



WEST BENGAL HOUSING BOARD

(Estd. under W.B. Act XXXII of 1972)

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No. 234 /JD(EW)-I/HB

Dated : 11 .11.2014.

8th CORRIGENDUM NOTICE

Name of Work : "Design and Construction of Sunray Housing Project as per Sanctioned Plan comprising of (B+G+10)-storied Tower-1 & 2 and (G+10)-storied Tower-3 Buildings along with Club House, Facility bldg, Swimming Pool and other Infrastructure Development works including all works of Civil along with Sanitary & Plumbing, Electrical, Fire Fighting etc. at New Town, Rajarhat, Kolkata, West Bengal."

Ref. NIT No. : NIT No.03/2014-15/ JD(EW)-I/WBHB circulated vide No. Memo No. : 168 / JD(EW)-I / WBHB Date : 20.08.2014 of the Joint Director(EW)-I, West Bengal Housing Board.

Ref. Tender ID : 2014_WBHB_22740_1

All concerned are hereby notified that the following corrigendum has been made to the NIT for above noted work (e-tender) :

Sl. No.	Particulars	In place of	To be read as
1)	Sub-Section 5.5(Scope & specification for Electrical works) / page-1 & 2 / Detailed scope of works / Sl.1. Power Source from WBSEDCL/NTESCL in underground system both H.T. & L.T. / c. / last sentence.	Relevant charges as required by the power supply authority for this entire works will have to be borne by the agency.	Relevant charges as required by the power supply authority for this entire works will have to be borne by the agency. The charges for HT portion and Testing & supervision charges of LT portion as paid to the supply authority by the Contractor on behalf of WBHB will be reimbursed by WBHB on production of necessary documents.
2)	Sub Section 5.5 (Scope & specification for Electrical works) / page-3 / Sl.8. Solar Power Plant	The bidder should design a suitable capacity solar power plant system showing actual position of different component etc. in the blue print.	The bidder should design a suitable capacity solar power plant system (to feed at least 25% street light) showing actual position of different component etc.
3)	Sub-Section 5.5(Scope & specification for Electrical works) / page-5 / Sl.11.3, Page-5	The normal power supply to the premises shall be available from WBSEDCL/NTESCL at 12 KV and fault level..... The Transformer shall be protected on the H.T. side by 11KV. Circuit breaker i.e. VCB(Vacuum Circuit Breaker), with necessary Metering and protection.	The normal power supply to the premises shall be available from WBSEDCL/NTESCL at 33 KV & 350MVA fault level. Suitable capacity of H.T. cable shall be used to connect to main 4-pannel RMU & to Transformer (inside the compact sub-station) to step down the voltage level at 433 volt and other RMU's of distribution sub-station(compact outdoor type) after installation of sub-station along with

			L.T. distribution up to meter board in several locations to be handed over to the supply authority with required metering and protection of transformers.
4)	Sub-Section 5.5(Scope & specification for Electrical works) / page-6 to 11 / Sl.11.5 Power distribution scheme & Sl.11.6 Electrical load.	All tables & contents.	Deleted and to be read as furnished in Annexure-C1
5)	Sub-Section 5.5 (Scope & specification for Electrical works) / page-11 / Sl.11.7 Calculation of D.G. Set	Load description = 5929.74 KVA.	Load description = 1188.50 KVA.
6)	Sub-Section 5.5 (Scope & specification for Electrical works) / page-16 & 17 / Sl.21.2 Scope	1) 11KV HT switch Board. 6-A) Specification of HT cable (XLPE) (11KV).	1) 33 KV HT switch Board. 6-A) Specification of HT cable (XLPE) (33 KV).
7)	Sub-Section 5.5 (Scope & specification for Electrical works) / page-20 / Sl.2 Design criteria	All Contents of Sl.2 i), ii) & iii)	Deleted and to be read as follows : To be submitted by bidder, considering 33 KV/.433 KV supply and distribution system as per NTEC guide line.
8)	Sub-Section 5.5(Scope & specification for Electrical works) / Page-21 to 28 From 11 KV HT switch board to Fuses.	All contents From 11 KV HT switch board to Fuses.	Deleted and to be read as furnished in Annexure-C2.
9)	Sub-Section 5.5(Scope & specification for Electrical works) / Page-29 to 30/ Sl.21.10 Dry type indoor distribution transformer.	All the contents for Sl.21.10 a, b, c, & d.	Deleted and to be read as furnished in Annexure-C3 (Sl. 3.7.0 to 3.7.14).
10)	Sub-Section 5.5(Scope & specification for Electrical works) / Page-30 to 32/ 'Test & inspection' to 'Transient Event Counter'.	All the contents under Routine Tests, type tests, Dynamic Short circuit test, Submission Routine test certificate, specification of LT panel & switch gear, codes & standard and 'Transient Event Counter'.	Deleted and to be read as furnished in Annexure-C3 (Sl. 3.8.0 to 3.8.4).
11)	Sub-Section 5.5 (Scope & specification for Electrical works) / Page-34 / Sl.25.2 Quality assurance.	Specification of HT cable (XLPE) (11KV)	Specification of HT cable (XLPE) (33KV)
12)	Sub-Section 5.5(Scope & specification for Electrical works) / Page-37 / Sl.25.3 Fire Seal system	Given particulars under table for separation of cable.	Deleted. To be read as per I.E.Rule & NTEC guide line.

13)	Sub-Section 5.5(Scope & specification for Electrical works) / Page-65 / Electrical sub-station works, Sl. 2, Transformer (dry type) Makers name.	AEG/CROMPTON/VOLTAMPS/RAYCHEM	AEG/CROMPTON/VOLTAMPS/RAYCHEM/ ABB/SCHNEIDER
14)	Sub-Section 5.6(Major items of Electrical works) / Page-37 to 49 / Sl. 32 (1) to 32 (7).	All the contents.	Deleted & to be read as follows : Supply, installation, testing & commissioning of compact Elec. Sub-station(out door type) of 33 KV/0.433 KV, drawing power source from NTESC/WBSEDCL (33 KV), is to be taken to 4-panel RMU(350MVA fault level) (to be installed by the Bidder) inside the premises, and 33 KV ring main through all the sub-stations(compact) to be done by the NTSC Ltd. Bidder should make all necessary communication/ arrangements to get it done. Total net work from RMU(inside the sub-station) for power distribution, including load distribution upto individual and common meter, installing of sub-stations, sub-station wise load distribution, transformer(Dry type), panels, L.T. cables, energy meters etc. are under the scope of bidder. Bidder shall submit all necessary drawings, SLD, specification, detailed load design calculation, cable trench drawing (H.T. & L.T.) etc. to the power supply authority for approval, duly verified by WBHB by utilizing the space as shown in the site layout plan. All the H.T. switch gear, transformer and L.T. switch gear in package/compact sub-station should be of same manufacturer and should be having minimum warranty period as applicable.
15)	Sub-Section 5.6 (Major items of Electrical works) / Page-50 to 57 / Sl. 12(A), (B) (C), (E) & (F) Energy meter Board with busbar chamber.	All the contents.	Deleted & to be read as follows : Bidder has to design and execute with specification etc. for L.T. meter Board(Both for sub-station and L.T. consumers) as per NTESC guide line. 1 No. Energy meter for each of compact sub-stations to be considered.
16)	Sub-section-5.1 (Project Features with Area Statement) /Page-2 / Sl. A) 7. Energy Sub-stations / Col. Detailed Provisions/Facilities.	6 Nos. single storied buildings	6 Nos. (or as per design requirement) Package/Compact Sub-station(open type) over a concrete platform measuring 5.0 m x 3.5 m (Approx.) with depth as per design to be and others as required.

17)	Sub-section-5.7 (Payment Schedule for the SUNRAY Housing Project) / Page 1 to 8.	Payment Schedule for the SUNRAY Housing Project	Revised as per Annexure-C4.
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All other terms & conditions of the Bid will remain unchanged.

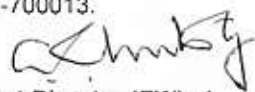

Joint Director (EW)-I,
West Bengal Housing Board

No. 234 / 1(10) / JD(EW)-I/HB

Dated: 11.11.2014

Copy forwarded for information & wide circulation to the :-

1. Vice-Chairman, HRBC, St. Georges Gate Road, Kolkata-700021
2. Chief Engineer, Housing Directorate, Govt. of W.B. N.S. Building, 1, K.S. Roy Road, Kol-700001.
3. Chief Engineer-I, WB HIDCO, "HIDCO BHABAN", Premises No. 34-1111, Major Arial Road, 3rd Rotary, New Town, Kolkata -700156.
4. Chief Municipal Engineer, Dev. & Planning Deptt., K. M. C., S.N. Banerjee Road, Kol-700014.
5. Superintending Engineer (P.W.D), Presidency Circle.-I, N.S. Bldg, 1, K.S.Roy Road, Kol-700001.
6. Superintending Engineer (P.W.D), Presidency Circle.-II, Hestings, Kolkata-700027.
7. Superintending Engineer (P.W.D), Southern Circle. C.I.T. Bldg, P-16, India Exch. Place Extn, Kol-73.
8. Superintending Engineer (P.W.D), Bidhan Nagar Circle, Purta Bhawan, Salt lake, Kol-700091.
9. Superintending Engineer (P.W.D), Eastern Circle, 45, Ganesh Ch. Avenue, Kol-700013.
10. Federation of Contractors' Association, West Bengal.


Joint Director (EW) - I,
West Bengal Housing Board.

No. 234 / 2(16) / JD(EW)-I/HB

Dated: 11.11.2014

Copy forwarded for information & wide circulation to the:-

1. Housing Commissioner, WBHB
2. Director (Engg.),WBHB
3. FA-Cum-CAO,WBHB
4. CA-Cum-AP,WBHB
5. Senior Architect, WBHB.
6. DHC & Secy., WBHB
7. Joint Director (EW)-II / III / IV / V / (E.P.) / (EEW), WBHB
8. AHC-I, WBHB with the request to publish the Notice in BOARD's Web site. Soft copy of the Corrigendum is being sent through e-mail.
9. DD(EW)-Sunray H.P., WBHB
10. Estimator, JD(EW)-I/Sunray H.P., WBHB.
11. Notice Board


Joint Director (EW) - I,
West Bengal Housing Board.

