

BOQ for Erection Testing & Commissioning (ETC) Works for 400kV Switchyard

Customer : POWERGRID CORPORATION OF INDIA LTD.

Project : 400kV/220kV S/S BHUJ [PART-2] PROJECT

BOQ 1

Rev.0

Note:	This BOQ covers Erection, Testing & Commissioning works including unloading, storage, security of equipments/materials, material handing, up keeping of records, material verifications, issuing of material to other contractors, and handing over of executed system & spares to customer for 400kV & 220kV Substation BHUJ [Part-2] Project and final material reconciliation and handing over of surplus material to BHEL. Bidder has to fill unit rate in against each item.						
S.No.	Voltage (kV)	Type	Description	Unit	Total Qty	Unit Rate	Total Amount (Rs.)
	MAIN EQUIPMENTS						
	400kV Transformer						
1.1	400 kV	500mVA	500 MVA, 400/220/33kV, 3-Ph Autotransformer alongwith Marshalling Kiosk, terminal connectors, accessories, insulating oil and online DGA, oil drying system. Work includes erection of all auxiliaries, viz turrets, bushings, terminal connectors, dry air circulation, filling of oil, oil filtration, Oil testing, laying of cable from Reactor auxiliaries to MK etc as required to complete the installation of Reactor.	Nos.	2	14,50,075.00	29,00,150.00
1.2			Dragging charges of above mentioned Transformer (1 No.) upto plinth.	m	30	2,500.00	75,000.00
1.3			Digital RTCC Panel for Transformer	Nos.	1	5,000.00	5,000.00
1.4			Complete dryout of transformer by N2 filling/ vaccuming/ purging and heating (if required)	Kg	100	1,689.32	1,68,932.00
	400kV EQUIPMENT						
2	400 kV		400KV SF6, 3 Phase Circuit Breaker alongwith lattice type GI supporting structure, terminal connectors, Breaker Control Cabinets, ladder and interpole cabling, SF6 cylinders complete in all respect (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		CB	with PIR & with CSD	Nos.	1	40,121.35	40,121.35
2.2		CB	without PIR & with CSD	Nos.	2	40,121.35	80,242.70
2.3		Cable	Special cabling between CB and Relay Panel in SPR for CSD	m	50	18.58	929.13
	400 kV	HDB (Electrically ganged)	3 Ph, 400kV Isolator, 3150/2000A, motor operated complete with 9 nos. of 400kV support insulators & terminal connectors without support structure				
3			- with one earth switch (motor/ manual operated)	Nos.	8	15,372.81	1,22,982.50
4	400 kV		1 Ph, 400kV Current Transformer complete with terminal connectors without support structure.	Nos.	9	7,179.61	64,616.49
5	400 kV	Solidcore with corona ring	400kV Post Insulators complete with corona ring & terminal connectors without support structure	Nos.	10	1,013.59	10,135.92
6	336 kV		1 Phase, Gapless type Metal Oxide 336kV Surge Arrester complete with surge counter, leakage current meter, insulating base, connecting cable and terminal connectors without support structure	Nos.	6	2,956.31	17,737.86
	220kV EQUIPMENT						
7			220KV SF6, 3 Phase Circuit Breaker alongwith lattice type GI supporting structure, terminal connectors, Breaker Control Cabinets, ladder and interpole cabling, SF6 cylinders complete in all respect (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).	Nos	4	35,000.00	1,40,000.00
8			1 Ph, 220kV Current Transformer complete with terminal connectors without support structure.	Nos	12	6,000.00	72,000.00
9			1 Ph, 220kV CVT complete with terminal connector without support structure.	Nos	6	6,000.00	36,000.00
10			3 Ph, 220kV Isolator, 2500/1600A, mechanically ganged and motor operated for isolator /earth switch, complete with 9 nos. of 220kV support insulators & terminal connectors without support structure				
10.1			with one E/S	Set	3	12,000.00	36,000.00
10.2			with two E/S	Set	5	13,000.00	65,000.00
11			3 Ph, 220kV Tendon Isolator, 1600A, individual pole motor operated, complete with 9 nos. of 220kV support insulators & terminal connectors without support structure				
11.1			without E/S	Set	5	12,000.00	60,000.00

