

## ANNEXURE-I

BOQ for Erection Testing &amp; Commissioning (ETC) Works for 765kV Yard

BOQ - 1  
Rev.1

Project : 765kV/400/220kV S/S BHUJ

Customer : POWERGRID CORPORATION OF INDIA LTD.

Note: This BOQ covers only ETC work for 765 kV Switchyard excluding unloading and storage - Unloading and storage of all the material required for 765kV Switchyard is covered under separate contract. ETC contractor of 765kV switchyard package shall ask in writing to unloading and storage contractor for issuance of items/material required for 765kV Switchyard. All arrangement for Lifting and shifting of 765kV equipments/ items (for 765kV Switchyard) from the storage area shall be in the scope of of the contractor of 765kV Switchyard. Bidder should quote only for ETC work in this BOQ.							
1	2	3	4	5	6	7	8
S.No.	Voltage Class (kV)	Type	Description	Unit	Main Qty	Unit Rate	Amount (Rs.)
<b>765kV Equipments</b>							
1	765kV	3 Ph	<b>3 Phase SF6 Circuit Breaker</b> alongwith lattice type Gi supporting structure, terminal connectors, Breaker Control Cabinets, ladder and interpole cabling,SF6 Gas cylinders with controlled switching scheme. (Supervision of Erection, Testing and commissioning will be done by supplier. Supplier will bring Timing kit and Gas leak detector only. Necessary manpower support, tools, tackles and testing kit to be in scope of ETC contractor).				
1.1			With PIR & with CSD	Sets	3	80,000	2,40,000
1.2			With PIR & without CSD	Sets	2	75,000	1,50,000
1.3			Without PIR & with CSD	Sets	5	73,000	3,65,000
1.4		CSD	Special cabling between CB and Relay Panel in SPR	m	600	22	13,200
2	765kV	1 Ph	<b>1 Phase SF6 Circuit Breaker</b> alongwith lattice type Gi supporting structure, terminal connectors, Breaker Control Cabinets, ladder and interpole cabling,SF6 Gas cylinders with controlled switching scheme. (Supervision of Erection, Testing and commissioning will be done by supplier. Supplier will bring Timing kit and Gas leak detector only. Necessary manpower support, tools, tackles and testing kit to be in scope of ETC contractor).				
2.1			Without PIR & with CSD	Nos.	1	30,000	30,000
3	765kV	Knee Type	3 Phase, Knee Type <b>Isolator</b> , motor operated Isolator and earth switch electrically ganged complete with 6 nos. of support insulators & terminal connectors without support structure ( 3 Nos. operating rod insulators are also included)				
3.1			- with one earth switch (motor operated)	Nos.	17	40,000	6,80,000
3.2			- with two earth switch (motor operated)	Nos.	2	40,000	80,000
4	765kV	Knee Type	1 Phase, Knee Type <b>Isolator</b> , motor operated Isolator and earth switch electrically ganged complete with 2 nos. of support insulators & terminal connectors without support structure (Operating Rod insulator :1 No.s for Isolator w/o earth switch , 2 Nos. of operating rod insulator for isolator with 1 E/S are also included)				
4.1			- without earth switch	Nos.	12	14,000	1,68,000
4.2			- with one earth switch (motor operated)	Nos.	33	14,000	4,62,000
Note: 624kV LA, 765kV CT or 765kV CVT may or may not be despatched in container by the manufacturers, it will be ETC contractor's responsibility to unload container and then un load equipments from the container. No additional price for unloading shall be payable.							
5	624kV	LA	1 Phase, Gapless type Metal Oxide <b>Surge Arrester</b> complete with surge counter, leakage current meter, insulating base, connecting cable/strip and terminal connectors. without support structure.	Nos.	24	4,000	96,000
6	765kV		1 Ph, <b>Current Transformer</b> complete with terminal connectors without support structure.	Nos.	24	14,000	3,36,000
7	765kV		1 Ph, <b>Capacitive Voltage Transformer</b> complete with terminal connectors without support structure.	Nos.	12	14,000	1,68,000
8	765kV	8kN	Bus support Insulators (Solid core Post insulator) with corona ring complete with terminal connectors without support structure.	Nos.	70	3,000	2,10,000
9	765kV	1mH	Wave Trap pedestal mounted including 3 Nos. 765kV Post Insulators and Terminal connectors without support structure.	Nos.	4	12,000	48,000
<b>Stringing Work</b>							
10	<b>Stringing hardware</b>						
			Inclusive of fixing various types of clamps, connectors, spacers, corona rings, sleeves, aluminum welding, fixing of socket and bends,				
10.1	765 kV	Double Tension	<b>765kV Double tension Polymer long Rod Insulator</b> suitable for quad AAC Bull conductor with / without turn Buckle. Subconductor spacing 450mm	set	126	4,500	5,67,000
10.2	765 kV	Single Suspension	<b>765kV Single suspension Polymer long Rod Insulator</b> suitable for quad AAC Bull conductor with straight / drop clamp. Subconductor spacing 450mm	set	69	3,400	2,34,600