DEMAND ELECTRICAL LOAD AT A GLANCE

SUNRAY HOUSING PROJECT

AT PLOT NO. - AA-IID/ BLOCK - 8

RAJARHAT, NEWTOWN, KOLKATA

Sl. No.	Type of Flat/ Bldg.	Qty of Flat/ Bldg.	Contd. Load in KW	Deduct Gysr Load		D.F.	Dem. Load Each	Total Demd Load in KW
1	TOWER - 1 (B+G+10Storyed)							
a)	2BHK Type Flat	9	13.662	4.5	9.162	0.55	5.04	45.352
b)	3BHK Type Flat	271	16.665	4.5	12.165	0.55	6.69	1813.193
c)	4BHK Type Flat	34	20.175	4.5	15.675	0.55	8.62	293.123
d)	4BHK Duplex type	32	23.000	6.0	17.000	0.55	9.35	299.200
e)	Stair Case (G+10 Storeyed)	11	0.624			1.0	0.62	6.864
f)	Stair Case (1Storeyed)	16	0.052			1.0	0.05	0.832
g)	Lobby & Corridor	11	4.000			1.0	44.00	44.000
h)	Meter Room	15	0.360			0.40	2.16	2.160
i)	Gr.fl. Parking & Comn Area	1	12.00			0.8	9.6	9.600
j)	Basement	1	20.00			0.8	16	16.000
k)	Sump Pump	8	0.746			0.6	3.58	3.581
l)	Crse (Gr. Fl.)	1	15.5	3.0	12.50	0.8	12.40	12.400
m)	Driver Rest Room & others	1	0.40		0.40	0.8	0.32	0.320
n)	Multi Gym (1st. Fl.)	2	10.00		10.00	0.65	13.00	13.000
o)	Indoor Games (2nd. Fl.)	1	8.00		8.00	0.8	6.40	6.400
p)	Domestic Water Pump-1	1	25.00		25.00	0.8	20.00	20.000
q)	Lift - 8 Passenger	9	11.00			1	99.00	99.000
r)	Lift - 16 Passenger	9	15.00			1	135.00	135.000
								2820.024
2	TOWER - 2 (B+G+10Storyed)							
a)	3BHK Type Flat	134	16.665	4.5	12.165	0.55	6.69	896.561
b)	Stair Case (G+10 Storeyed)	7	0.624			1	0.624	4.368
c)	Stair Case (1Storeyed)	4	0.052			1	0.052	0.208
d)	Lobby & Corridor	11	1.06			1	11.66	11.66
e)	Meter Room	4	0.400			0.4	0.64	0.64
f)	Gr.fl. Parking & Comn Area	1	8.00			0.8	6.4	6.40
g)	Basement	1	14.00			0.8	11.2	11.20
h)	Sump Pump	5	0.746			0.6	2.24	2.238
i)	Library (1st. Fl.)	1	10.00		10.00	0.65	6.50	6.500
j)	Helth Care (1st. Fl.)	1	8.00		8.00	0.8	6.40	6.400
k)	Multi Gym (2nd. Fl.)	1	10.00		10.00	0.65	6.50	6.500
l)	Indoor Games (2nd. Fl.)	1	8.00		8.00	0.8	6.40	6.400
m)	Lift - 8 Passenger	2	11.00			1	22.00	22.00
n)	Lift - 16 Passenger	4	15.00			1	60.00	60.00
								1041.1
3	TOWER - 3 (G+ 1 Storyed)							
a)	3BHK Type Flat	120	16.665	4.5	12.165	0.55	6.69	802.890
b)	Stair Case (G+10 Storeyed)	4	0.528			1	0.528	2.112
c)	Lobby & Corridor	2	2.64			1	5.28	5.28

Sl. No.	Type of Flat/ Bldg.	Qty of Flat/ Bldg.	Contd. Load in KW	Deduct Gyser Load		D.F.	Dem. Load Each	Total Demd Load in KW
	d) Meter Room	2	0.500			0.4	0.4	0.4
	e) Gr.fl. Parking & Comn Area	1	1.50			0.8	1.2	1.20
	f) Residential Association	1	10.00			0.8	8	8.00
	g) Domestic Pump Room-2	1	25.00			1	25.00	25.00
	m) Lift - 8 Passenger	2	11.00			1	22.00	22.00
	n) Lift - 20 Passenger	2	18.00			1	36.00	<u>36.00</u>
								902.9
4	CLUB (G+2 Storved)	1	55.00			0.8	44.0	44.00
5	Swmming Pool	1	15.00			0.4	6.0	<u>6.00</u>
								50.00
6	Facility Stract. (G+1 Storved)							
	a) Retail Shopping							37.71
	b) Stair Case & Lobby							1.56
	c) Community Hall							36.57
	d) Lift - 20 Passenger	2	10.00			1	20.00	20.00
								95.84
7	Sub-Station Bldg	6	2.00			0.4	4.8	4.80
8	Domestic Woter Pump -3	1	25.00			1.0	25.0	25.00
9	External Light	1	30.00			1.0	30.0	30.00
10	Watch Man Booth	1	6.00			1.0	6.0	6.00
11	Fire Pump (Jokey)	2	25.00			0.5	25.0	25.00
12	UPS (10x3 +10x2 +15x1+15x1)	1	80.00			1	80.0	<u>80.00</u>
								170.80

5080.62 KW

Consider Overall Diversity

1.20

4233.85 KW

Consider Power Factor

0.85

4981.00 KVA

Consider Loading of Tran.

0.80

6226.25 KVA

TECHNICAL SPECIFICATIONS FOR OUTDOOR TYPE **NON-EXTENSIBLE 33 KV COMAPCT RING MAIN UNIT SWITCHGEAR**

GENERAL

The RMU shall be 4 way type with 2 nos Fixed LOAD BREAK SWITCH and 2 nos VCB with protection, housed in steel enclosure with SF6 environment and suitable for outdoor installation.

This RMU should be complete with all the components necessary for its effective and trouble free operation along with associated equipment etc. Such components should be deemed to be within the scope of supplier's scope of supply.

The RMU should be fixed type, SF6 insulated, Vacuum circuit breakers with 3- O/C and 1- E/F relay (with IDMT and HS element) for the protection of the outgoing cable / Compact Substation. It should be maintenance free equipment having stainless steel robotically welded IP-67 enclosure.

SITE CONDITION :

Temperature :

Max. : 50 deg C

Min : 5 deg C

Avg : 32 deg C

Humidity :

Max : 100%

Min : 10%

Pollution : highly polluted Class III

1.0 REFERENCE STANDARD :

1.1 All equipment and material shall be designed manufactured and tested in accordance with the latest applicable IEC standard.

1.2 Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted. In such case copies of English version of the standard adopted shall be submitted.

1.3 The electrical installation shall meet the requirement of Indian Electricity Rules, 1956 as amended up to date, relevant IS code of practice and Indian Electricity Act, 1910. The Electricity Act, 2003 shall also apply. In addition other rules and regulations applicable to the work shall be followed. In case of any discrepancy, the most stringent and restrictive one shall be binding.

1.4 The high-tension switchgear offered shall in general comply with the latest issues including amendments of the following standards but not restricted to them.

RELEVANT IEC / IS

60694: 12729 Common clauses for high-voltage switchgear and control standards (for voltages exceeding 1000 V).

62271-200: A.C. Metal-enclosed switchgear and control gear

60129: Alternating current disconnectors (isolators) and earthing switches

60529: 13947 Classification of degrees of protection provided by enclosures

-IP 67 for tank with high voltage components

-IP 3X for the front covers of the mechanism

-IP 3X for the cable connection covers
-IP 54 for the outdoor enclosure (kiosk)
60265: High voltages switches Part 1
62271-100: 13118 High Voltage AC Circuit Breakers, General Requirement.
6005: Colour for ready mixed paints and enamels, Code of practice for phosphating of iron and steel,
60044-1: Current Transformers
60044-1 Voltage Transformers
60255: Electrical Relays
60 9135 High Voltage testing techniques.
427 13516 Method of Synthetic Testing of H.V.A.C Circuit Breakers.
IEC 62271-200 MV metal-enclosed switchgear,
(IEC 62271-102) AC disconnections and earthing switches,

2.0 DESIGN CRITERION

Service conditions

The 33 kV BREAKER shall be suitable for operations at an altitude up to 1000 meters, as per IEC 60120, above sea level. The BREAKER shall be capable of operating normally within the following temperature range:

- Maximum ambient temperature : + 50 ° C
- Minimum ambient temperature : + 5 ° C

Manufacturer shall declare whether BREAKER is able to operate in air temperature higher than + 50 ° C and if current de-rating is necessary. The BREAKER shall be capable of being electrically commanded. And BREAKER shall be suitable for future motorization. The BREAKER shall be capable of being exposed to high relative humidity and polluted environments. The BREAKER shall be suitable for outdoor use.

3.0 DESIGN PARAMETERS

Network Three phases - Three wires

Rated Voltage 36 kV

Service Voltage 33 kV

System Frequency 50 Hz

Lightning Impulse withstand Voltage

Phase to phase, phase to earth 170 kV

Power Frequency withstand voltage 70 kV rms - 1 mn

Rated Normal Current

Line switches 630 Amps

Rated Short time current withstand (1 sec) 25 kA

Internal Arc 1 sec 25 KA

Rated Short circuit making capacity of line switches & breaker 62.5KA

Number of operations at rated short circuit current on breaker 20 OC operations

Rated load interrupting current -Line switch 630 Amps

No load line / cable breaking current capacity – 25A

No load transformer breaking capacity – 25A

Number of mechanical operations of line switch 1000 O/C
Number of mechanical operations of Earth switch 1000 O/C
Number of electrical operations at full rated current 100 O/C at 630 amps
Number of electrical operations at full rated current for breaker -2000 O/C at 630 amps
Number of Mechanical operations at full rated current for breaker -2000 O/C
Insulating Gas SF6
Nominal operating gas pressure 1.4 bar abs, 20 Deg Cent
Gas leakage rate per Annum in percentage 0.1% per annum
Facilities for gas monitoring Required
Expected operating life time 30 years
Rated operating sequence of Circuit Breaker 0-0.3 sec-CO-3 min-CO
Total Opening time of Circuit breaker 40 – 50 ms
Total Closing time of Circuit breaker 30 – 45 ms
All of the switchgear shall be capable of withstanding these parameters without any damage being caused, in accordance with the standards mentioned in this specification

4.0 RMU CONFIGURATION

2 NOS OF BREAKER (OUTGOING FOR FEEDER CABLE) + LOAD BREAK SWITCH (INCOMER)+ LOAD BREAK SWITCH (RING).

The following configurations shall be required:

EACH OUTGOING CIRCUIT BREAKER (2 nos VCB) will have the following –

-
- SF6 INSULATED VACUUM Circuit breaker 36 kV, 630 A , 25 kA
 - Mechanism for motorised operation (with manual option) .
 - Capacitive voltage indication fixed type
 - ON, OFF, TRIP indication on the front mimic of the panel.
 - Cable box for termination of cable up to 1 No. x 400/300 sq. mm 33 KV cable
 - Emergency Trip Push Button.
 - Set of 36kV Cable boots (Touch Proof) suitable for **1x 3C- 400/300 mm sq 33 KV cable.**
 - relay for protection (50/51-RYBN)
 - Fault passage indicator
 - Protection CTS , 100-50 / 1 amps, protection class – 5P20, burden to be selected as per relay requirement
 - Metering CTS , 100-50 / 1 amps, Accuracy class –1.0, burden to be selected as per connected Ammeter and MFM
 - Ammeter with selector switch

LOAD BREAK SWITCH FOR INCOMING AND RING – 2 NOS.

