

BILL OF MATERIAL FOR ETC PACKAGE					
PGCIL BALIA PROJECT					
1.	2	3	4	5	6
Sl. No.	Description	Unit	QUANTITY	RATE	AMOUNT
A.	TRANSFORMERS/REACTORS				
1.1	Line Reactor				
1.1.1	50MVAR, 420kV Shunt Reactor along with all accessories, connectors, MK, Oil filtration/filling cabling etc. as well as NGR & Surge arrestor	Nos.	2		
1.1.2	NGR	Nos.	2		
1.1.3	120kV Surge Arrestor complete with surge counter,leakage current meter, insulating base, connecting cable, Line terminal connector and GS supporting structure	Nos.	2		
1.2	Line Reactor				
1.2.1	63 MVAR, 420kV Shunt Reactor along with all accessories, connectors,MK, Oil filtration/filling cabling etc. as well as NGR & Surge arrestor	Nos.	2		
1.2.2	NGR	Nos.	2		
1.2.3	120kV Surge Arrestor complete with surge counter,leakage current meter, insulating base, connecting cable, Line terminal connector and GS supporting structure	Nos.	2		
1.3	Bus Reactor				
1.3.1	80MVAR,420kV Shunt Reactor along with all accessories including connectors, MK, Oil filtration/filling cabling etc.	Nos.	1		
	LT Transformer				
2	630 kVA, 33/0.433 kV complete with terminal connectors, all auxiliaries and internal cabling and termination complete including oil filtration(optional), if necessary	Nos.	2		
3	CIRCUIT BREAKER				
3.1	420 kV Circuit Breakers , 3 Ph., 2000A, 40 KA, without closing resistor alongwith Support Structure, Rigid / Expansion type terminal connectors for Al tube / ACSR Moose, Breaker Control Cabinets and interpole cabling	Nos.	4		
3.2	Same as above 2000A, 40 KA but with closing resistor	Nos.	4		
3.3	420 kV Circuit Breakers , 3 Ph., 3150A, 40 KA, without closing resistor alongwith Support Structure, Rigid / Expansion type terminal connectors for Al tube / ACSR Moose, Breaker Control Cabinets and interpole cabling		7		
3.4	Same as above 3150A, 40 KA but with closing resistor		1		
4	CURRENT TRANSFORMER				
4.1	Current Transformer 420 kV , (5 core) CT, 2000A, 40 KA with 120% extended current rating 1 Phase, complete with Rigid / Expansion type terminal connectors for Al tube / ACSR conductor	Nos.	27		
4.2	Current Transformer 420 kV , (5 core) CT, 3000A, 40 KA with 120% extended current rating 1 Phase, complete with Rigid / Expansion type terminal connectors for Al tube / ACSR conductor	Nos.	24		
5.0	Capacitive Voltage Transformer , 1 Ph., 420 kV, complete with Line terminal connector	Nos.	30		
6	Isolators 420 kV , 3 phase double break, motor operated (Tandem / Standard - mechanically ganged) complete with 9 Nos. support insulators per Isolator, Rigid / Expansion type terminal connectors for Al tube / ACSR Moose conductor.				
6.1	(a) 2000 A, 40 KA. isolator with one E/S	Nos.	26		
6.2	(b) 3150 A, 40 KA, isolator with one E/S	Nos.	22		
6.3	(c) 3150 A, 40 KA, isolator with two E/S		2		
6.0	Surge Arrestor 390 kV , Gapless, Metal Oxide, 1 Phase, complete with surge counter,leakage current meter, insulating base, connecting cable, Line terminal connector .	Nos.	39		
7	CONTROL & RELAY PANELS				
	400 kV (Simplex type panels)				
	Circuit Breaker Relay Panel				
	With Auto Reclose	Nos.	16	Only erection in scope of ETC contractor.	
	Without Auto Reclose	Nos.	1		

	Line Protection Panel Comprising MI & MII protn panels for 8 lines (Total 2__ panels in one set) (With 1 No. DR Restitution unit (PC) for Whole Station	Set	8	Supervision of Testing and commissioning in scope of respective suppliers.	