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S.No.	Voltage (kV)	Type	Description	Unit	Total Qty	Unit Rate	Total Amount (Rs.)
12			1 Phase, Gapless type Metal Oxide 216kV Surge Arrester complete with surge counter, leakage current meter, insulating base, connecting cable and terminal connectors without support structure	Nos	6	2,500.00	15,000.00
13			220kV Post Insulators complete with corona ring & terminal connectors without support structure	Nos	50	1,000.00	50,000.00
		CONTROL AND RELAY					
15			400 kV Control & Relay Panels				
			Supervision of 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				
15.1			400kV Circuit Breaker Relay Panel with Auto reclose (1 set = 1 panel)	Set	1	4,223.30	4,223.30
15.2			400kV Circuit Breaker Relay Panel without Auto reclose (1 set = 1 panel)	Set	2	4,223.30	8,446.60
15.3			400kV Transformer Protection Panel (1 set = 2 panels)	Set	2	8,446.60	16,893.20
16			220 kV Control & Relay Panels				
			Supervision of 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				
16.1			220kV Circuit Breaker Relay Panel with Auto reclose (1 set = 1 panel)	Set	1	4,223.30	4,223.30
16.2			220kV Circuit Breaker Relay Panel without Auto reclose (1 set = 1 panel)	Set	3	4,223.30	12,669.90
16.3			Bus Bar Protection Panel (1 set = 1 panel)	Set	1	4,223.30	4,223.30
		FO CABLE LAYING - Contractor's supplied GI Pipe					
			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				
17		SUPPLY INCLUDED	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	1200	190.05	2,28,058.20
18			Armoured FO cable along with connectors for SAS & Busbar Protection.The supply of F.O Cable shall be in SAS Suppliers scope . Contractor scope :- The laying of network/optical cables. 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	1500	13.51	20,271.84
19		STRINGING HARDWARE					
19.1	220kV	Double Tension	220kV Double tension Polymer long rod insulator / disc insulator string suitable for QUAD ACSR BERSIMIS / MOOSE conductor with / without turn Buckle	set	96	2,286.90	2,19,542.40
19.5	220kV	Double Tension	220kV Double tension Polymer long rod insulator / disc insulator string suitable for TWIN ACSR BERSIMIS / MOOSE conductor with / without turn Buckle	set	42	2,286.90	96,049.80
19.3	220kV	Single Suspension	220kV Single suspension Polymer long rod insulator / disc insulator string suitable for QUAD ACSR BERSIMIS / MOOSE conductor with straight / drop clamp	set	30	1,871.10	56,133.00
19.4	220kV	Single Suspension	220kV Single suspension Polymer long rod insulator / disc insulator string suitable for TWIN ACSR BERSIMIS / MOOSE conductor with straight / drop clamp	set	48	1,871.10	89,812.80
20		BUS MATERIAL					
			Inclusive of fixing various types of clamps, connectors, spacers, corona rings, sleeves, aluminum welding, fixing of socket and bends,				

