

ANNEXURE-I

BOQ for Erection Testing & Commissioning (ETC) Works (Rev 00)

Project : Substation Package for Extension of 400kV Tumkur Pooling station (Pavagada) (including transformer & Reactor), Extension of 400/220kV Mysore Substation and Extension of 400/220kV Tumkur (Vasantnarsapur) (including Transformer) under Transmission System for Ultra Mega Solar Power Part at Tumkur (Pavagada), Karnataka-Phase-II (Part -A)

Customer : Power Grid Corporation of India Limited

Location : 400/220kV Tumkur (Vasantnarsapur) S/s Extn.

S.No.	Voltage Class (kV)	Type	Description	Unit	Qty.	Unit Rate (Rs.)	Total (Rs.)
MAIN EQUIPMENTS							
1.1a	400/220/33 kV	500MVA	500MVA, 400/220/33 kV, 3-Ph Autotransformer complete in all respect alongwith OLTC and its MB Box, Radiator Bank and its cooling arrangement, Conservator, Cooler Control Cabinet/Marshalling Kiosk, accessories and insulating oil. Work includes erection of all auxiliaries viz turrets, bushings, terminal connectors, associated earthing works (excluding riser connections to main earthmat), laying of cable from Transformer auxiliaries to MK & OLTC, Oil filtration , filling of oil, hot oil circulation, Oil testing etc as required to complete the installation of 500MVA transformer (Supervision of unloading, Erection, Testing and commissioning will be done by OEM). Note:- 1) Charges for Oil filtration, filling of oil, hot oil circulation etc for first time commissioning of Transformer are deemed to be covered in this line item. 2) Charges for testing of oil supplied in drums are covered separately under item no. 1.3 below.	Nos.	1	1536324.81	1536324.81
1.1b			Dragging/shifting charges of main tank of above mentioned Transformer (1 No.) upto plinth	m	50	2648.70	132434.94
1.1c			On line dissolved gas (multi gas) and moisture analyser	Nos.	1	1000.00	1000.00
1.1d			On line insulating oil drying system (Cartridge type)	Nos.	1	1000.00	1000.00
1.1e			Digital RTCC Panel consisting of digital RTCC relays for Transformer	Set	1	5000.00	5000.00
1.2			N2 Cylinders for complete dryout of Transformer by vaccuming/ N2 filling/ purging and heating (if required)	Kg	100	1689.32	168932.00
1.3			Oil Testing (BDV, ppm, Resistivity & Tan delta etc as per Powergrid specification) for oil supplied in drums (if required)	No. of Samples	25	7000.00	175000.00
1.4			Oil filtration charges (if required) This item is executed only if re-filtration of Transformer oil is required.	kl	1	1662.50	1662.50
2	400 kV	CB	SF6, 3 Phase Circuit Breaker alongwith lattice type GS supporting structure, terminal connectors, Breaker Control Cabinets, ladder and interpole cabling. (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	without PIR & with CSD (Work also includes mounting of CSD in respective Relay Panel in Control Room)	Nos.	1	40121.35	40121.35
2.2		CSD	Laying of Special cable (for Control Switching Device) between existing/new SF6, 3 Ph Circuit Breaker (in Yard) and Relay Panel (in Panel/Control Room)	m	100	18.58	1858.25
3	220 kV	Without PIR	SF6, 3 Phase Circuit Breaker alongwith lattice type GS supporting structure, terminal connectors, Breaker Control Cabinets, ladder and interpole cabling. (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.	1	24899.57	24899.57
4	400 kV	HDB (Normal)	3 Ph, Isolator , motor/ manual operated complete with 9 nos. of support insulators & terminal connectors without support structure			-	
4.1			- with one earth switch (motor/ manual operated)	Nos.	2	15372.81	30745.62
5	220 kV	HDB (Normal)	3 Ph, Isolator , motor/ manual operated complete with 9 nos. of support insulators & terminal connectors without support structure				
5.1			- with one earth switch (motor/ manual operated)	Nos.	1	15072.75	15072.75
5.2			- with two earth switch (motor/ manual operated)	Nos.	1	15592.50	15592.50
6	220 kV	HDB (Tandem)	3 Ph, Isolator , motor/ manual operated complete with 9 nos. of support insulators & terminal connectors without support structure				
6.1			- without earth switch (Tandem Type)	Nos.	2	15072.75	30145.50
7	400 kV	Upto 3000 A	1 Ph, Current Transformer (3000 A), live/dead tank complete with terminal connectors without support structure.	Nos.	3	7179.61	21538.83
8	220 kV	Upto 1600 A	1 Ph, Current Transformer (1600 A), live/dead tank complete with terminal connectors without support structure.	Nos.	3	4980.32	14940.97
9	336 kV		1 Phase, Gapless type Metal Oxide Surge Arrester complete with surge counter, leakage current meter, insulating base, connecting cable and terminal connectors without support structure.	Nos.	3	2956.31	8868.93
10	216 kV		1 Phase, Gapless type Metal Oxide Surge Arrester complete with surge counter, leakage current meter, insulating base, connecting cable and terminal connectors without support structure.	Nos.	3	3006.33	9018.99
11	400 kV	Solidcore with corona ring	Post Insulators complete with corona ring & terminal connectors without support structure.	Nos.	3	1013.59	3040.78