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1	2	3	4	5	6	7	8
S.No.	Voltage Class (kV)	Type	Description	Unit	Main Qty	Unit Rate	Amount (Rs.)
10.5	765 kV		Guy wire arrangement (As per enclosed sketch)	set	5	2,000	10,000
<b>Bus material &amp; shield wire</b>							
11	-	AAC Bull Conductor	Conductor complete with Tee connectors for droppers to equipment connections, PG clamps for busbar jumpering. Twin/Quad bundle spacers etc to complete to complete the stringing work are included in the scope	Km	31	70,000	21,70,000
12		4.5"	Al Tube (ETC of Al.Tube includes Aluminium welding and bending to be included. Welding sleeve tube will be supplied by BHEL.)	km	2	3,40,000	6,80,000
13	-	7/9 SWG Shield Wire	GI Stranded Shield wire including tension clamp, PG clamp and clamping on structure for down conductor, fixing/bolting with earth strip etc to complete the earthing connection/stringing work are included in the scope	Km	5	30,000	1,50,000
<b>Cabling Work</b>							
			A. <b>Cabling</b> including laying, tagging , dressing, ferruling, lugging, ,soldering, tapping, jointing, crimping, termination, and drilling/ cutting holes in cable gland plates- laying can be either on trays, supports, underground, buried in ground or through GI/PVC pipe over/under ground, through wall etc. All erection materials viz. ferrules, copper lugs, cable ties / straps, Al. tags, markers, GI / PVC wall sleeves with rubber / nylon bushes and flexible steel conduits shall be supplied by bidder. Glands shall be quoted separately.				
14			<b>Control cables</b>				
14.1		PVC	2Cx2.5 sqmm Cu	Km	59	13,300	7,84,700
14.2		PVC	5Cx2.5 sqmm Cu	Km	40	13,300	5,32,000
14.3		PVC	7Cx2.5 sqmm Cu	Km	15.5	14,300	2,21,650
14.4		PVC	10Cx2.5 sqmm Cu	Km	47.5	14,300	6,79,250
14.5		PVC	14Cx2.5 sqmm Cu	Km	40.5	19,300	7,81,650
14.6		PVC	19Cx2.5 sqmm Cu	Km	17	21,300	3,62,100
14.7		PVC	27Cx2.5 sqmm Cu	Km	17	24,300	4,13,100
15			<b>Auxiliary Power cables</b>				
15.1		PVC	2Cx6 sqmm Al/Cu	Km	5.5	13,300	73,150
15.2		PVC	4Cx6 sqmm Al/Cu	Km	10.5	13,300	1,39,650
15.3		PVC	4Cx16 sqmm Al/Cu	Km	20	13,300	2,66,000
15.4		PVC	3.5Cx35 sqmm Al/Cu	Km	1.5	19,300	28,950
15.5		PVC	3.5Cx70 sqmm Al/Cu	Km	9	28,300	2,54,700
<b>Cable Glands</b>							
16			<b>Supply &amp; installation - Tin/ Nickel, Nichel/chromium - Plated (coating thickness not less than 10 microns) Powergrid approved / Sunil &amp; Co. / Arup/ Comet / QPIE make brass cable glands, double compression heavy duty type complete with necessary armour clamp &amp; tapered washer etc for the following cables (Bidder's Scope is to supply and fixing) Qty may vary by ±50%</b>				
16.01		PVC/ XLPE	2Cx2.5 sqmm Cu	Nos.	200	184	36,800
16.02		PVC/ XLPE	5Cx2.5 sqmm Cu	Nos.	600	200	1,20,000
16.03		PVC/ XLPE	7Cx2.5 sqmm Cu	Nos.	300	240	72,000
16.04		PVC/ XLPE	10Cx2.5 sqmm Cu	Nos.	300	270	81,000
16.05		PVC/ XLPE	14Cx2.5 sqmm Cu	Nos.	600	300	1,80,000
16.06		PVC/ XLPE	19Cx2.5 sqmm Cu	Nos.	400	325	1,30,000
16.07		PVC/ XLPE	27Cx2.5 sqmm Cu	Nos.	200	375	75,000
16.08		PVC/ XLPE	2Cx6 sqmm Al/Cu	Nos.	50	200	10,000
16.09		PVC/ XLPE	4Cx6 sqmm Al/Cu	Nos.	52	250	13,000
16.10		PVC/ XLPE	4Cx16 sqmm Al/Cu	Nos.	132	300	39,600
16.11		PVC/ XLPE	3.5Cx35 sqmm Al/Cu	Nos.	6	350	2,100
16.12		PVC/ XLPE	3.5Cx70 sqmm Al/Cu	Nos.	22	400	8,800
<b>Cable Trench Materials</b>							
17			<b>Cable Rack</b> work includes welding and fabrication of cable racks of mild steel angles(50x50x6 mm supplied by BHEL) & painted racks (paint suply in scope of bidder) on inserts of trench walls in trenches in switchyard and control room. Cable rack assembly will be of 2/3/4 tier.	MT	20	13,500	2,70,000