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S.No.	Voltage (kV)	Type	Description	Unit	Total Qty	Unit Rate	Total Amount (Rs.)
20.1	-	ACSR Bersimis	Conductor complete with Tee connectors for droppers to equipment connections, PG clamps for busbar jumpering, Twin/Quad bundle spacers etc to complete.	Km	7	51,524.26	3,60,669.82
20.2		4"	Al Tube (ETC of Al.Tube includes Aluminium welding and bending to be included. Welding sleeve tube will be supplied by BHEL.)	m	550	291.41	1,60,274.24
20.3		3"	Al Tube (ETC of Al.Tube includes Aluminium welding and bending to be included. Welding sleeve tube will be supplied by BHEL.)	m	10	257.62	2,576.21
20.4	-	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.	Km	1	26,184.46	26,184.46
21	Marshalling Kiosks &						
21.1			Bay Marshalling Kiosks (Outdoor, Floor mounted on cable trench)	Nos.	7	3,294.17	23,059.22
21.2			CT Junction Box (on CT structure)	Nos.	7	1,942.72	13,599.03
21.3			CVT Junction Box (on CVT structure/ on foundation)	Nos.	2	1,942.72	3,885.44
	CABLE LAYING WORKS						
			A. Cabling 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.				
22			Control cables				
22.1		PVC	2Cx2.5 sqmm Cu	Km	5.6	11,825.24	66,221.34
22.2		PVC	5Cx2.5 sqmm Cu	Km	15	11,825.24	1,77,378.60
22.3		PVC	7Cx2.5 sqmm Cu	Km	2	12,669.90	25,339.80
22.4		PVC	10Cx2.5 sqmm Cu	Km	4	12,669.90	50,679.60
22.5		PVC	14Cx2.5 sqmm Cu	Km	5	16,893.20	84,466.00
22.6		PVC	19Cx2.5 sqmm Cu	Km	2	18,582.52	37,165.04
22.6		PVC	27Cx2.5 sqmm Cu	Km	2	21,707.76	43,415.52
						-	-
23			Auxiliary Power cables			-	-
23.1		PVC	2Cx6 sqmm Al/Cu	Km	2	11,825.24	23,650.48
23.2		PVC	4Cx6 sqmm Al/Cu	Km	4	11,825.24	47,300.96
23.3		PVC	4Cx16 sqmm Al/Cu	Km	9	11,825.24	1,06,427.16
23.4		PVC	3.5Cx35 sqmm Al/Cu	Km	2.5	16,893.20	42,233.00
23.5		PVC	3.5Cx70 sqmm Al/Cu	Km	7	24,495.14	1,71,465.98
	CABLE GLAND		CONTRACTOR'S SUPPLY				
24		SUPPLY INCLUDED	Supply & installation - Tin/ Nickel, Nichel/chromium - Plated (coating thickness not less than 10 microns) Powergrid approved / Sunil & Co. / Arup/ Comet / QPIE make brass cable glands , double compression heavy-duty type complete with necessary armour clamp & tapered washer etc for the following cables (Bidder's Scope is to supply and fixing). Individual quantity may vary upto any extend and even may deleted.				
24.01		PVC	2Cx2.5 sqmm Cu	Nos.	60	168.93	10,135.92
24.02		PVC	5Cx2.5 sqmm Cu	Nos.	350	168.93	59,126.20
24.03		PVC	7Cx2.5 sqmm Cu	Nos.	100	202.72	20,271.84
24.04		PVC	10Cx2.5 sqmm Cu	Nos.	100	228.06	22,805.82
24.05		PVC	14Cx2.5 sqmm Cu	Nos.	150	253.40	38,009.70
24.06		PVC	19Cx2.5 sqmm Cu	Nos.	50	274.51	13,725.73
24.07		PVC	27Cx2.5 sqmm Cu	Nos.	50	316.75	15,837.38
24.08		PVC/ XLPE	2Cx6 sqmm Al/Cu	Nos.	80	168.93	13,514.56
24.09		PVC/ XLPE	4Cx6 sqmm Al/Cu	Nos.	14	232.28	3,251.94
24.10		PVC/ XLPE	4Cx16 sqmm Al/Cu	Nos.	150	253.40	38,009.70
24.11		PVC/ XLPE	3.5Cx35 sqmm Al/Cu	Nos.	20	295.63	5,912.62
24.12		PVC/ XLPE	3.5Cx70 sqmm Al/Cu	Nos.	50	337.86	16,893.20
25	STEEL STRUCTURES						
25.1			Galvanised steel Lattice Structures including hardwares for Towers, beams & equipment support	MT	220	3,800.97	8,36,213.40