	Reactor Protection Panel (1 set = _2_ panels)	Set	5		
	BUS BAR PROTECTION (1 set = _2_ panels)	Set	1		
	Other /common equipment pertaining to C&R system				
	Time Synchronisation equipment including antenna and associated cables(1 set = _1_ panels)	Set	1		
	Complete substation automation system for 400 kV including hardware and software for remote control station alongwith associated equipment and KIOSKS for 24 bays .	Set	1		
8	PLCC				
8.1					
a)	2000A , 40kA Wave Traps 1 ph complete with support insulators (3 nos per wave trap), Rigid / Expansion type terminal connectors for Aluminium tube / ACSR Moose and	Nos.	8		
b)	3000A , 40kA Wave Traps 1 ph complete with support insulators (3 nos per wave trap), Rigid / Expansion type terminal connectors for Aluminium tube / ACSR Moose and	Nos.	8		
b)	Coupling Device (Phase to Phase)	No.	8		
c)	Carrier equipment (for speech+protection nd speech+data)	Kms	24		
f)	Protection Coupler	No.	16		
h)	EPAX 24 Lines with 24 Telephones, Cables etc	Set	1		
l)	Test & Measurement Equipment	Set	1		
9	LT SWITCHGEAR				
1.1	415V Main Switchboard	Set	1		
1.2	415V ACDB	Set	1		
1.3	415 V MAIN LIGHTING DB	Set	1		
1.4	415V Emergency LDB	Set	1		
1.6	220V DCDB	Set	2		
1.7	50V DCDB	Set	2		
10	BATTERIES				
1.1	220V , 600AH LEAD ACID BATTERY	Sets	2		
1.2	50V , 1000AH LEAD ACID BATTERY	Sets	2		
11	BATTERY CHARGER SYSTEM				
1.1	220V, 80 A Float Cum Boost	Nos.	2		
1.2	50V, 165 A Float Cum Boost	Nos.	2		
12	DG Set Along with Control Panel (250kVA)	Set	1		
13.	LAYING, DRESSING, GLANDING AND TERMINATION OF AUXILIARY POWER AND CONTROL CABLES (Ferrules and Lugs to be included in ETC contractor supply, Glands will be supplied by BHEL. All other erection materials viz ferrules, lugs, Cable ties,/ streps markers etc. included in the quoted rates).				
BIDDER TO QUOTE SEPARATELY FOR FOLLOWING LAYING CONDITIONS FOR ALL TYPE OF CABLES BELOW:					
1. LAYING ON RACK/TRAYS IN TRENCHES OR IN CABLE SPREADER ROOM.					
2. LAYING IN BURIED TRENCHES AS PER IS:1255 1983).					
13.1	HT Cables (33 kV XLPE cables)				
13.1.1	1C, 185 sq . Mm AL or 1C,120sqmm Cu	Meters	3000	Burried Cable with trefoil clamps	
13.1.2	Outdoor Termination Kit for the above				
		Nos	12		
13.2	Power Cables (1100 V grade)				
a)	1C x 150 sqmm	Meters	2000	Cable in Trenches with trefoil clamps	
b)	3.5C x 70 sqmm	Meters	2500	Cable in Trenches	
c)	3.5C x 35 sqmm	Meters	9000	Cable in Trenches	
d)	4C x 16 sqmm	Meters	6000	Cable in Trenches	
e)	4C x 6 sqmm	Meters	7000	Cable in Trenches	
f)	2C x 6 sqmm	Meters	19000	Cable in Trenches	

g)	2C x 2.5 sqmm	Meters	5000	Cable in Trenches	
	NOTE : The above lengths are subject to change at contract stage. Also these lengths will be laid in various part lengths may be from 15 metres to 500 metres with termination at both ends complete with glands etc.				