-
- Cable switch 36 kV, 630 A, 25 kA.
 - Mechanism for motorised operation (with manual option)

- Capacitive voltage indication fixed type
- ON, OFF, EARTH indication on the front mimic of the panel.
- Cable box for termination of cable up to **1x 3C-400 sq. mm 33 KV cable**
- Set of 36kV Cable Boots suitable for **1x 3C-400 mm sq 33 KV cable.**
- Earth Switch with interlocking arrangement

5.0 MAKE OF MAIN / MAJOR EQUIPMENTS

MAKES OF 33 KV 4 Way RMU: Schneider-Italy/ ABB-Norway

Make of Protection Relay : Schneider /Alstom / ABB / C&S

Make of HT CT & PT : ABB/Schneider/Eqv

Make of MFM / TVM : SECURE/L&T/Schneider(Earswhile CONZERV)

Make of Indicating Instru : AE

6. GENERAL TECHNICAL SPECIFICATION OF RMU

6.1 Introduction

The BREAKER shall meet the criteria for compact, metal-enclosed outdoor switchgear in accordance with IEC 62271-200, IEC 60694:

- Switchgear classification: PM class
- Loss of service continuity class: LSC2A

It shall include, within the same metal enclosure, the number of MV functional units required for connection, power supply, i.e.: switch disconnectors, earthing switches.

6.2 Switchboards

The switchgear and busbar shall all be contained in a stainless steel enclosure filled with SF6 at 0.3 bar relative pressure to ensure the insulation and breaking functions. Sealed for life, the enclosure shall meet the "sealed pressure system" criterion in accordance with the IEC 62271-1 standard (§ 3.6.6.4 and 5.15.3) : "a volume for which no further gas processing is required during its entire expected life. In addition, manufacturer shall confirm that maximum leakage rate is lower than 0,1 % / year. It shall provide full insulation, making the switchgear insensitive to the environment (temporary flooding, high humidity...), IP67 degrees of protection in accordance with recommendation IEC 60529 § 14.2.7. It shall provide full insulation, making the switchgear insensitive to the environment conditions such as pollution, humidity, dust, etc.

The active parts of the switchgear shall be maintenance-free and the switchboard shall be low-maintenance. The switchgear shall provide IP2X degree protection with the exception of the MV cable entrance and earthing plug where entrance is admissible. The tank shall be made of 3 mm ANSI 304 unpainted stainless steel. The colour shall be RAL 9002 / 7035 for the enclosure. The switchboards shall be suitable for mounting on at trench, utilities space or base. Each switchboard shall be identified by an appropriately sized label which clearly indicates the functional units and their electrical characteristics.

The switchgear shall be designed so that the positions of the different devices are visible in its front panel; in addition the cubicle must have voltage indicators that allow check if any income or outcome is energized.

In accordance with the standards in effect, the switchboards shall be designed so as to prevent access to all live parts during operation without the use of tools.

6.3 Dielectric medium

SF6 gas is the preferred dielectric medium for MV BREAKER s. Oil filled / Air insulated switchgear will not be considered. SF6 gas used for the filling of the BREAKER shall be in accordance with IEC 60376.

6.4 Bus bars

Comprising of 3 nos of single phase copper busbar and connected to the switch or circuit breaker. The bus bar should be integrated in the cubicle. Bus bars should be rated to withstand all dynamic and thermal stresses for the full length of the switchgear.

6.5 Earthing of metallic parts

There shall be continuity between the metallic parts of the switchboard and cables so that there is no electric field pattern in the surrounding air, thereby ensuring the safety of people. The substation frames shall be connected to the main earth busbar without dismantling any busbar.

6.6 Earthing of the main circuit

The cables shall be earthed by an earthing switch with short-circuit making capacity; the earthing switch can only be operated when the cable switch is open. in compliance with IEC standard 62271-102. The earthing switch shall be fitted with its own operating mechanism. The speed of the manual as well as motorised closing, driven by a fastacting mechanism, is independent of the operator. Mechanical interlocking systems shall prevent access to the operating shaft to avoid all operator errors such as closing the earthing switch when the cable switch is closed and the earthing switch operating shaft shall have a padlocking facility.

6.7 Earthing Switch

Earthing switch should be rated equal to the switchgear rating. Earthing switch should be Quick make type capable of making rated fault current. It can be operated from the front of the cubicle.

6.8 Circuit Breaker:

The circuit breaker inside SF6 chamber shall be consist of Vacuum circuit breaker confirming to latest IEC standards. The CB shall be maintenance free. The breaker shall be capable of performing a full cycle O-0.3sec-CO-3min CO. The CB shall be three position independent operation. The disconnector operation is only possible when circuit breaker is open. The CB shall be suitable for up gradation for electrical operation in future. The CB shall be equipped with a self powered protection relay for over current and earth fault. The circuit breaker mechanism shall have mechanical endurance of at least 2000 mechanical operation. It shall be fitted with a local system for manual as well as motorised tripping by an integrated push button.

6.9 "network" disconnectors:

They shall be maintenance-free, with breaking in low pressure SF6 gas. The position indicator shall **provide positive contact indication** and reliability of indication in accordance with IEC 62271-102 standard. The switches shall be of the type E3 "increased operating frequency" in accordance with IEC 60265-1 § 3.104 standard. They shall have 3 positions with individual operating mechanism for network disconnector and earth switch , open-disconnected, closed and earthed, and will be constructed in such a way that natural interlocking prevents unauthorized operations.

The switches shall be fully mounted and inspected in the manufacturer's factory.

Manuals well as motorised opening and closing will be driven by a fast-acting mechanism, independent of operator action. Each load break switch shall be suitable for an electrical operation. The load break switch and earthing switch operating mechanism shall have a mechanical endurance of at least 1000 mechanical operations. An operating mechanism can be used to manually as well as motorisedly close the switch and charge the mechanism.

6.10. BREAKER bushings and Cable terminations

6.10.1 Bushing

The bushing should be conveniently located for working with 2 runs of 3 core 400 Sq mm 33 kV cables specified and allow for the termination of these cables in accordance with the instructions supplied for the 630A M16 bolted connectors on line switches. The profiles of the cable connection bushings shall be in compliance with EN-50181 standards.

6.10.2 Cable clamps

A ferro-magnetic cable clamp arrangement must be provided for all network cables terminated on the BREAKER.

6.10.3. Padlocking facilities

Live load break switches and earthing switches can be locked in the open or closed position by means of padlocks introduced in holes of 8 mm diameter.

6.11. Voltage indicator lamps and phase comparators

Each function shall be equipped with a voltage indicator box on the front of the device to indicate whether or not there is voltage in the cables. The capacitive dividers will supply low voltage power to the lamps. Three inlets can be used to check the synchronization of phases. This device shall be in compliance with IEC 61 958 standard.

6.12 Relay specification for outgoing feeder of 33 KV.

Protection Relay

The 33 KV compact switchgear shall be equipped with SELF POWER numerical MICROPROCESSOR BASE RELAY relays, to trip the circuit breakers. This relay shall have 3 O/C and 1 E/F element with IDMT & High Set characteristics.

6.13. Fault locators / Fault passage indicator

The FPI shall facilitate quick detection of faulty section of line. The fault indication may be on the basis of monitoring fault current flow through the device. The FPI should be self-powered and should have internal lithium battery for external indication and setting of FPI in the absence of current.

The FPIs shall include:

Fault detection - Phase to phase and Phase to earth faults.

One potential-free output contacts for hardwiring to RTUs. On this basis, the SCADA/DMS will be able to monitor phase / earth fault condition.

Local fault indications - LCD display on FPI front panel along with LED indication on front panel of RMU enclosure.

Multiple reset option –

End of time delay (Adjustable from 2 to 16 Hrs)

Remote reset (Via potential free input contact of FPI)

Manual reset (Reset button on front panel of FPI)

Automatic reset on current restoration.

The characteristics of the FPIs shall include:

Phase fault thresholds configurable from at least 100 to 800 A

Earth fault thresholds configurable from at least 20 to 200 A

Multiple number of steps for adjusting phase and earth fault thresholds.

Fault current duration range configurable from at least 40 ms to 100 ms in 20 ms steps and further 100 ms to 300 ms in 50 ms steps.

Variations with respect to these characteristics may be acceptable as long as they prove applicable and provide the same or better flexibility.

6.14. Front plate

The front plate shall have an IP 3X degree of protection. The front plate shall include a clear mimic diagram which indicates the different functions. The position indicators shall give a true reflection of the position of the main contacts. They shall be clearly visible to the operator. The lever operating direction shall be clearly indicated in the mimic diagram. The manufacturer's plate shall include the switchboard's main electrical characteristics.

6.15. Cable insulation testing

The Cable testing is possible without disconnecting the cables from the bushing. It shall be preferable to carry out the phase by phase testing. The maximum test voltage shall be less than 50 kV DC for 15 minutes.

6.16 Finishing

The device shall be fully designed for use in a hot, humid atmosphere and shall be low-maintenance. At least two lifting rings shall be installed on the top of the switchboards for handling.

7.0 Safety of people

Any accidental overpressure inside the sealed tank will be limited by the opening of a pressure limiting device in the lower part of the enclosure. Gas will be released to the bottom and rear of the switchboard away from the operator. Manufacturer shall provide type test report to prove compliance with internal fault, according the relevant standards.