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S.No.	Voltage Class (kV)	Type	Description	Unit	Qty.	Unit Rate (Rs.)	Total (Rs.)
12	220 kV	Solidcore with/without corona ring	Post Insulators complete with/without corona ring & terminal connectors without support structure.	Nos.		-	
12.1			low level (upto 5.9 m height from plinth).	Nos.	30	647.73	19431.82
12.2			High level (above 5.9 m to 8 m height from plinth).	Nos.	9	824.38	7419.42
13	ILLUMINATION SYSTEM (Only Unloading, Storage is in scope of ETC Contractor)					-	
13.1	-	Illumination Sys	Lighting Panels, fixtures, Receptacles and other accessories/materials etc. as required for complete installation and commissioning of Illumination System (Refer Annexure-B for details)	Lot	1	30866.43	30866.43
14	BUS BAR MATERIALS					-	
14.1	Stringing hardware					-	
14.1.1	220 kV	SingleTension	Tension insulator string with double/single anchoring point, string comprising 1X16 nos. disc with hardware set with all accessories including tension clamp with/without Turn Buckle set suitable for twin/quad conductor.	Set	6	1871.10	11226.60
14.1.2	220 kV	Single Suspension	Suspension insulator string comprising 1X16 nos. disc with hardware set with all accessories including drop/through type suspension clamp suitable for twin/quad conductor.	Set	6	1871.10	11226.60
14.2	-	ACSR Bersimis/ Moose	Conductor complete with Tee connectors for droppers to equipment connections, PG clamps for busbar jumpering, Twin/Quad bundle rigid/flexible spacers etc to complete.	Km	2	51524.26	103048.52
14.3		4.5"	Al Tube (ETC of Al.Tube includes Aluminium welding and bending to be included. Welding sleeve tube will be supplied by BHEL)	m	54	329.42	17788.54
14.4		4.0"	Al Tube (ETC of Al.Tube includes Aluminium welding and bending to be included. Welding sleeve tube will be supplied by BHEL)	m	427	295.89	126344.02
14.5.1	-	7/9 SWG	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	0.5	26184.46	13092.23
14.5.2	-	7/9 SWG	GI Stranded Shield wire (Bidder's Scope is to supply 7/9 SWG Shield Wire (Customer accepted) only. ETC is covered under item no. 14.5.1)	Km	0.5	45000.00	22500.00
	ENGINEERED ITEMS					-	
15			Cabling including laying, tagging , dressing, ferruling, lugging, ,soldering, tapping, jointing, crimping, termination, and drilling/ cutting holes in cable gland plates, ETC of glands - laying can be either on (existing/new) trays, supports, underground (buried in ground or through GI/PVC pipe), over 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. Supply rates of Glands shall be quoted separately under item no. 16. (Removal of Pre-cast trench cover for cable laying & replenishing cover on trench after cable laying in case of existing trench is also in bidder's scope)			-	
15.1			Control cables			-	
15.1.1		PVC	5Cx2.5 sqmm Cu	m	4000	11.83	47300.96
15.1.2		PVC	7Cx2.5 sqmm Cu	m	2500	12.67	31674.75
15.1.3		PVC	10Cx2.5 sqmm Cu	m	10000	12.67	126699.00
15.1.4		PVC	14Cx2.5 sqmm Cu	m	2000	16.89	33786.40
15.1.5		PVC	19Cx2.5 sqmm Cu	m	2000	18.58	37165.04
15.1.6		PVC	2Cx2.5 sqmm Cu	m	2000	11.83	23650.48
15.2			Auxiliary Power cables				
15.2.1		PVC	2Cx6 sqmm Al	m	500	11.83	5912.62
15.2.2		PVC	4Cx6 sqmm Al	m	2000	11.83	23650.48
15.2.3		PVC	4Cx16 sqmm Al	m	4000	11.83	47300.96
15.2.4		PVC	3.5Cx35 sqmm Al	m	500	16.89	8446.60
15.2.5		PVC	3.5Cx70 sqmm Al	m	4000	24.50	97980.56
15.2.6		XLPE	3.5Cx300 sqmm Al	m	600	56.59	33955.33
16			Tin/ Nickel, Nickel/chromium - Plated (coating thickness not less than 10 microns) 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 only & ETC is covered under item no. 15) Overall Qty may vary by ±50% (Cable glands to be procured from Powergrid approved Vendors)				
16.1			Control cables				
16.1.1		PVC	5Cx2.5 sqmm Cu	Nos.	72	168.93	12163.10
16.1.2		PVC	7Cx2.5 sqmm Cu	Nos.	19	202.72	3851.65
16.1.3		PVC	10Cx2.5 sqmm Cu	Nos.	65	228.06	14823.78
16.1.4		PVC	14Cx2.5 sqmm Cu	Nos.	31	253.40	7855.34
16.1.5		PVC	19Cx2.5 sqmm Cu	Nos.	31	274.51	8509.95
16.1.6		PVC	2Cx2.5 sqmm Cu	Nos.	12	168.93	2027.18
16.2			Auxiliary Power cables				
16.2.1		PVC	2Cx6 sqmm Al	Nos.	12	168.93	2027.18
16.2.2		PVC	4Cx6 sqmm Al	Nos.	110	232.28	25550.97
16.2.3		PVC	4Cx16 sqmm Al	Nos.	26	253.40	6588.35
16.2.4		PVC	3.5Cx35 sqmm Al	Nos.	10	295.63	2956.31
16.2.5		PVC	3.5Cx70 sqmm Al	Nos.	26	337.86	8784.46