13.3	Power Cables (XLPE) (1100 V grade)				
	1CX630 sqmm	Meters	3500	Burried Cable with trefoil clamps	
	3.5C x 300 sqmm	Meters	4000	Cable in Trenches	
	NOTE : The above lengths are subject to change at contract stage. Also these lengths will be laid in various part lengths may be from 15 metres to 500 metres with termination at both ends complete with glands etc.				
13.4	Control Cables (PVC)				
a)	5C x 2.5 sqmm	Meters	14000	Cable in Trenches	
b)	7C x 2.5 sqmm	Meters	2500	Cable in Trenches	
c)	10C x 2.5 sqmm	Meters	32000	Cable in Trenches	
d)	14C x 2.5 sqmm	Meters	15000	Cable in Trenches	
e)	19C x 2.5 sqmm	Meters	8500	Cable in Trenches	
	NOTE : The above lengths are subject to change at contract stage. Also these lengths will be laid in various part lengths may be from 15 metres to 500 metres with termination at both ends complete with glands etc.				
14	Laying of PVC Conduits/GI including excavation, backfilling, making and repairing of walls in trenches, cutting, threading, fixing of sockets/ bends where required etc. complete (payment will be made for the as erected pipe length).				
a)	PVC pipe, 50 NB	Meter	3500		
b)	PVC pipe, 110 NB	Meter	3000		
c)	GI pipe 50 NB	Meter	3000		
d)	GI Pipe 110 NB	Meter	3000		
15	40 mm MS ROD FOR Risers/rod electrode including cutting bending and welding etc.	MT	200		
16	STEEL STRUCTURES FOR				
	400 KV S/S				
a)	Lattice Structure (excluding CB structure)	MT	677		
b)	Pipe Structure	MT	236		
c)	Structure Hardwares	MT	34		
17	Bus Bar Material				
a)	400 kV Bus Post Insulators with corona ring	Nos.	258		
b)	Double tension 120kN discs string insulator each string comprising 2x25 discs with Hardware set (Ball & socket dia. 20mm) suitable for QUAD moose conductor with subconductor spacing as 450mm having twin point of attachment with 2 turn-buckle	Nos.	84		
c)	Double tension 120kN discs string insulator each string comprising 2x25 discs with Hardware set (Ball & socket dia. 20mm) suitable for QUAD moose conductor with subconductor spacing as 450mm having twin point of attachment without turn-buckle	Nos.	84		
d)	Single tension 120kN discs string insulator each string comprising 1x25 discs with Hardware set (Ball & socket dia. 20mm) suitable for TWIN moose conductor with sub conductor spacing as 450mm having single point of attachment with 1 turn-buckle	Nos.	39		
e)	Single tension 120kN discs string insulator each string comprising 1x25 discs with Hardware set (Ball & socket dia. 20mm) suitable for TWIN moose conductor with sub conductor spacing as 450mm having single point of attachment without 1 turn-buckle	Nos.	39		
f)	Single suspension 120kN disc string insulator each string comprising 1 x 25 discs with hardware set with drop clamp (Ball & Socket dia.20mm) suitable for QUAD moose conductor with sub conductor spacing as 450mm	Nos.	57		
g)	Single suspension 120kN disc string insulator each string comprising 1 x 25 discs with hardware set with drop clamp (Ball & Socket dia.20mm) suitable for QUAD moose conductor with sub conductor spacing as 450mm	Nos.	45		
h)	ACSR Conductor MOOSE along with spacers, Tee connectors, PG Clamps etc.	M	30000		

I)	A) 4" IPS Al Tube	M	800	ETC of Aluminium tubes include Aluminium Welding. Welding Sleeve tube will be supplied by BHEL.	
	B) 5" IPS Al Tube	M	3000	Electrodes, Welding machines and any other equipment will be in ETC Contractor scope.	
j)	Overhead shielding wire alongwith Shield wire connectors etc.	M	1600		
18	Station Earthing (above ground)				
a)	40mm 3 m long Pipe Electrode	Nos.	10		
b)	75x12 mm GI Flat	Metres	8000		
c)	50x6 mm GI Flat	Metres	2500		
d)	25X3 mm GI Flat	Metres	500		
Note for Earthing: The earthing includes earthing of all 400 kV switchyard equipment, towers and LM's, pipe structures, transformer neutrals, cable trenches, fence and Control room equipments using necessary Connectors for earthing flats.					