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1	2	3	4	5	6	7	8
S.No.	Voltage Class (kV)	Type	Description	Unit	Main Qty	Unit Rate	Amount (Rs.)
18			Laying of 100/110NB PVC pipe at a depth of 300mm including excavation, backfilling, making and repairing of walls in trenches, cutting, threading, fixing of sockets/ bends where required etc. complete. Both ends of PVC pipe shall be closed . (Payment will be made for the as erected pipe length)	Meter	5000	90	4,50,000
19			Laying of 50/65 NB PVC pipe at a depth of 300mm including excavation, backfilling, making and repairing of walls in trenches, cutting, threading, fixing of sockets/ bends where required etc. complete. Both ends of PVC pipe shall be closed . (Payment will be made for the as erected pipe length)	Meter	7000	75	5,25,000
20			Laying of <b>Cable trays:</b> including bends, tees, elbow, reducers, stiffeners coupler plates, bolting to racks, structure etc. to complete. Scope of minor fabrication is also involved.				
20.1			100 to 150 mm wide, 2.5 M long Perforated type	Meter	500	40	20,000
20.2			100 to 750 mm wide, 2.5 M long Ladder type	Meter	100	30	3,000
<b>STRUCTURE AND EARTHING WORKS</b>							
21			<b>Earthing material-</b> The earthing includes earthing of all switchyard equipment, towers, pipe structure, cable trenches, fence, pipe electrode for LA, CVT, neutral of transformer & at interconnections of other grids, Control room equipments using necessary Connectors for earthing flats. Earthing clamping shall be carried out by ETC contractor. GS strip including cutting, bending, welding with 40 mm dia MS rod riser/earth strip, applying zinc rich paint, clamping to structure/building wall etc. to complete. Hardware required for connecting flat on pads of structure & equipment included in scope. The Earthing of equipments, Auxiliary Earthmats under Iso/ ES/ CB MOM boxes shall be carried out as per Powergrid standard earthing drawing.				
21.1			75 x 12 mm GI Flat	kM	7	70,000	4,90,000
21.2			50 x 6 mm GI Flat	kM	2.5	55,000	1,37,500
21.3			50 x 6 mm MS Flat	kM	2	55,000	1,10,000
21.5			40mm dia MS Rod for equipment risers	MT	12	12,000	1,44,000
22			<b>Steel Structure</b>				
22.1			Galvanised steel Lattice Structures including hardwares for Towers, beams & equipment support	MT	1600	4,200	67,20,000
22.2			Galvanised steel Pipe Structures including hardwares for equipment support	MT	5	3,500	17,500
23			<b>Control and Relay panels</b>				
			Testing and commissioning of relays in scope of panel supplier. Necessary manpower support, tools, tackles and testing equipment to be in scope of ETC contractor				
			<b>765 kV Control &amp; Relay Panels :</b>				
23.1			765kV Circuit Breaker Relay Panel with Auto reclose (1 set = 1 panel)	Set	5	4,500	22,500
23.2			765kV Circuit Breaker Relay Panel without Auto reclose (1 set = 1 panel)	Set	5	4,500	22,500
23.3			765kV Line Protection Panel (1 set = 2 panels)	Set	2	9,000	18,000
23.4			Transformer Protection Panel (For both HV & MV side) (1 set = 2 panels)	Set	2	9,000	18,000
23.5			765kV Reactor Protection Panel (1 set = 2 panels)	Set	3	9,000	27,000
23.6			765kV Busbar Protection Panel (1 set = 4 panels)	Set	1	18,000	18,000
<b>FO CABLE LAYING - Contractor's supplied GI Pipe</b>							
24			SAS : Armoured Fibre Optic system Cable for SAS and Busbar protection ( to be laid in GI Pipe) ( Scope - Laying of the cables in the 25NB GI PIPE), SUPPLY OF GI PIPE (Powergrid accepted) shall also be in contractor's scope				

