustic Fill	Mineral wool or Fiber Glass With Class ‘O’ Flame Spread/ As per class ASTM E 84
	Internal	0.8 mm thick perforated SS-316.
	Splitters	0.8 mm thick perforated SS-316.
	Mounting Arrangement	Suitable Bracket For Floor/Wall Mounting

stainless steel pin, such that full force of operator is applied to the blade connecting linkage.

V02.3.3.3. NOT USED

V02.3.3.4. NOT USED

V02.3.3.5. The actuators shall be furnished with spring actuated devices capable of driving the dampers to their "POWER OFF" positions within a period of 15 seconds after the operators are de-energised. The "POWER OFF" position of a damper (normally open or normally closed) is defined as the position which the damper assumes when its operators are de-energised. The spring return devices shall be fully operational as specified throughoutand following exposure to ambient and air stream temperatures of 250 degree C for two hour.

V02.3.3.6. Conduit boxes shall have tightly fitting, gasketted covers designed to resist the entrance of dust and fluids; and shall have threaded conduit openings. All electrical components, conduit and boxes shall be weatherproof. Conduit boxes shall be mounted to the motor mounting plates.

V02.3.3.7. The initial charge of lubricants for damper components shall be supplied by the manufacturer.

V02.3.3.8. Co-ordinate with damper manufacturer the installation of damper pneumatic operators from operational and service standpoint.

V02.3.4. Damper finishing

V02.3.4.1. All galvanised parts shall have either a hot-dipped or an electro-deposited zinc coating. The weight of the coating shall be not less than 750 grams per square meter of surface. The zinc coating shall be performed after the material is fabricated. The use of zinc pigmented paint in lieu of galvanising will not be allowed. The galvanising shall conform to ASTM A 123; and withstand an eight dip Preece Test in accordance with ASTM A 239.

V02.3.5. Nameplates

V02.3.5.1. Each damper shall be provided with a stainless steel nameplate permanently stamped with the name and address of the manufacturer, Contractor's model type, serial number and the Authority's designated damper number.

V02.3.5.2. Each damper pneumatic actuator shall be provided with stainless steel nameplate.

V02.3.5.3. Nameplates shall be attached to respective component in a location conspicuous after installation.

V02.3.6. Screens

V02.3.6.1. Screens mounted on damper module frame shall be one-inch mesh No. 10 U.S.S. gauge or 3.5mm galvanised steel wire. Each screen shall be complete with a frame for rigidity. The screen shall be reinforced across the shorter dimension with 30 mm by 30mm by 3mm galvanised steel angles on 600 mm maximum centres.

V02.3.6.2. Screen companion flanges shall be bolted to damper companion flanges with bolts spaced not more than 300 mm on centre.

V02.3.7. Factory damper tests

V05.3.11.4.4 If the calculated thrust is less than 95% of the specified value, adjust the fan blade angle to increase the airflow; and remeasure the exit jet velocity and air volume until the calculated thrust is at least 95% of the specified value.

V05.3.12 Replacement Materials

V05.3.12.1 ~~Furnish two fan assemblies as spare. Design and construct each spare booster fan assembly to make it identical to the booster fan assemblies being installed as part of the tunnel ventilation system. Furnish spare booster fan assemblies complete with all accessories to make it readily interchangeable with any one of the booster fan assemblies removed and taken out of service for maintenance in the future.~~

V05.3.12.2 Package spare fan assemblies separately and deliver and unload at a site designated by the Authority at a later date. Package all spare items suitable for long-term indoor storage, and identify each package clearly with the Contract number, description and quantity of the contents.

DATA SHEETS FOR JET FANS		
Type-		Tubular Tube Axial Flow with short casing
Reference Code / Standard		BS EN ISO 9001
Flow Direction		as per BOQ
Thrust		As specified in BOQ
Noise Criteria		Refer to Notes
High Temperature Operation		2 Hours @ 250 °C
FAN	Blade	Aerofoil Construction, Dynamically Balanced , Adjustable
	Material	Cast Aluminum
	Bearings	Fan mounted on motor Shaft
	Hub	Cast Aluminum
	Casing	Rolled Steel Sheet, Heavy Gauge
	Shaft	Impellor mounted on motor shaft
	Mounting	Shaft Key And Positive Locking Device
Drive Arrangement		Direct Drive
Motor	Type	TEFC Induction Motor,EFF-1 / IE-2, Continuous Duty
	Design	As Per or Relevant ISO Standard/ Relevant IEC
	Connection	Three Phase, 415 V, 50 Hz, AC Power Supply
Paint		Epoxy Paint after Surface Treatment For Corrosion/ Hot Dipped galvanized surface
NoiseAttenuator	Type	Square, Rectangular Flange Type
	High Temperature Operation	Two Hour's @ 250 °C
	Construction	To Comply with DW 144 Class B Code

Name of the Bid: **Design Verification, Detail Engineering, Supply, Installation, Testing and Commissioning of Environment Control System (ECS), Tunnel Ventilation System (TVS), Electrical and Mechanical System (E&M) and Building Management System (BMS) for two underground Metro Stations at Chhoti Chaupar and Badi Chaupar on East–West Corridor of Jaipur Metro Phase- 1B**

NCB NO: **JP/EW/1B/E1**

Name of the Bidder:

CHECK LIST FOR FINANCIAL SUBMISSION
(To be attached with Financial Bid submission)

SL No	Reference	Description of Item	Submitted		Submitted on page no
			YES	NO	
1	ER	Pricing of Unqualified Withdrawal of Conditions, Qualifications, Deviations, etc as per item no. 10 of Section 6			
2	BDF Vol I&II	Bill of Quantities / Pricing Document in Sealed condition in Financial package envelope as per Section 4 Vol I & II			
3		Priced BOQ in MS Excel format in a CD in sealed condition in Financial package envelope.			
4		The supporting documents/ printed literature are translated in English language and is duly certified by the authorized signatory			
5		Each page of the submittal has been numbered, signed and stamped by authorized signatory.			
6		Financial Submission has 'ORIGINAL' and 'Two true copies' of the same as per ITB Clause 22.1.			