19	Other Switchyard Items				
a)	Marshalling Kiosk	Nos.	16		
b)	CT Junction boxes	Nos.	17		
c)	CVT Junction boxes	Nos.	10		
d)	AC KIOSK (9 M x 4 M)	Nos	14		
20	Trench Material				
a)	Cable Trench Material consisting of ladder type trays of various width complete with side coupler plate, bolts, nuts, washers etc. and also various type of rack assemblies eg., 1/2/3/4 tiers normal or under hung type in various combinations	MT	32		
b)	Cable Trench Material without cable tray	MT	8		
21	High Wall type split AC unit of 2TR capacity	Nos	12		
B	MANDATORY SPARES TO BE HANDLED & STORED				
I	SF6 Circuit Breaker		420KV		
1.	SF6 Gas	Kg	40% of total		
2.	Trip coils with resistor	Nos.	6		
3.	Closing coils with resistor	Nos.	6		
4.	Terminal pad and connectors	Nos.	3		
5.	Molecular filter for SF6 Circuit for 1 pole of CB	Set	3		
6.	Density/Pressure monitor for SF6 circuit for 1 pole of CB	Nos.	1		
7.	Corona rings (1 no. of each type)	Set	1		
8.	Relays, power contactors, switch fuse units, limit switches, push buttons, timers & MCB	Set	1		
9.	Closing Coil Assembly/valve	Nos.	1		
10.	Trip Coil Assembly/valve	Nos.	1		
11.	Pressure switches (for one CB)	Set	1		
12.	Pressure gauges and coupling devices (1 no. of each type)	Set	1		
13.	Aux. Switch assembly	Nos.	1		
14.	Operation counter	Nos.	3		
15.	Spring operated closing mechanism, if applicable	No.	1		
16.	Micro Filter Set	Set	1		
17.	Micro switches for aux. Contact assembly	Set	1		
18.	All types coupling for SF6 gas	Set	1		
19.	Pipe length (Copper & Steel)	Set	1		
II	Isolators		420KV		
1	Copper contact fingers for female & male contacts (for one phase)	Set	2		
2	Relays, power connectors ,MCBs, switch fuse , push buttons and resistors for electrical control circuit.	Set	1		
3	Limit Switch and auxilliary contact (Complete for one MOM box of isolator)	Set	2		
4	Motor housing bearing assembly	Set	1		
5	Motor with gear and level gear assembly	Set	1		
6	Corona Shield rings (1 no. of each type)	Set	3		

7	Hinge pins, if applicable	Nos.	3		
8	Bearings (1 no. of each type)	Set	3		
9	Current Carrying assembly	Nos.	2		
10	Interlocking coil with resistor	Nos.	2		
III	Current Transformers		420KV		
1.	Current Transformer with 120% extended rating	Nos.	2		
IV	Capacitor Voltage Transformers				
1.	Capacitive voltage Transformer	Nos	2		
V	Surge Arresters				
1.	390kV surge Arrestor with insulating base with surge counter and accessories	Nos	1		
VII	Line Protection Panel Equipment spares				
1	Over voltage protection relay with timers (stage-1 & stage-2)	Set	1		
2	Disturbance Recorder comprising of evaluation and acquisition units (if stand alone)	Set	1		
3	Distance to fault locator excluding mutual compensation unit (if stand alone)	Set	1		
4	Main I Relay (Excluding Trip Relay)		1		
5	Main II Relay (Excluding Trip Relay)		1		
VIII	Reactor Protection Panel spares				
1.	Reactor differential protection relay including all aux. CTs	Set	1		
2.	Restricted earth fault protection relay with non-linear resistor	Set	1		
3.	Reactor Back-up impedance protection relay	Set	1		
IX	Common Spares				
1	Power supply module for B/B Protection	Set	1		