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1	2	3	4	5	6	7	8
S.No.	Voltage Class (kV)	Type	Description	Unit	Main Qty	Unit Rate	Amount (Rs.)
24.1			Supply and Laying of 25 mm GI pipes( light grade) conduits alongwith socket, bend and joint on trench rack support . Cutting, threading, fixing of clamps sockets/ bends/joints where required etc. complete. Supply of required clamp for fixing GI conduits on Cable rack shall be in ETC contractor scope. (Payment will be made for the as erected pipe length). GI conduits shall be used for laying of fiber optic cables /sensor cables.	M	5000	225	11,25,000
24.2			Armoured FO cable along with connectors for SAS & Busbar Protection. The laying of network/optical cables cables shall be in the contractor scope. However, Optical cable will be laid under SAS supplier's supervision. Splicing and Termination shall be in SAS supplier's scope.). FO cable shall be laid in 25mm dia. GI pipes .	M	8000	15	1,20,000
<b>MKJB CTJB CVTJB</b>							
25			<b>Marshalling Kiosks &amp; CT / CVT Junction Boxes</b>				
25.1			Bay Marshalling Kiosks ( Outdoor, Floor mounted on cable trench)	Nos.	6	3,200	19,200
25.2			CT Junction Box (on CT structure)	Nos.	8	1,600	12,800
25.3			CVT Junction Box (on CVT structure/ on foundation)	Nos.	4	1,600	6,400
<b>Miscellaneous</b>							
26			Installation of <b>terminal connectors</b> at customer supplied/erected items whereas erection of equipments are not in scope of contractor. Terminal connectors shall be provided by BHEL. Any other ETC works related to items below is not in the scope of this BOQ.				
26.1			765 KV single phase reactors	No	11	900	9,900
26.2			765 KV single phase Transformer	No	7	900	6,300
27		SUPPLY INCLUDED	SUPPLY AND INSTALLATION OF ISMC 100, ISMC 50 for Panel Supports	MT	1	72,000	72,000
28		SUPPLY INCLUDED	SUPPLY AND INSTALLATION OF "STANDARD BAY NAME PLATE" as per drawing number C/ENG/STD/BAY NAME PLATE	Nos.	8	1,000	8,000
<b>Total Amount (Rs.)</b>							<b>225,55,600</b>
<b>Following also forms the scope of ETC work in addition to above, but not limited to this.</b>							
1	<b>Bidders to quote a percentage above/ below/ at par the item rate mentioned in the BOQ. The quoted percentage shall be applicable uniformly on all item rates of BOQ. The Percentage to be quoted in price schedule format attached with this BOQ.</b>						
2	Assembly, installation, pre-commissioning test and commissioning tests (As per BHEL/Powergrid FQP) are included in the scope.						
3	All the drawings and documents as per Annexure-1 shall be followed for ETC work.						
4	Annexure- 2 (Switchyard Erection guidelines) shall be followed for ETC work.						
5	Minor Civil works such as modification of civil foundations, making holes in the trenches/ control room building, grouting, fixing of trench material will be in the scope of ETC contractor.						
6	Removal of gravel, if gravelling is done, for connection of Equipment earthing strip to the existing mat (wherever earthing mat is already laid), and after completion of earthing , contractor should place the gravel to bring it in original shape.						
7	The quantities given in items mentioned above may undergo a change to any extent.						
8	Quoted rates are deemed to be inclusive of miscellaneous works viz erection of clamps and connectors.						
9	All paint , welding electrodes & other consumable by contract supplies shall be part of ETC works. Paint /welding electrode make etc. is subject to BHEL/CUSTOMER site incharge approval.						
10	Equipment erection (say Isolator ) means complete erection, metallic, post insulator, connectors (expansion/rigid tubular for Al.Tube / single/double/quadruple conductor), connection to the next in line (if connected to overhead busbar or droppers) including PG clamps/Tee connectors etc. This will be clear from the enclosed electrical layout drawings.						
11	Equipment and tower erection would include supply and erection of miscellaneous items , viz Phase colour discs , labels painting of equipments , phase colour painting , phase marking , bay identification board , danger plates , rubber mats , device number marking on the equipment, keyboard etc as per site requirements. Supply & Mounting of phase color discs & Danger plates shall be as per IS-2551; 1982 & IS 5; 1978.						
12	Welding of Aluminium tubes ( supply of welding sleeve excluded) as per Annexure-3 is in ETC contractor's scope and joints shall be tested by radiography. Welding and Bending machines and any other equipment will be in ETC Contractor scope.						
13	Complete ETC package is under the scope of bidder. All TNP including oil filtrating machine, cranes etc. required to complete the job shall be provided by bidder only.						
14	Testing instruments (dully calibrated) have to be arranged by ETC Contractor at it's own cost ( List is only provided for information , if any other instrument not mentioned below but required for successful completion of ETC work shall be in ETC contractor's scope) , (However OMICRON or equivalent kit for Numerical relay testing shall be arranged by BHEL.)						
14.1	DCRM (OPERATIONAL ANALYSER )						
14.2	Contact Resistance Measurement kit (CRM)						
14.3	Capacitance and Tan delta measurement Kit						