8.0 Type and routine tests

According to this specification and IS/IEC recommendations in accordance with relevant IS 9920/IEC 265/IEC 420 the following **type test certificates** shall be provided:

- Impulse withstand test,
- Temperature-rise test,
- Dielectric test
- Arc fault test
- Short-time & peak withstand current test,
- Mechanical endurance / operation test,
- Checking of degree of protection,
- Switch, earthing switch making capacity.
- Switch, breaking capacity.
- Duty cycle test
- Internal arc withstand test for HT Chamber
- Checking of partial discharge on complete unit

In addition, for switches, test reports on rated breaking and making capacity shall be provided. For earthing switches, test reports on making capacity, short-time withstand current

and peak short-circuit current shall be provided.

The **routine tests** carried out by the manufacturer shall be backed by test reports signed by the factory's quality control department. They shall include the following:

- Conformity with drawings and diagrams,
- Power frequency High voltage withstand test
- Functional operation including interlocking /signaling/aux. device
- Measurement of closing and opening speeds,
- Checking of filling pressure,
- Checking of gas-tightness,
- Dielectric testing.
- Main circuit resistance measurement.
- Fuse combination mechanical checking.

Each type of H.V. Switchgear shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards and during manufacture and on completion.

9.0. Factory Acceptance Test

The acceptance tests shall include all the routine tests mentioned below and also **demonstration of tripping through the relay by secondary injection tests.**

These tests shall be carried out in accordance with relevant standards but not necessarily limited to the following:

- (a) Withstand voltage at Power Frequency for all current carrying parts including wiring
- (b) Measurement of resistance of the main circuit -Extensible / extensible BREAKER
- (c) Leakage test
- (d) Withstand power frequency voltage on auxiliary circuits
- (e) Operation of functional locks, interlocks, signaling devices and auxiliary devices
- (f) Suitability and correct operation of protections, control instruments and electrical connections of the circuit breaker operating mechanism (primary & secondary injection)
- (g) Verification of wiring
- (h) Visual Inspection Routine test shall be carried out on all equipment such as circuit breakers, current transformers, relays, etc. as per relevant standards.

(i) Tripping and closing time of circuit breaker and load break switches.

10.0 Quality

When requested by the customer, the supplier shall provide proof that he applies a quality procedure in compliance with the standard, namely:

- Use of a quality manual approved and signed by a top management representative,
- Periodic updating of the manual so that it reflects the quality control procedures in effect,
- ISO 9001 and ISO 14001 certification.

TECHNICAL SPECIFICATIONS for 990 kVA, 33/0.433 kV Package Sub-Station

1.0.0 CODE & STANDARDS:

- 1.1.0 All equipment and material shall be designed manufactured and tested in accordance with the latest applicable Indian Standard / IEC standard.
- 1.2.0 Equipment and material confirming to any other standard which ensures equal or better quality may be accepted. In such case copies of English version of the standard adopted shall be submitted.
- 1.3.0 The electrical installation shall met the requirement of Indian Electricity Rules as amended upto date relevant IS/IEC code of practice and Indian electricity act.
- 1.4.0 The Unitized Sub-station offered shall in general comply with the latest issues including amendments of the following standards but not restricted to it.

Title	Indian & IEC Standards
High Voltage Low Voltage Pre-Fabricated Substation	IEC:62271-202
33 kV, Switchgear cubicles	IS: 13118, IS: 3427, IEC:60694, IEC:60298
Ring main unit 33 kv grade,	IS:9920, IEC:60265
Code of practice for selection, installation and maintenance of Switchgear	IS:10118
Distribution Transformer	IS: 2026
Indian Electricity Rules	1956
Indian Electricity Act	1910

2.0.0 DESIGN CRITERIA

- 2.1.0 Compact Sub-station shall consist of **33KV SF6 Insulated compact switchgear with 2 nos Isolator + Vacuum Circuit Breaker insulated in SF6 as protection to transformer with Bus PT inside the CSS + Dry type cast resin Transformer + L.T. Switchgear** with all connection accessories, fitting & auxiliary equipment in an pre-fabricated Enclosure to supply Low-voltage energy from high-voltage system as detailed in this specification. The complete unit shall be installed on a substation plinth (base) as **Outdoor substation**. 33KV Load Break Cable Switches controls incoming-outgoing feeder cables of the 33KV ring distribution system. The Vacuum Circuit Breaker in SF6 insulation shall be used to control and isolate the 33kV/433V Distribution transformer. The transformer's L.T. side shall be connected to L.T. switchgear by means of Aluminum busbar. The connection cables to consumer shall be taken out from the L.T. switchgear. Make of the same shall be SCHNEIDER/ABB only.

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2.2.0 The pre-fabricated unitized substation shall be designed for :

- a) Compactness,
- b) Fast installation,
- c) Maintenance free operation,
- d) Safety for worker/operator & public.

2.3.0 The Switchgear and component thereof shall be capable of withstanding the mechanical and thermal stresses of short circuit listed in ratings and requirements clause without any damage or deterioration of the materials.

2.4.0 For continues operation at specified ratings temperature rise of the various switchgear components shall be limited to permissible values stipulated in the relevant standard and / or this specification.

2.5.0 Service Conditions:

2.5.1 The equipment offered shall be suitable for continuous satisfactory operation in heavily polluted and tropical area of Installation.

The Enclosure consisting of High Voltage switchgear-control gear, Low Voltage switchgear-control gear & Transformer of the Unitized substation shall be designed to be used under **normal outdoor service condition with all natural cooling only**. The enclosure should take minimum space for the installation including the space required for approaching various doors & equipment inside. The enclosure construction shall be such that it fully protects ingress of rain water, dust & rusting.

3.0.0 SPECIFIC REQUIREMENT

3.1.0 The main components of a prefabricated-unitized substation are Transformer, High-voltage switchgear-control gear, Low-voltage switchgear-control gear, corresponding interconnections (cable, busbars) & auxiliary equipment. The components shall be enclosed, by either common enclosure or by an assembly of enclosure. All the components shall comply with their relevant IS/IEC standards.

3.1.1 Ratings:

Description	Unit	Value
Rated Voltage / Operating Voltage	kV rms	36/33
Rated frequency & Number of phases	Hz & nos.	50 & 3
Rated maximum power of substation	kVA	990KVA
Rated Ingress protection class of Enclosure	IP:	IP: 54 for LT Switchgear & HT Switchgear compartments and IP-34 for Transformer compartment.
HV Network & Busbar		
RMU		3 WAY (2Nos.Isolators+1No. Breaker)+Bus PT
Rated current	Amp	630A for 33kV
Rated short time withstand current	kA rms / 1secs	25 KA at 33 kV,

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LV Network		
LV Incomer: 4P ACB 1600Amp rating and fault withstand capacity of 50kA- One No. LV, Outgoings : 3P MCCB 630 Amp rating and fault withstand capacity of 50KA.- 4 Nos. LV Interconnection 4P ACB 1600A, rating and fault withstand capacity of 50kA- One No.		

3.2.0 OUTDOOR ENCLOSURE:

- 3.2.1 The enclosure shall be made of 2.0 mm thickness Galvanized Sheet Steel tropicalised to meet Indian weather conditions including all the partition sheets & doors.
- 3.2.2 The base of the enclosure shall be of 4.0 mm thickness Hot Dip Galvanized Sheet Steel to ensure rigidity for easy transport & installation. The entire Package Substation shall be Factory Assemble & Factory Fitted.
- 3.2.3 The structure of the substation shall be capable of supporting the gross weight of all the equipment & the roof of the substation compartment shall be designed to support adequate loads. Incase of relocation of the Package Substation, the entire substation should be capable of getting lifted and placed as a Single Unit without dismantling of any of the major equipments inside. The lifting arrangement should be from the bottom of the enclosure & not from the top.
- 3.2.4 There shall be proper / adequate ventilation inside the enclosure so that hot air inside enclosure are directed out by help of duct. Louvers apertures shall be provided so that there is circulation of natural air inside the enclosure. The Package Substation should be designed & engineering to have natural cooling & ventilation instead of forced cooling / ventilation as the same would derate the Transformer further and shall be an additional load on the Transformer.
- 3.2.5 The complete design shall be compartmentalized.
- 3.2.6 **Interconnection:** The connection of HT switchgear to Transformer shall be with the help of suitable size of cables from Transformer to LT switchgear with the help of suitable size of Aluminum busbars.
- 3.2.7 **Covers & Doors:** Covers & doors are part of the enclosure. When they are closed, they shall provide the degree of protection specified for the enclosure. All covers, doors or roof shall be provided with locking facility or it shall not be possible to open or remove them before doors used for normal operation have been opened. The doors shall open outward at an angle of at least 90degrees & be equipped with a device able to maintain them in an open position. Proper padlocking facility shall be provided for doors of each compartment. Transformer compartment doors must be open from both the sides & should not have access from outside. There should be provision to take out **Transformer from the PSS from side. Interlocking of opening of door of transformer compartment should be such that HV compartment should be opened before opening the transformer compartment.**
- 3.2.8 **Earthing:** All metallic components shall be earthed to a common earthing point. It shall be terminated by an adequate terminal intended for connection to the earth system of the installation, by way of flexible jumpers/strips & Lug arrangement. The continuity of the earth system shall be ensured taking into account the thermal & mechanical stresses caused by the current it may have to carry. The components to be connected to the earth system shall include :
- a) The enclosure of Unitized / prefabricated substation,

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- b) The enclosure of High voltage switchgear & control gear from the terminal provided for the purpose.
- c) The metal screen & the high voltage cable earth conductor,
- d) The transformer tank or metal frame of transformer,
- e) The frame &/or enclosure of low voltage switchgear,

3.2.9 **Internal Illumination:** There shall be arrangement for internal lighting activated by associated switch on doors for HV, Transformer & LV compartments separately.

3.2.10 **Labels:** Labels for warning, manufacturer's operating instructions etc. & those according to local standards & regulations shall be pasted / provided inside and shall be durable & clearly legible.

3.2.11 **Painting and Fabrication process :**

- a) The paints shall be carefully selected to withstand tropical heat rain. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling. For this purpose powder coating shall be used.
- b) Special care shall be taken by the manufacturer to ensure against rusting of nuts, bolts and fittings during operation. All bushings and current carrying parts shall be cleaned properly after final painting.
- c) The fabrication process shall ensure that there are no sharp edges on the GI sheets used.