Undertaking

This is to undertake that I have checked the above list with our submittal . I am also aware that if the application is not containing the above documents, our application is liable to be rejected

Authorized Signatory

JAIPUR METRO RAIL CORPORATION

Name of the Bid: **Design Verification, Detail Engineering, Supply, Installation, Testing and Commissioning of Environment Control System (ECS), Tunnel Ventilation System (TVS), Electrical and Mechanical System (E&M) and Building Management System (BMS) for two underground Metro Stations at Chhoti Chaupar and Badi Chaupar on East–West Corridor of Jaipur Metro Phase- 1B**

NCB NO: **JP/EW/1B/E1**

Name of the Bidder:

CHECKLIST FOR BIDDERS QUALIFICATION SUBMISSION
(To be attached with Technical Bid submission)

SL No	Reference to the Bid	Description of Item	Submitted		Submitted on page no
			YES	NO	
1	BDS clause22.1	Submission has "ORIGINAL" and Two true copies of the same.			
2	Section-4 Vol-I	Letter of Technical Bid			
3	Section-4 Vol-I	Letter of Price Bid			
4	ITB-21& Section-4	Bid security as per applicable format			
5		Banks detail for bid security			
6	ITB-3	Undertaking for Corrupt & Fraudulent Practice			
7		Tender index			
8	ITB-4	In case of single entity, articles of incorporation or constitution of the legal entity in accordance with ITB4.1 and ITB4.2			
9	ITB-22.2	Authorization to represent the firm or Joint Venture in accordance with ITB 22.2			
10	ITB-4.1	In case of Joint Venture, letter of intent to form Joint Venture or Joint Venture agreement, in accordance with ITB 4.1			
11		Memorandum of Understanding in case of JV/Consortium/Pratnership as per BDS clause ITB22.2			
12		Power of Attorney having the specimen signature of authorized signatory duly notarized is enclosed.			

13		Board of Resolution or delegation of authorization for the concerned PoA is enclosed.			
14		Article of Incorporation of Applicant JV/Consortium partners are enclosed.			
15		Notes: (i) In case of Foreign Partner(s), Power of Attorney(s)and Board of Resolution confirming authority on the person(s) issuing the Power of Attorney for such actions, shall be submitted **duly notarized by the notary public of origin**			
16		(ii) In the case of government-owned enterprise, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5			
17	BDF section-4	Form PER-I Proposed Personnel			
18	BDF section-4	From PER-II Resume of proposed personnel			
19	BDF section-4	Form ELI - 1: Bidder's Information Sheet			
20	BDF section-4	Form ELI - 2: Joint Venture Information Sheet			
21	BDF section-4	Form LIT - 1: Pending Litigation and Arbitration			
22	BDF section-4	Form FIN - 1: Historical Financial Performance (certified by Chartered Accountant)			
23	BDF section-4	Form FIN - 2: Average Annual Turnover (certified by Chartered Accountant)			
24	BDF section-4	Form FIN – 3: Availability of Financial Resources (certified by Chartered Accountant)			
25	BDF section-4	Form FIN- 4: Financial Requirements for Current Contract Commitments (certified by Chartered Accountant)			
26	BDF section-4	Form FIN- 5: Compliance Check of Financial Resources (certified by Chartered Accountant)			
27	BDF section-4	Form EXP – 1: Contracts of Similar Size and Nature			
28	BDF section-4	Form EXP – 2: Experience in Key Activities			

29	BDF section-4	Form EXP – 3: Subcontractors			
30		Details regarding Letter of Acceptance/Work completion certificates /taking over certificates to substnatiate the expetience details filled in from EXP-1, EXP-2 , EXP-3			
31		Successfully or substantially completed certificates successfully from client clearly indicating the nature/scope of work, actual completion cost and actual date of completion for such work should be submitted			
32		In case the work is executed for private client, copy of work order, bill of quantities, bill wise details of payment received certified by Chartered Accountant under his signature, stamp and membership number, Tax Deducted at Source (TDS) certificates for all payments received and copy of final/last bill paid by client shall be submitted			
33		Technical submission in PDF format in a CD			
34	ER	Statement of Deviaitons as per item no.10 of Section 6 Employer Requirement			
35	BDF	Requirements for Bidder's Technical Proposals as per Section 4			
36	BDF	Schedule of Sub-Contractors			
37	ER	Schedule of Vendors/ Equipment & Systems as per Item no.15			
38	BDF/ER	Project Organisation as per item no. 7 Section 6 and PER-I & II of Section 4			
39	BDF	Proposal for Contractor’s Machinery as per form EQU and item no. 8 of Section 4			
40	ER	Detail of Foreign Currency as per item no.14 of Sec6			
41	Section-6 Clause-12	Outline Quality Plan			
42	Section-6 Clause-13	Outline Safety, Health & Environment Plan			
43	Section-6 Clause-7	Staffing Schedules and Organization Chart			

44		The supporting documents /printed literature are translated in English language and is duly certified by the authorized signatory			
45		Each page of the submittal has been numbered , signed and stamped by authorized signatory.			

Undertaking

This is to undertake that I have checked the above list with our submittal . I am also aware that if the application is not containing the above documents, our application is liable to be rejected

Authorized Signatory