2	Metrosil (Non linear resistor)	Set	1		
3	Interposing CT & PT	Set	1		
X	Substation Automation System				
	Bay Control Unit	Nos	2		
	Longest Optical Cable	Nos	1		
	Switch Of each Type	Set	1		
XI	PLCC Equipments				
1.	Coupling Device (Ph to Ph)	Set	1		
2.	Telephone 4 wire	Set	2		
3.	Co-axial connector	Set	2		
4.	Set of cards for carrier equipment (1 no. of each type)	Set	1		
5.	Set of cards for protection coupler (1 no. of each type)	Set	1		
6.	Set of prints for EPAX	Set	1		
XII	LT Switchgear				
1.	Relays (1 no. of each type)	Set	1		
2.	CT, PT (1no. Of each type)	Set	1		
3.	Switches and meters (2 nos. of each type and size)	Set	1		
4.	Push buttons (5 nos. of each type and color)	Set	1		
5.	TPN Switch/MCB (1 No. of each rating and type)	Set	1		
6.	LT CB spares for each rating				
a)	Spring charging motor	Nos.	1		
b)	Aux. Contact set (for complete CB)	Set	2		
c)	Bus bar seal off insulator	Nos.	5		
d)	Arc chutes	Nos.	1		
e)	Moving contact	Nos.	1		
f)	Arcing contact	Nos.	1		
g)	Bus bar insulator	Nos.	5		
h)	Inter phase barrier	Nos.	5		
l)	Spring (closing/opening) (each type)	Nos.	1		
j)	Closing coil	Nos.	1		
k)	Tripping coil	Nos.	1		
l)	Limit switch	Nos.	1		
m)	Jaw contact	Nos.	1		
n)	Aux. Finger contact (for complete CB)	Set	1		
o)	Bus bar strip 1mm (Al.)	Mtr	5		
XIII	Batteries (220V)				
1.	Dry and uncharge cells	Nos.	10		
2.	Inter cell connectors (with bolt & nuts)	Nos.	10		
3.	Float level indicators	Nos.	10		
4.	Vent plugs	Nos.	10		

XIV	Batteries (50V)				
1.	Dry and uncharge cells	Nos.	10		
2.	Inter cell connectors (with bolt & nuts)	Nos.	10		
3.	Float level indicators	Nos.	10		
4.	Vent plugs	Nos.	10		
XV	Battery Charger (220V)				
1.	Set of control cards (for one charger)	Set	1		
2.	Set of relays (1 no. of each type)	Set	1		
3.	Set of contactor (1 no. of each type)	Set	1		
4.	Micro switches (if applicable) (for one charger)	Set	1		
5.	Filter capacitor	Nos	1		
6.	Three phase full wave bridge rectifier (Thyristor/diode)	Nos	1		
7.	Set of wound resistor (if applicable) (for one charger)	Set	1		
8.	Set of switches (1 no. of each type)	Set	1		
9.	Potentiometer	Nos	1		
10.	Fuses of thyristor with indicator	Nos	6		
11.	Rectifier transformer	Nos	1		
12.	Control transformer	Nos	1		
13.	Series Inductor	Nos.	1		
XVI	Battery Charger (50V)				
1.	Set of control cards (for one charger)	Set	1		
2.	Set of relays (1 no. of each type)	Set	1		
3.	Set of contactor (1 no. of each type)	Set	1		
4.	Micro switches (if applicable) (for one charger)	Set	1		
5.	Filter capacitor	Nos	1		
6.	Three phase full wave bridge rectifier (Thyristor/diode)	Nos	1		
7.	Set of wound resistor (if applicable) (for one charger)	Set	1		
8.	Set of switches (1 no. of each type)	Set	1		
9.	Potentiometer	Nos	1		
10.	Fuses of thyristor with indicator	Nos	6		
11.	Rectifier transformer	Nos	1		
12.	Control transformer	Nos	1		
13.	Series Inductor	Nos.	1		
XVII	DG Set				
1.	Set of filters (Lub oil/fuel/air) (complete for DG set)	Set	1		
2.	Solenoid Coil assembly	Nos.	1		
3.	Self starter assembly with clutch engaging and disengaging arrangements complete with motors	Nos.	1		