3.2.14 **Enclosure GTP:**

1)	Ambient Temperature	50° C
2)	Type of Ventilation for a) Normal Condition b) Hot Condition	- Natural - Natural
3)	Compartmentalized	Yes
4)	Rated temperature enclosure class	10
5)	Degree of protection for external enclosure	IP34 Transformer Compartment. IP54 MV & LV Compartment
6)	Applicable Standard	IEC 62271 / 61330
7)	Enclosure material	Galvanized sheet Steel
8)	Thickness of sheet (GI only)	2mm for enclosure. 4mm for PSS Base.

Note: No capacity de-ration of equipment / components upto 40°C ambient temperature.

3.3.0 **33kV Switchgear**

3.3.1 Non-extensible SF6 Insulated Compact Switchgear as required shall consist of following items:

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- 3.3.2** Load Break Cable Switch with integral earth switch having full making capacity shall be used for Incoming/outgoing cables.
- 3.3.3** Vacuum Circuit Breaker shall be used for distribution network of HT switchgear. Circuit Breaker complete with operating mechanism, self powered, static type O/C,E/F protection relay with associated Current Transformers shall be used for control and protection of Transformer. An integral cable earthing switch with full making capacity shall be provided.
- 3.3.4** The above Load Break Cable Switch, Vacuum circuit breaker, Bus bars should be mounted inside a sealed for life, cast resin / stainless steel tank. The operating mechanism of the switches and breakers shall be outside the SF6 tank and accessible from front. The tank should be filled with SF6 gas at an adequate pressure. The degree of protection for gas tank should be IP67. There shall be provision for filling the SF6 gas at site. Moreover Stainless Steel Gas Tank shall confirm to the sealed pressure system as per IEC and ensure the gas leakage to 0.1 % per year as per IEC.
- 3.3.5** The Circuit Breaker is required to control 33 kV/433 volts distribution Transformer of rating upto 990KVA and relay settings and Current Transformers shall be selected accordingly.
- 3.3.6** **General Finish:** Totally enclosed, metal enclosed, vermin and dust proof suitable for tropical climate use as detailed in the specification.
- 3.3.7** **Ratings:** The bus bars shall have continuous rating of 630 Amps. The isolator shall have a continuous rating of 630 Amps. Vacuum Circuit Breaker shall have a continuous rating of 200 Amps. in accordance with relevant IS / IEC standard
- 3.3.8** **Breaking & Making Capacity:** The Load Break Cable Switches shall be capable for breaking rated full load current. The same along with its earthing switch shall also be suitable for full making capacity of the system as specified. The complete switchgear shall be suitable for breaking capacity of 25kA symmetrical at 33000 volts three phase for 33kV system for 1 sec
- 3.3.9** **Busbar:** Switchgear shall be complete with all connection, bus-bars etc. Aluminum busbars continuous rating shall be 630 Amps. The busbars should be fully encapsulated by SF6 gas inside the tank.
- 3.3.10** **Remote Monitoring :** The Package sub-station will be kept in isolated place and need to be integrated with a remote monitoring device. The device to be installed in the Package substations to provides compact, open solutions as under :
- a. Fault passage indicator compatible with any type of earthing system
 - b. Substation monitoring: sending of an alarm in the event of an incident
In the substation for efficient maintenance thru SMS message.
 - c. Power monitoring unit on the MV and LV network for improved monitoring
of load curves and improved power distribution efficiency
 - d. Substation digital concentrator for interfacing between the substation's
communicating equipment (if any) and the SCADA control centre thru a open protocol like IEC-870-5-104.

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e. Communication with the remote control centre with call management upon alarm and SMS message.

f. Local and remote operation and maintenance by embedded Web server

3.3.11 Remote Operation: Provision shall be there for remote operation of the switchgear's Isolator & Breaker shall be possible using **Motors fitted** to the operating mechanism at a latter date. It shall be possible to fit the motors either directly in manufacturing plant or on site as & when required. Installation on site shall be possible.

3.3.12 Protection: The circuit breaker shall be fitted with static type self powered relay inside the front cover to avoid any tampering. The same shall be used in conjunction with suitable CT's and Tripping Coil for fault tripping of the Circuit Breakers. CT's shall be mounted on bushing of breaker. CT's mounted on cable inside cable compartment are also acceptable.

3.3.13 Touch Proof Cable Termination: Each Cable compartment shall be provided with three bushings of adequate sizes to terminate the incoming outgoing 33kV, 3 Core cables as the case may be. There shall be enough height from the base of the mounted switchgear so that the cables can be bent and taken vertically up to the bushings. The Cable termination shall be done by Heat shrinkable Termination method so that adequate clearances shall be maintained between phases for Termination. Cable Termination boots shall be supplied by the switchgear manufacturer.

3.3.14 Earthing of the main circuit : The moving contacts of the earthing switch shall be visible in the closed position through transparent covers.

Locking Arrangement: Suitable padlocking arrangements shall be provided as stated below:

- a) Circuit Breaker manual operating handle in the "OFF" position.
- b) Each feeder Panel operating handle in 'Closed' 'Open" or 'Earth' position.
- c) Each isolator operating handle in 'Closed', ' Open', or 'Earth' position.

Technical parameters.

		Non-Extensible ring compact switchgear with SF6 insulated Vacuum Circuit Breaker
		33kV
3.4.1	Switchgear Data	
a)	Service	Indoor
b)	Type	Metal clad
c)	Number of phases	3
d)	Voltage	3300V
e)	Rated Frequency	50 Hz
f)	Rated Current	630 Amp (isolator)
g)	Short Circuit rating	
	i) Breaking	25kA rms for Breaker
	ii) Short time withstand for 1 Sec.	25 kA rms
	iii) Rated S/c making	62.5 kA peak for Breaker
h)	Rated insulation level kV rms	70 kV

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i)	Rated Level kV impulse	170kV
j)	System earthing	Solidly earthed at substation

3.4.2	Breaker	
a)	Type	Vacuum Breaker in SF6 tank
b)	Rated voltage	33kV
c)	Breaking current	
	i) Load breaking	25KArms.
d)	Making current	62.5 KA peak
e)	Rated current	630 Amps.
f)	No. of poles	3
g)	Operating mechanism.	Trip free & free handle type with mechanically operated indication & pad locking.
3.4.3	Isolators	
a)	Type	Load breaking and fault making in SF6 tank
b)	Rated current	630 Amps.
d)	Rated breaking capacity	630 Amps.
e)	Fault making capacity	62.5 KA peak
f)	No. of poles	3
g)	Operating mechanism	Operating handle with ON, OFF, Earth positions with arrangement for padlocking in each position.
3.4.4	Bus PT	
	Type	Inside the PSS
	Rating	33/V3//110/V3/110/V3, CI 1.0 & CI 3P
	VA Burden	100VA
3.4.5	Busbars:	
a)	Material	Copper
b)	Type	SF6 insulated
c)	Rated Current	630 Amps

3.5 Isolator:

- 3.5.1 The Isolators offered shall conform to IS: 4710/9920 as amended to date. The isolator shall be triple pole, spring assisted, hand operated, non-automatic type with quick break contacts. The operating handle shall have three positions 'ON', 'OFF' and 'EARTH' which shall be clearly marked with suitable arrangement to padlock in any position. A safety arrangement for locking shall be provided by which the isolator operation shall be prevented from 'ON' position to 'EARTH' position or vice versa.

Switchgear:

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Sealed for life, the enclosure shall meet the “sealed pressure system” criteria in accordance with IEC: 298 (a system for which no handling of gas is required through out service life of approximate 30 years.) There shall be no requirement to ‘top up’ the SF6 gas. In addition, manufacturer shall confirm that maximum leakage rate is lower than 0.1% per year. It shall provide full insulation, making the switchgear insensitive to the environment. Thus assembled, the active parts of the switchgear unit shall be maintenance free.

The switchgear & switchboard shall be designed so that the position of different devices is visible to the operator on the front of the switchboard & operations are visible as well. The switchboard shall be designed so as to prevent access to all live parts during operation without the use of tools.

RMU should be tested for internal arc fault test.

Circuit Breaker:

The Unit shall consist Tee-off spring assisted, three pole Vacuum Circuit breaker, with integral fault making / dead breaking earth switch. The function shall be naturally interlocked to prevent the main & earth switch from being switched ‘ON’ at the same time & the circuit breaker not allowed to trip in ‘Earth On’ position. The selection of the main/earth switch lever on the panel, which is allowed to move only if the main or earth switches in the off position. The lever shall be able to pad locked in either the main or earth position.

Protection :

Protection Relays: The Circuit breaker shall be fitted with static type self powered relay inside the front cover to avoid any tampering.

3.7.0 Transformer

- 3.7.1 The specification covers design manufacture, testing packing and delivery of 3 phase 50 Hz Dry type Cast resin distribution transformer of rating 990 kVA – 33/0.433 KV

It is not the intent to specify completely herein all the details of the design and construction of equipment.

However the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation upto the Bidder’s guarantee, in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered equipment shall be complete with all components necessary for their effective and trouble free operation. Such, components shall be deemed to be within the scope of Bidder’s supply irrespective of whether those are specifically brought out in this specification and / or the commercial order or not.

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It is intended to embrace the latest & best technology available in the market & hence equipment offered that differs the specification will merit rejection of the bid.

The manufacturer should have manufacturing base in India or should offer from product from Plant based out in Europe. Product manufactured in china , korea are not accepted

3.7.2 TOLERANCES:

Tolerances on all the dimensions shall be in accordance with provisions made in the relevant IS/IEC standards/ and in these specifications.

3.7.3 GUARANTEE:

The equipment shall be guaranteed for the period of two years from the date of commissioning. The equipment found defective within above guarantee period shall be replaced / repaired by the supplier free of cost, within one month of receipt of intimation

3.7.4 SYSTEM PARTICULARS:

1. The transformers shall be suitable for indoor installation with following system particulars and should be suitable for service under fluctuations in supply voltage as permissible under Indian Electricity Act & Rules there under.

a) Nominal System Voltage	:	33kV
b) Corresponding Highest System Voltage	:	36kV
c) Neutral earthing	:	Solidly earthed
d) Frequency	:	50 Hz with ± 3 %
Tolerance		

3.7.5 SERVICE CONDITIONS:

1. Equipment to be supplied against the specification shall be suitably design to work satisfactorily under following tropical conditions:-

Maximum ambient temperature (Degree Celsius)	:	45
Minimum ambient temperature (Degree Celsius)	:	10
Relative humidity (% range)	:	up to 95%
Altitude	:	<1000metres

2. The climatic conditions are prone to wide variations in ambient conditions and heavily humid and polluted hence the equipment shall be of suitably designed to so that the dielectric strength is very high and partial discharge less than 10Pc.