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25.2			Galvanised steel Pipe Structures including hardwares for equipment support	MT	48	3,209.71	1,54,065.98
		Cable Trench Materials					
26			Cable Rack work includes welding and fabrication of cable racks of mild steel angles (50x50x6 mm supplied by BHEL) & painted racks (paint supply 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	13	11,656.31	1,51,532.00
27			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	1200	77.71	93,250.46
28			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	1500	65.04	97,558.23
29			Laying of Cable trays including cover: including bends, tees, elbow, reducers, stiffeners coupler plates, bolting to racks, structure etc. to complete. Scope of minor fabrication is also involved.				
29.1			100 to 150 mm wide, 2.5 M long Perforated type	Meter	100	44.34	4,434.47
29.2			100 to 750 mm wide, 2.5 M long Ladder type	Meter	10	35.90	358.98
		Earthing work					
30			Earthing material - 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				
30.1			75 x 12 mm GI Flat	kM	4	59,970.86	2,39,883.44
30.2			50 x 6 mm GI Flat	kM	1	47,300.96	47,300.96
30.3			50 x 6 mm MS Flat	kM	2	47,300.96	94,601.92
30.4			40NB Pipe electrode	Nos.	6	6,841.75	41,050.48
30.5			40mm dia MS Rod for equipment risers	MT	10	10,389.32	1,03,893.18
		Miscellaneous					
31		SUPPLY INCLUDED	SUPPLY AND INSTALLATION OF ISMC 100 OR ISMC 50 for Panel Supports	MT	0.8	60,815.52	48,652.42
32		SUPPLY INCLUDED	SUPPLY AND INSTALLATION OF "STANDARD BAY NAME PLATE" as per drawing number C/ENG/STD/BAY NAME PLATE	Nos.	7	844.66	5,912.62
33		Spares	MANDATORY SPARES FOR SUBSTATION EQUIPMENT AS PER ANNEXURE - 1.1				
33.1		Spares	500 MVA, 400/220/33 kV Single Phase Auto Transformer	Lot	1	21,116.50	21,116.50
33.2		Spares	400kV Isolator	Lot	1	3,125.24	3,125.24
33.3		Spares	220kV SF6 Circuit Breaker	Lot	1	9,713.59	9,713.59
33.4		Spares	220 KV Current Transformer(1-Ph) complete in all respects including terminal connector (of each type)	Lot	1	1,689.32	1,689.32
33.5		Spares	220kV, 4400pf CVT (1-Ph) complete in all respects including terminal connector (of each type)	Lot	1	1,689.32	1,689.32
33.6		Spares	216kV Surge Arrester	Lot	1	2,956.31	2,956.31
33.7		Spares	220kV Isolator	Lot	1	3,125.24	3,125.24
33.8		Spares	Bus Post Insulator	Lot	1	1,182.52	1,182.52

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S.No.	Voltage (kV)	Type	Description	Unit	Total Qty	Unit Rate	Total Amount (Rs.)
			Total Amount (Rs.)				84,07,188.67

Following also forms the scope of ETC work in addition to above, but not limited to this.

Note:							
1	Erection, Installation, pre-commissioning test and commissioning tests (As per BHEL/Powergrid FQP) are included in the scope.						
2	All the drawings and documents as per Annexure-1 shall be followed for ETC work. List of drawing/document/instruction for execution will be issued by site during contract stage.						
3	Annexure- 2 (Switchyard Erection guidelines) shall be followed for ETC work.						
4	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.						
5	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.						
6	The quantities given in items mentioned above may undergo a change to any extent.						
7	Quoted rates are deemed to be inclusive of miscellaneous works viz erection of clamps and connectors.						
8	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.						
9	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.						
10	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.						
11	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.						
12	Completed 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.						
13	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.						
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.)						
14.01	DCRM (OPERATIONAL ANALYSER)						
14.02	Contact Resistance Measurement kit (CRM)						
14.03	Capacitance and Tan delta measurement Kit						
14.04	Dew Point Measurement kit						
14.05	5kV/1kV Megger						
14.06	Primary current Injection Kit						
14.07	Secondary current/Voltage Injection kit						
14.08	1Ph Variac						
14.09	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 requirements 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.						

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

PRICE SCHEDULE FORMAT

(ANNEXURE-II)

SUB: RECEIPT OF EQUIPMENT/ MATERIAL AT SITE, UNLOADING, INSPECTION, VERIFICATION, STORAGE, UP-KEEPING DURING STORAGE, ERECTION, TESTING, COMMISSIONING AND HANDING OVER OF 400/220 kV SUBSTATION AT BHUJ (PART-2) 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 (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 BOQ (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 of BOQ (Annexure-I).

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, UNLOADING, INSPECTION, VERIFICATION, STORAGE, UP-KEEPING DURING STORAGE, ERECTION, TESTING, COMMISSIONING AND HANDING OVER OF 400/220 kV SUBSTATION AT BHUJ (PART-2) IN GUJARAT.

Sl No.	Description	Amount (Rs.)
1	Total Amount for ETC work for 400/220 kV substation at Bhuj (part-2) in Gujarat (Annexure-I)	84,07,188.67
2	Value of percentage above/below/at par (As indicated in Price Schedule Format, Annexure-II) applicable to the total amount mentioned at sl. no. 1 above.% above/below/ at par
3	Total amount after consideration of percentage above/below/ at par.	