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<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
<b>S.No.</b>	<b>Voltage Class (kV)</b>	<b>Type</b>	<b>Description</b>	<b>Unit</b>	<b>Main Qty</b>	<b>Unit Rate</b>	<b>Amount (Rs.)</b>
14.4			Dew Point Measurement kit				
14.5			5kV/1kV Megger				
14.6			Primary current Injection Kit				
14.7			Secondary current/Voltage Injection kit				
14.8			1Ph Variac				
14.9			Multimeters				
14.10			Clamp on meter				
14.11			Relay test kit				
15	The scope of supply items as mentioned in above BOQ are tentative . Items shall be supply by contractor as per exact site requiremnets only.						
16	For scope of supply items in ETC contractor scope following should be followed . (1)The approval of makes shall be obtained from BHEL/Customer . (2)Drawings and MQP shall be submitted for approval in line with specification and relevant IS. (3) Quality -Inspection & dispatch clearance shall be given by BHEL/Customer.						
17	Cable racks and supports shall be painted after installation with two coats of metal primer (comprising of red oxide and zinc chromate in a synthetic medium) followed by two finishing coats of aluminium paint. The red oxide and zinc chromate shall conform to IS:2074. Supply of paint under bidder's scope.						

**TRANSMISSION BUSINESS GROUP  
(SUB- CONTRACTS MANAGEMENT)  
TBG – NOIDA**

**PRICE SCHEDULE FORMAT**

**(ANNEXURE-II)**

**SUB: RECEIPT OF EQUIPMENT/ MATERIAL AT SITE, INSPECTION, VERIFICATION, STORAGE, UP-KEEPING DURING STORAGE, ERECTION, TESTING, COMMISSIONING AND HANDING OVER OF 765KV SUBSTATION (PKG-I) AT BHUJ IN GUJARAT.**

(a) I/ We hereby agree to execute the above work at ----- % (in figure) ----- (in words) Above/ Below/At Par the rates of items given in BOQ for ETC works of 765kV substation (Annexure-I) of subject tender.

**NOTE:**

1. In this annexure the tenderer shall quote a percentage above or below or at par the rates shown in the Bill of Quantities of ETC works of 765kV substation (Annexure-I). The percentage quoted shall be clearly written both in words and figures In case of discrepancy in rates in figure and words, the minimum will be taken into account by BHEL.
2. The quoted percentage will apply to the individual items uniformly.

Date:

Place

Signature of tenderer

Name & Designation of authorized person(s) with seal

### ANNEXURE-III

**SUMMARY OF PRICES FOR RECEIPT OF EQUIPMENT/ MATERIAL AT SITE, INSPECTION, VERIFICATION, STORAGE, UP-KEEPING DURING STORAGE, ERECTION, TESTING, COMMISSIONING AND HANDING OVER OF 765KV SUBSTATION AT BHUJ IN GUJARAT (PKG-I)**

<b>SI No.</b>	<b>Description</b>	<b>Amount (Rs.)</b>
1	Total amount as per the rates in BOQ for subject ETC works of 765kV substation (Annexure-I)	225,55,600.00
2	Applicable percentage above/below/ at Par to the total amount in BOQ for subject ETC works of 765kV substation (As indicated in Price Schedule Format, Annexure-II).	.....% above/below/ at par
<b>3</b>	<b>Total amount for subject ETC works of 765kV substation after consideration of percentage above/below/ at par.</b>	