3.7.6 STANDARDS

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1. The materials shall conform in all respects to the relevant Indian / International Standard Specification, with latest amendments thereof, some of them are listed below:

a.	IS: 5	Colours for ready mixed paints and enamels.
b.	IS:1180	Three phase distribution transformers up to and including 100 kVA, 11KV
c.	IS 11171/IEC 60076-Part 11	Dry type transformer
d.	IS:2099	Bushing
e.	IS:3347	Dimensions for porcelain transformer bushing for use in normally and lightly polluted atmospheres

Material conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above, would also be acceptable. In case the Bidders who wish to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic English translations shall be furnished along with the offer.

3.7.7 SPECIFIC TECHNICAL REQUIREMENT:

1. Standard kVA Ratings:-
The standard ratings of transformers shall be 990KVA ,33/0.433KV
2. Nominal voltage ratings
 - i) Primary voltage - 33 kV
 - ii) Secondary voltage - 0.433kV
3. The windings of the transformers shall be connected to Delta (Δ) on the primary side and star (Y) on the secondary side. The neutral of the LT winding shall be brought out to a separate terminal. The vector group shall be Dyn11.
 - a. Percentage Impedance: 6.25% at 75deg C (subject to IS tolerance)
 - b. Temperature Rise;
 - i) Average winding temperature rise over an ambient temperature of 50 deg. C shall not exceed 90 DegC by resistance method. Max. temperature of winding shall not exceeds 155° C.
 - ii) Core, metallic parts and adjacent material shall in no case reach a value that may damage these material or reduce their life expectancies.

3.7.8 DESIGN & CONSTRUCTION

CORE

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1. The core shall be of Prime grade cold rolled grain oriented (C.R.G.O) annealed steel lamination, having low loss and good grain properties, coated with insulation, bolted together to the frames firmly to prevent vibration or noise. All core clamping bolts shall be effectively insulated. The complete design of core must ensure permanency of the core losses with continuous working of the transformers. Transformer shall be of BOLTLESS core design

Core shall be purchased Directly from Manufacturer or from their accredited Marketing organization of Repute & not through any agent. Bidders have to submit manufacturer's name during bidding having sufficient credential & Core has to be purchased from the approved manufacturer.

Stage inspection of the core shall be done at manufacturer's premises & inspection call shall be given with following Documents

- a) Invoice of the supplier
- b) Mill's test certificate
- c) Packing list
- d) Bill of landing & Bill of Entry certificate by customs

3.7.9 WINDING:

H. V. & L. V. Coils

- i) HV coil should be casted with epoxy resin & should be premixed with active filler which should make the coil self extinguishing & should comply to fire behavior class F1 as per IEC 60076
- ii) LV Winding LV Winding shall be made from Copper Foil Pre Impregnated with class F epoxy resin so as to have lower stray losses & higher withstand capacities under bolted short circuit conditions
- iii) Manufacturer should comply to Climatic test category of C2 & Environmental category of E2 as per IEC 60076 so as to withstand changing climatic variations & should be able to withstand high degree of pollution & humidity up to 95%
- iv) Transformer shall be self extinguishing – F1 Certified as per IEC 60076-Part 111

3.7.10 CLEARANCES: Clearances provided shall be strictly as per IS 11171 / IEC 60076-Part 11

3.7.11 H. T. & L. T. BUSHING :

For 33KV Bushing will be used and for 433 volts, 1 kV Bushing shall be used. Bushing of the same voltage class shall be interchangeable. Bushing with same plain shades as per IS 3347 amended up to date shall be mounted on the side of the enclosure and not on the top cover. Only sheet metal pocket shall be provided for mounting of HV bushing and the same shall not be fixed on pipes.

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Sheet metal pocket shall be designed in such a way that all HT bushing shall be remain parallel and equidistance throughout. Bushing having type tested as per IS 3347 amended up to date shall only be acceptable.

3.7.12 TERMINAL MARKING PLATES AND RATING PLATES:

Terminals shall be provided with terminal marking plates. The transformer shall provide with riveted rating plate of minimum 8 SWG aluminum anodized material sheet in a visible position. The entries of the rating plate shall be indelibly marked (for example by etching, engraving or stamping).

The marking as 'DSIR.' And ' Sr. No....' of Transformer will be engraved on Transformer enclosure, below L.T. Bushings.

The name of the company, order No., capacity, month and year of manufacturing shall be engraved on the enclosure of transformer just below the nameplate clearly visible. The engraving can be done on separate plate which shall be firmly welded to enclosure and shall form integral part of the enclosure.

C2/E2/F1 shall be engraved in the rating plate

3.7.13. TECHNICAL PARAMETERS OF 630KVA,500KVA,400KVA,300KVA & 200KVA DRY TYPE 11KV/415V, THREE PHASE DISTRIBUTION TRANSFORMERS

a)	Rating –	990KVA
b)	Applicable standard	IS-2026
c)	Cooling	AN
e)	Rated System Voltage	33Kv/433V
f)	Frequency	50Hz with $\pm 3\%$ tolerance
h)	Phases	Three
i)	Impedance	6.25% at 75deg C (subject to IS tolerance)
j)	Service	Indoor
k)	Duty	Continuous
l)	Overload Capacity	As per IS2026
m)	Vector Group (Three Phase)	Dyn11
n)	Tap Changer	Off Load Tap changer on HV winding $\pm 5\%$ in steps of 2.5% of taps by link
o)	Core Material	The core shall be built up with thin laminations of Prime grade. Non-ageing, low loss, high permeability cold rolled super grain oriented silicon steel.

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P)	Climatic Class	C2 to be supported by test certificate as the transformer need to perform moderate temperature difference
q)	Envirnomenta class	E2 to be supported by test certificate as the transformer need to perform in heavily polluted environment.
r)	Fire Class	F1 to be supported by test certificate ensuring safety of people & property against Fire
s)	Load loss at 50% loading	5300 W
t)	Load loss at 50% loading	1280 W @ 75 degree celcius & at full load

2. TEST AND INSPECTION:

ROUTINE TESTS : Manufacturer's Lab should have NABL accreditation so as to authenticate the offered GTP figures. In case the testing lab is not NABL accredited then the same to be done without any extra cost before supply of the transformers.

- i) All transformers shall be subjected to the following routine tests at the manufacturer's works.
- ii) The tests are to be carried out in accordance with the details specified in IS 2026 or as agreed upon between the purchaser and the manufacturer.
 - 1. Measurement of winding resistance.
 - 2. Ratio, polarity and phase relationship.
 - 3. Impedance voltage.
 - 4. Load losses.
 - 5. No-load losses and No-load current.
 - 6. Insulation resistance.
 - 7. Induced over voltage withstand.
 - 8. Separate source voltages withstand.
- iii) All the routine tests shall be conducted in the suppliers' laboratory at their cost.
- iv) Heat run test shall be arranged free of cost on the unit selected from the 1st lot by employer's representative. The test should be done at NABL accredited lab only
- v) The calculations to confirm the thermal ability as per Clause no. 9.1 of latest IS: 2026 Part-I or equivalent International Standard shall be submitted to Inspecting Engineer.
- vi) Partial discharge test shall be carried out on one transformer & value shall be less than 10 Pc

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3. **DRAWINGS :**

A set of following drawings shall be submitted by the Bidder.

- i) General Dimensional drawing
- ii) Core details drawing.
- iii) Rating & Diagram Plate Drawing.
- iv) HV/LV Bushings
- v) Operation and Maintenance Manual.

3 **CLEANING AND PAINTING:**

The surface of the enclosure shall be properly pre-treated / phosphate in a seven enclosure process and shall be applied with a powder coating of 40 microns thickness. The powder coating shall be of dark admirably green colour for transformer. Powder coating shall be suitable for outdoor use only. The seven tank process facility shall be enhance to ensure proper quality for outdoor application.

The month and year of supply shall be painted in **red bold English** lettering at some conspicuous place on the transformer, which shall be clearly visible from the ground.

5, **Acceptance tests**

The transformers shall be subjected to the following routine/ acceptance test in presence of purchaser's representative at the place of manufacture before dispatch without any extra charges. The testing shall be carried out in accordance with IS: 1180 and IS: 2026.

1. Checking of weights, dimensions, fitting and accessories, tank sheet thickness, oil quality, material, finish and workmanship as per GTP / QA Plan and contract drawings.
2. Physical verification of core coil assembly and measurement of flux density of one unit of each rating, in every inspection with reference to short circuit test report
3. All tests as specified in clause 6.1

6. **INSPECTION**

All tests and inspection shall be made at the place of manufacturer and unless otherwise especially agreed upon the manufacturer and the purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities, without charge to satisfy him that the material is being furnished in accordance with specification.

The manufacturer shall provide all services to establish and maintain quality of workman ship in his works and that of his sub-contractors to ensure the mechanical / electrical performance of components, compliance with drawings, identification and acceptability of all materials, parts and equipment as per latest quality standards of ISO 9000.

Along with the bid the manufacturer shall prepare Quality Assurance Plan identifying the various stages of manufacture, quality checks performed at each

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stage and the Customer hold points. The document shall also furnish details of method of checking, inspection and acceptance standards / values and get the approval of purchaser or his representative before proceeding with manufacturing. However, purchaser or his representative shall have the right to review the inspection reports, quality checks and results of manufacturer's in house inspection department which are not customer hold points and the manufacturer shall comply with the remarks made by purchaser or his representative on such reviews with regards to further testing, rectification or rejection etc. Manufacturer should submit the list of equipment for testing along with latest calibration certificates to the purchaser.

Purchaser shall have every right to appoint a third party inspection to carry out the inspection process. The purchaser has the right to have the test carried out at his own cost by an independent agency wherever the dispute regarding the quality of supply. Purchaser has right to test 1% of the supply selected either from the stores or field to check the quality of the product. In case of any deviation purchaser have every right to reject the entire lot or penalize the manufacturer, which may leads to blacklisting among other things.

3.7.14. QUALITY ASSURANCE PLAN:

The Bidder shall invariably furnish following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of equipment offered.

- i. Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in the presence of Bidder's representative, copies of test certificates.
- ii. Information and copies of test certificates as in (I) above in respect of bought out accessories.
- iii. List of manufacturing facilities available.
- iv. Level of automation achieved and list of areas where manual processing exists.
- v. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.
- vi. List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports shall be furnished with the bid. Manufacturer shall possess 0.1 class instruments for measurement of losses.
- vii. Quality Assurance Plan (QAP)

3.8.0 LT SYSTEM

For 990KVA PSS

LT compartment : **433V, LT devices with PVC sleeved Aluminium busbars** suitable for 1600A to house following equipment,

INCOMER:

1 No. 4 pole 1600 A, 4 Poles, 65 KA, manual fixed type Microprocessor based O/C , S/C , E/F release with inbuilt current metering in micrologic.