4.	Lube oil pressure safety control	Nos.	1		
5.	High water temp. safety control	Nos.	1		
6.	Diode	Nos.	1		
XVIII	AC & Ventilation				
	One Complete Unit	Nos	1		
XIX	Fire Fighting System				
1.0	HVW Pumps				
1.	Shaft Sleeves (for one pump)	Set	1		
2.0	Diesel engine drive				
1	Fuel oil filter element	Set	1		
2	Lubricating oil filter element	Set	1		
3	Self Stater	Set	1		
3.0	Jockey Pump				
1	Shaft sleeves	Set	1		
2	Gland packing	Set	1		
4.0	Hydrant Pumps & Jockey Pumps				
1.	Shaft Sleeves (for one pump)	Set	1		
2.	Gland Packing (for one pump)	Set	1		
XX	General				
1.	Quartzoid bulb detector	No.	10% of total population		
2.	Projectors (Nozzles)	No.	10% of total population		
3.	Smoke detectors				
a)	Photo electric type	No.	10% of total population		
b)	Ionisation type	No.	10% of total population		
4	Heat detectors	No.	10% of total population		
5	Level switch	No.	1		
7	Bronze pipe fitted with nozzle and guide coupling	No.	2		

9	Isolation valves	Set	1 for each type		
10	Annunciation printed circuits (for solid state annunciation)	Set	1 for each type		
11	Strainer	Set	1		
12	Deluge Valve	No.	1		
13	Safety Valve for Hydro pneumatic system	No.	1		
XXI	Erection Hardware Items				
	5% spares of the actual quantities for Disc Insulator string & Hardware, BPI, clamps & connectors(excluding connectors for CB, Isolator, CT, CVT and SA), ACSR bersimis, spacers, corona bell, welding sleeves etc.				
	No spares are to be considered for ACSR Moose conductor, BMB, grounding conductors, cable tray, Pipes (GI/PVC/hume), buried cable trenches, angles, channels and Junction Boxes				
RR.	Illumination System				
1	Single Pole MCB	Lot			
2	Triple Pole MCB	Lot			
3	Fluorescent Tube & Starter				
	Choke	Lot			
	Bottom Strip	Lot			
	Top Cover & Reflector	Lot			
	Holders	Lot			
4	Sodium Vapour & Mercury Vapour Lamps				
	Lamp	Lot			
	Ballast	Lot			
	Condenser	Lot			
	Lamp Holder	Lot			
	Cover & Reflector	Lot			
	Complete Fittings	Lot			
	Switches & Sockets	Lot			
	Junction Box	Lot			
5	Incandescent Lamps				
	Bulbs	Lot			
	Holders	Lot			
	Complete Fittings of all types	Lot			
6	Spares For Bus bars				
1	Aluminum Tube 4" dia	Lot			
2	Rigid Connector	Lot			
3	Sliding Connector	Lot			
4	Tube to Twin Moose Connector	Lot			
5	Double Tension Hardware with insulator	Lot			
6	Suspension Hardware with insulator	Lot			
7	T Connector for conductor	Lot			
8	Yard Marshalling Box	Lot			
9	Spacers	Lot			
10	PG Clamps	Lot			
11	Corona Bells	Lot			
Notes for ETC works					
1	Loading / Unloading, handling, shifting to & from stores, proper storage,assembly, installation, pre-commissioning test and commissioning tests are included in the scope.				
2	MS welding - apply red lead paint then aluminium paint then bitumen after welding				
3	GI welding - apply 2 coats of cold galvanising anti corrosive paint after welding				
4	10% welding joints in earthing shall be tested for dye penetration test.				
5	Quoted rates are deemed to be inclusive of miscellaneous works, viz.. Erection of clamps and connectors, phase colour discs etc.				
6	Lot quantity may vary from 1% to 20% of the main equipment supply quantity.				