OUTGOING:

4 Nos. 630 amp , 3 Pole , 50 KA , TMD based MCCB with O/C + E/F release.

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Interconnection:

2 Nos adjacent Compact Sub-station will be connected through . 4 pole 1600 A, 4 Poles ACB.

The design of LV products should comply with the following standards.

1. IEC-439-1, 1992 Low voltage Switch gear and Control gear assemblies Part-I, type tested and partially type tested assemblies.
2. IEC-947-1, 1998 Low voltage Switch gear and Control gear Part-I general rules.
3. IEC-1180-1, 1992 High voltage test techniques for low voltage equipment Part-I definition test and Procedure requirement
4. IEC-529, 1989 Degree of protection provided by enclosures (IP code)

EQUIPMENT SPECIFICATION

3.8.1. Air circuit breaker (ACB)

These shall be fixed type with manually operated (MDO type) mechanism. The short circuit mechanism and breaking capacity as shall be supported by test certificate. The test certificates should be from CPRI / any Govt. approved recognized test house / laboratory.

The circuit breaker shall be fitted with CT operated thermal overload and short circuit releases devices for suitable current rating.

- a) Overload releases should be settable from 50% to 100% of the rated current I_n .
 - b) Ambient temperature compensated type and there should not be de-rating of ACB current carrying capacity at 50°C. The testing of ACB for the temperature rise shall be carried out by the manufacturer as per the prevailing, IS / IEC or any other international standards.
 - c) ACB shall be provided with very sensitive overload and short circuit release. Short circuit release should have settable value as required with an adjustable times having setting range of 40 – 460 m seconds, to have a proper co-ordination with short circuit release of outgoing MCCBs.
- 1) 3 phase, 4 wire, neutral earthed having link arrangement.
 - 2) Rated current thermal current - as required
 - 3) Service voltage - 415 volts
 - 4) No. of break / pole - one
 - 5) Frequency - 50 c / s
 - 6) Rated insulation voltage - 1000 volts
 - 7) Rated short circuit breaking capacity
Rated services S/C breaking capacity I_{cs} (rms) – 65kA
Rated ultimate S/C breaking capacity I_{cu} (rms) – 65kA
 - 8) Break Time - less than 40ms
 - 9) S/C making capacity 1cm (peak) - 105kA
 - 10) Rated short time withstands current - I_{cw} 65kA for 1 sec.
 - 11) Suitable for outdoor installation.
 - 12) It shall conform to IS 13947 / pt.2 / 1993 with latest amendment, if any.
 - 13) Performance category - Utilization category – B.
 - 14) The status of open and close shall be clearly visible.
 - 15) The trip indication separated for overload and individual phase wise trip indication for short circuit to be provided.

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- 15) The ACB shall have the provision to lock the operating mechanism in off position.
- 16) The operating mechanism should be form front and the compartment should have the degree of protection IP – 54.
- 17) Separator shall be provided between all phases inside. ACB enclosed to prevent travel of arc during short circuit.
- 18) The CT's mounted for thermal overload release shall have secondary winding inaccessible including tripping mechanism of O/L and magnetic releases to avoid tampering CT's should also have provision of separators.
- 19) Two nos. earthing bolts for propose of earthing of ACB may also be provided & suitable for G.I stay wire of size 7 / 10 SWG.
- 20) The bus bar size shall be confirming to relevant IS and the neutral bus bar shall be of same wire of size as phase bus bar and should be suitable for connecting neutral.
- 21) The ACB shall be tested in accordance with the provision of IS: 13947 – Part I or relevant IEC

3.8.3. Interconnecting bus bar

Bus bar shall be of high conductivity aluminum (E91E) supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that defined in BIS. The main bus bars shall have uniform current ratings throughout their length as specified in data sheet / job specification. The current rating of the neutral shall be half that of the phase busbars. Removable neutral links shall be provided on feeders to permit isolation of the neutral bus bar.

Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and double spring washers shall be used for all bus bar, joints and supports.

The hot spot temperature of bus bars including joints at design ambient temperature shall not exceed 95°C for normal operating conditions. It must be recorded during type tests. The current rating of the bus bars shall be as required for design ambient temperature at site conditions and for being inside the cubicle at fully loaded condition. The vendor shall suitably de-rate the nominal rating to suit the above condition.

Minimum clearance between live parts, between live parts / neutral to earth shall be 19mm. However clearances between terminals at components shall be as per applicable individual standard for components.

Interconnections between the main bus bars and individual units shall be made using vertical / horizontal aluminum bus bars of adequate rating.

- 3.8.4. HT & LT metering:
Shall be as per schedule of quantities

4.0 Package Substation – Configuration

HV Side	Transformer	LV Side
Options	Options	Options
3 Way RMU Comprising: Two Nos.Fault make load break SF 6 insulated switches and a VCB insulated by SF 6 for protection of the transformer + Bus Connected PT Inside the PSS	Cast resin Dry type transformer with partial discharge less than 10 Pc	4P ACB- 1 No. Note: Ics=Icu=Icw for 1 Sec for ACB's 3P MCCB – 4 Nos. 1 no. Interconnecting ACB

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5.0 VOLTAGE CONFIGURATIONS OF PACKAGE SUBSTATION

- a. 33 kV / 433 V

6.0 TYPE TESTS

33 kV / 433 V Compact substations HT switchgear must be type tested for 25 kA/1sec & Internal arc tested for 25kA for 0.1 sec.

7.0 MAKES

PSS supplier shall give HT Switchgear, Transformer and LT Switchgear of their own make only, combination of different makes are not preferred.

Annexure - C4

Payment Schedule for the SUNRAY Housing Project at Newtown, Rajarhat.

Name of Work : “Design and Construction of Sunray Housing Project as per Sanctioned Plan comprising of (B+G+10)-storied Tower-1 & 2 and (G+10)-storied Tower-3 Buildings along with Club House, Facility bldg, Swimming Pool and other Infrastructure Development works including all works of Civil along with Sanitary & Plumbing, Electrical, Fire Fighting etc. at New Town, Rajarhat, Kolkata, West Bengal.”

Sl. No.	Activities of the Project	% of Total Project Cost
1.	On approval of Detailed design and working drawings & details (both structural & Architectural) as per requirement for (B+G+10)-storied Tower-1 & 2 and (G+10)-storied Tower-3 Buildings, 2-storied Facility building, 3-storied Club building with Swimming Pool and all other Infrastructures like Management Office, Energy Sub-stations & Cable Trench, Open Air Theatre, Underground Reservoirs for domestic / Fire fighting / RWH, Internal Roads, Landscaping, Horticulture & Greeneries and other ancillary works including designing & detailing of other services e.g. providing External Water Supply-Sewerage & Drainage network along with allied works like Sanitary & Plumbing, Electrical installations, Solar plant for compound lighting, fire detection & fighting, CCTV, Lift etc.(both internal & external as required).	1.00%
2.	On completion of (a) submission of Quantity Estimates (Schedule of Quantities of Items) of different works before execution, (b) submission of 'As-built Drawings' after execution of works and Obtaining all the required completion certificates/ occupancy certificates/ NOCs from the various local authorities and furnishing them to WBHB.	0.25%
3.	On completion of Piling work of foundation including all Testing Of Pile.	
a)	Tower-1 (B+G+10)-Storied Building	8.39%
b)	Tower- 2 (B+G+10)-Storied Building	3.50%
c)	Tower-3 (G+10)-Storied Building	1.48%
d)	3-Storied Club Building with Swimming Pool & 2-Storied Facility Building	1.24%
4.	On completion of Pile Cap with Basement Floor Slab	
a)	Tower-1 (B+G+10)-Storied Building	5.15%
b)	Tower- 2 (B+G+10)-Storied Building	2.05%

5.	On Completion of Balance work of Basement upto Ground Floor Slab	
a)	Tower-1 (B+G+10)-Storied Building	3.49%
b)	Tower- 2 (B+G+10)-Storied Building	2.32%
6	On completion of balance work of foundation upto Plinth level (Structural portion only).	
a)	Tower-3 (G+10)-Storied Building	1.13%
b)	3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.44%
7.	On Completion of all type of R.C.C Structural work like Concreting, Shuttering, reinforcement work etc. of the entire Building from Ground to Top most level including Stair Roof & Overhead Reservoir etc.	
a)	On completion of R.C.C work from Gr. to 3rd. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	5.70%
ii)	Tower-3 (G+10)-Storied Building	1.08%
iii)	3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.54%
b)	On completion of R.C.C work from 4th. to 7th. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	6.35%
ii)	Tower-3 (G+10)-Storied Building	1.14%
c)	On completion of R.C.C work from 8th. to Top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	5.16%
ii)	Tower-3 (G+10)-Storied Building	0.96%
8.	On Completion of all type of 200mm/125mm th. Brick work of the entire Building from Ground to Top most level including Stair Roof etc.	
a)	On completion of Brick work from Gr. to 3rd. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.79%
ii)	Tower-3 (G+10)-Storied Building	0.16%
iii)	3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.11%
b)	On completion of Brick work from 4th. to 7th. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	1.28%
ii)	Tower-3 (G+10)-Storied Building	0.21%
c)	On Completion of Brick work from 8th. to Top most level	

i)	Tower-1 & 2 (B+G+10)-Storied Building	1.20%
ii)	Tower-3 (G+10)-Storied Building	0.21%
9.	On Completion of all type of Internal & External Plaster of the entire Building from Ground to Top most level including Stair Roof & Overhead Reservoir etc.	
a)	On Completion of Plastering work from Gr. to 3rd. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.59%
ii)	Tower-3 (G+10) Storied Building with 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.16%
b)	On Completion of Plastering work from 4th. to 7th. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.67%
ii)	Tower-3 (G+10)-Storied Building	0.13%
c)	On Completion of Plastering work from 8th. to Top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.55%
ii)	Tower-3 (G+10)-Storied Building	0.12%
10.	On Completion of 25/35 mm Artificial stone flooring, 52 mm. thick metallic hardener flooring, 60mm th. Interlocking paver block etc. of the entire Building in Basement & Ground floor	
a)	Tower-1 & 2 (B+G+10)-Storied Building	0.63%
b)	Tower-3 (G+10)-Storied Building, 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.05%
11.	On Completion of Flooring work including Dado/Skirting e.g. Vitrified tiles, Marble Slab, Black granite slabs, Black Stone slab,1st quality Ceramic tiles,1st quality Mat finish Ceramic tiles in the entire Building from Ground to Top most level including basement, Stair , lift, lobby etc.	
a)	On Completion of Flooring works from Gr. to 3rd. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	1.38%
ii)	Tower-3 (G+10)-Storied Building, +3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.51%
b)	On Completion of Flooring works from 4th. to 7th. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	1.87%
ii)	Tower-3 (G+10)-Storied Building	0.30%

c)	On completion Flooring works from 8th. to Top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	1.45%
ii)	Tower-3 (G+10)-Storied Building	0.23%
12.	On Completion of Roof Treatment works made with well burnt earthen pots including Screed Concrete & water proofing compound on entire roof of Buildings and also stair roof portion.	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.35%
ii)	Tower-3 (G+10)-Storied Building, +3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.09%
13.	On Completion of all type of M.S /Stainless Steel work like M.S. or W.I. Ornamental grill, 1.5mm thick M.S. sheet, Steel rolling grills link type shutter, 500mm wide M.S ladder including Stair & Gangway railing etc. from Ground floor to top most level of roof and basement floor.	
a)	On Completion M.S works from Gr. to 3rd. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.49%
ii)	Tower-3 (G+10)-Storied Building, 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.20%
b)	On Completion M.S works from 4th. to 7th. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.75%
ii)	Tower-3 (G+10) Storied Building	0.05%
c)	On Completion M.S works from 8th. to Top most level	0.00%
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.66%
ii)	Tower-3 (G+10)-Storied Building	0.04%
14.	On Completion of all type Wood work in Door & Window frame, Solid flush type doors of deluxe decorative (One side/Both side), Panel shutter of door and window and PVC door frame with shutter of the entire building from Ground floor to top most level	
a)	On Completion of Wood works from Gr. to 3rd. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.82%
ii)	Tower-3 (G+10)-Storied Building, 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.17%
b)	On Completion of Wood works from 4th. to 7th. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	1.25%

ii)	Tower-3 (G+10)-Storied Building	0.16%
c)	On completion of Wood works from 8th. to Top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	1.02%
ii)	Tower-3 (G+10)-Storied Building	0.13%
15.	On Completion of all types of Aluminium Door & Window with glazing , Structural glazing work of the entire building including Staircase (from Ground floor to top most level)	
a)	On Completion of Aluminium Casement Window (Fixed,Openable or louvered) work from Gr. To top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	1.16%
ii)	Tower-3 (G+10)-Storied Building, 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.39%
b)	On Completion of Glazing work from Gr. To Top most Level.	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.17%
ii)	Tower-3 (G+10)-Storied Building with 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.04%
c)	On Completion of Aluminium Sliding door work from Gr. To Top most Level in Tower-1 & 2 (B+G+10)-Storied Building	0.36%
d)	On Completion of Aluminium Structural glazing work from Gr. To Top most Level in Tower-1 & 2 (B+G+10)-Storied Building.	0.32%
16.	On Completion of Painting work over Timber, Plastered & Steel Surfaces as required with one coat of Primer and Two coats of Synthetic enamel paint for the entire building including Stair from Ground floor to top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.14%
ii)	Tower-3 (G+10)-Storied Building, 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.09%
17.	On Completion of White washing, Rendering the surface of walls and ceiling with white cement based wall putty including Applying Interior grade Acrylic Primer over the building surface as required including Stair from Ground floor to top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	1.26%
ii)	Tower-3 (G+10)-Storied Building, 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.33%

18.	On Completion of Protective and Decorative Acrylic exterior emulsion paint over a coat Exterior grade Acrylic primer over required surfaces of the building including Stair from Ground floor to top most level	
a)	On Completion of Painting works from Gr. to 3rd. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.09%
ii)	Tower-3 (G+10)-Storied Building, 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.03%
b)	On Completion of Painting works from 4th. to 7th. Floor level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.12%
ii)	Tower-3 (G+10)-Storied Building	0.03%
c)	On Completion of Painting works from 8th. to Top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.10%
ii)	Tower-3 (G+10)-Storied Building	0.03%
19.	On Completion of Hardware fitting & fixture of Door & Window of the entire Building including Stair room from Ground floor to top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.36%
ii)	Tower-3 (G+10)-Storied Building with 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.06%
20.	On Completion of Supplying, installation & commissioning fire steel door frame & shutter of the entire Building including Stair room from Ground floor to top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.21%
ii)	Tower-3 (G+10)-Storied Building with 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.04%
21.	On Completion of Expansion joint in floor, roof etc. with Bituminous filler & approved type Thermo coal board over required surface of the Building including Stair room from Ground floor to top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.03%
22.	On Completion of Supplying, fitting & fixing UPVC pipes A- Type and Fittings for the entire Building including Stair room from Ground floor to top most level	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.06%

ii)	Tower-3 (G+10)-Storied Building, 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.02%
23.	On Completion of M.S Tubular Structure with Roof covering Sheet & False Ceiling work etc. in 3 -Storied Club Building, Swimming Pool & 2- Storied Facility Building	0.05%
24.	On Completion of Sanitary-Plumbing Fittings & Fixtures for the Entire building from Gr. floor to Top most floor.	
i)	Tower-1 & 2 (B+G+10)-Storied Building	1.98%
ii)	Tower-3 (G+10)-Storied Building	0.44%
iii)	3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.05%
25.	On Completion of Internal Pipe line work of the entire Building from Ground floor to top most level.	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.15%
ii)	Tower-3 (G+10) Storied Building with 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.04%
26.	On Completion of External Pipe line work including making connection with Overhead Water Reservoir of the entire Building from Ground floor to top most level.	
i)	Tower-1 & 2 (B+G+10)-Storied Building	0.41%
ii)	Tower-3 (G+10)-Storied Building with 3 -Storied Club Building with Swimming Pool & 2- Storied Facility Building with On completion of Supplying , installation and Commissioning of Mechanical equipments, Pool Basin equipment, Maintenance Equipment,Pool Decorative Equipment,Plumbing works, and all Electrical works for Swimming Pool.	0.11%
27.	Other Infrastructures comprising of construction of Management Office, Energy Sub- stations & Cable Trench, Open Air Theatre, Base for DG sets, Underground Reservoirs for domestic / Fire fighting along with Pump House, Rain water storage Reservoirs & Re-charge Wells for RWH, Boundary Wall with Gates, Garbage Compartment, Internal Roads, surface Parking Areas, Landscaping, Horticulture & Greeneries and other ancillary works including providing External Water Supply-Sewerage & Drainage network.	
a)	On Completion of Construction of Open Air Proscenium (Theatre) With adjoining Underground Water reservoir (Fire / Domestic) including Foundation & Plinth, Superstructure, Internal Water Supply & Plumbing Works etc.	0.64%

b)	On Completion of Construction of Management Building including Foundation & Plinth, Superstructure, Internal Water Supply & Plumbing Works etc.	0.04%
c)	On Completion of Underground Rain Water Tank with Recharge Wells for Rain water Harvesting including necessary arrangement as per drawing.	1.28%
d)	On Completion of Construction of Underground Water Reservoir with Pump House including Foundation & Plinth , Superstructure, Internal Water Supply & Plumbing Works etc.	0.55%
e)	On Completion of Construction of Garbage Compartment with Allied Structure including Foundation upto Plinth & Superstructure Works etc.	0.03%
f)	On Completion of Construction of Electrical Cable Trench & Foundation of 6nos. Electrical Substations(Package/Compact type) etc. as required.	0.86%
g)	On completion of Boundary wall with Entrance Gate & Watchman's Booth.	0.26%
h)	On completion of Internal Road , Pathway ,Car Parking Space & Foundation of Generator Set etc.	1.57%
i)	On completion of External Underground sewerage, Drainage & Water supply net work etc.	0.61%
j)	On completion of Landscaping, Horticulture , Greeneries & Childern Playing Equipment etc.	0.18%
28.	Installation, Testing & Commissioning of Fire Fighting Works.	
a)	On Complication of Installation, Testing & Commissioning of Fire Hydrant System of all Buildings in the entire Project area.	0.47%
b)	On Complication of Installation, Testing & Commissioning of Fire Sprinkler System and Recirculation Line of all Buildings in the entire Project area.	0.11%
c)	On Complication of Installation, Testing & Commissioning of Fire Pump & Accessories works.	0.08%
d)	On Complication Installation, Testing & Commissioning of Fire Alarm & Fire Extinguisher .	0.13%
29.	On completion of Internal Electrical Installation works of the entire building of :	
a)	(B+G+10)-storted Tower-1	3.50%
b)	(B+G+10)-storted Tower-2	1.31%
c)	(G+10)-storted Tower-3	0.98%

d)	3-Storied Club Building with Swimming Pool & 2- Storied Facility Building	0.31%
30.	On completion of Supplying, Installation, Testing & Commissioning of Passenger Lifts :	
a)	9 Nos. 10-Passenger & 9 Nos. 19-Passenger Lift for (B+G+10)-storied Tower -1 building.	1.84%
b)	2 Nos. 10-Passenger & 4 Nos. 19-Passenger Lift for (G+10)-storied Tower - 3 building.	0.62%
f)	2 Nos. 10-Passenger & 2 Nos. 20-Passenger Lift for (G+10)-storied Tower - 3 building.	0.39%
g)	2 Nos. 9-Passenger Lift for 3-Storied Club Building & 2 Nos. 19-Passenger lift for 2-Storied Facility Building.	0.32%
31.	On completion of Supplying, Installation, Testing & Commissioning of 990 KVA , 33/0.433 KV Package/Compact Sub-station-1 to 6 (i.e. 6 Nos. or as required as per design) including SITC of Out door type non-extensible 33KV Compact Ring Main Unit (RMU) switch gear.	3.57%
32.	On completion of Supplying, Installation, Testing & Commissioning of Diesel Engine Alternator Sets of 2x500 KVA, 1x380 KVA & 1x100 KVA capacity.	0.76%
33.	On Completion of External Illumination Works	0.12%
34.	On Completion of Supplying, Installation, Testing & Commissioning of Domestic Water Pump	0.04%
35.	On Completion of Advance Lightning Protection System	0.06%
36.	On Completion of Renewable Solar Plant	0.51%
37.	On completion of Supplying , installation and Commissioning of C.C.T.V.	0.05%
	TOTAL	100.00%