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S.No.	Voltage Class (kV)	Type	Description	Unit	Qty.	Unit Rate (Rs.)	Total (Rs.)
16.2.6		XLPE	3.5Cx300 sqmm Al	Nos.	2	2618.45	5236.89
17			Marshalling Kiosks & CT/CVT Junction Boxes				
17.1			Bay Marshalling Kiosks (Outdoor, Floor mounted on cable trench)	Nos.	2	3294.17	6588.35
17.2			CT Junction Box (on CT structure)	Nos.	2	1942.72	3885.44
18			Laying of Cable trays : including bends, tees, elbow, reducers, stiffeners coupler plates, bolting to racks, structure etc. to complete.				
18.1			150 to 750 mm wide, 2.5 M long Ladder type	m	100	35.90	3589.81
18.2			100 to 250 mm wide, 2.5 M long Perforated type	m	100	44.34	4434.47
19			Cable Rack work includes welding of mild steel & 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. (Supply of MS Angles is in bidder's scope)	MT	2	54802.91	109605.82
20			Laying of PVC conduits 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. <u>Both ends of PVC conduits shall be closed by plastering.</u> (Payment will be made for the as erected pipe length) (Supply of PVC Pipe (class 4 as per IS 4985, Customer accepted) alongwith accessories like sockets, bends, tees etc is in Contractor's scope)				
20.1			PVC pipe, 50/ 63 NB	m	650	104.34	67820.23
20.2			PVC Pipe, 100/ 110NB	m	500	262.96	131479.36
21			Laying of GI conduits 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. <u>Both ends of GI conduits shall be closed by plastering.</u> (Payment will be made for the as erected pipe length)				
21.1			GI pipe, 50/ 63 NB	m	100	79.96	7996.40
21.2			GI Pipe, 100/ 110NB	m	100	99.44	9944.24
22			Laying of 30mm GI Pipes in Trenches including cutting, threading, fixing of sockets/ bends/TEEs where required etc. complete. Both ends of conduits shall be closed by plastering. (Payment will be made for the as erected pipe length) (Supply of GI Pipe (light grade, Customer accepted) alongwith accessories is in Contractor's scope)	m	250	190.05	47512.13
23			Earthing material - The earthing includes earthing of all switchyard equipment, towers, lattice/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 C/ENG/STD/EARTHING (SH-1 to 28) :				
23.1			75 x 12 mm GI Flat	km	0.9	59970.86	53973.77
23.2			50 x 6 mm GI Flat	km	0.8	47300.96	37840.77
24			Galvanised steel Lattice Structures including hardwares for Towers, beams & LM	MT	9	3800.97	34208.73
25			Galvanised steel Pipe Structures including hardwares for equipment support	MT	29	3209.71	93081.53
26			Control & Relay Panel (Testing and commissioning of relays in scope of panel OEM. Necessary manpower support, tools, tackles and testing equipment to be in scope of ETC contractor)				
26.1			400 kV Circuit Breaker Relay panel without auto reclose(with automation)	Nos	1	4223.30	4223.30
26.2			400kV Transformer Protection panel(for HV & MV side) - (with automation)	Nos	1	8446.60	8446.60
26.3			220kV Circuit Breaker Relay panel without auto reclose (with automation)	Nos	1	4223.30	4223.30
26.4			Common Equipments-Special Relay test Kit (Only unloading, Storage in ETC contractor scope)	Nos	1	1607.14	1607.14
26.5			Armoured Fibre Optics cable for SAS, Busbar protection and OLTE (to be laid in HDPE pipe in trench)	m	250	13.51	3378.64
27			Repair/Modification work in Control room for fixing of 400/220 kV panels in present scope including covering of gap and floor finishing.	Lot	1	25722.02	25722.02
28			Making Cut out in the floor of existing control room, work includes cutting RCC & finishing	sq. m	10	2182.95	21829.50
29			Supplying Rubber mats (Class-A suitable for 1.1 kV as per IS: 15652) and laying in front of Panels	sq. m	10	1299.38	12993.75
30			Panel Supporting Angles / Channel etc on cable trench in Control Room & Bay Control Room, Vertical support for cables etc (Including Supply).	MT	0.5	65644.43	32822.21
31			Installation of Cable Sealing System (as per specification enclosed at Annexure-C). The work includes supply of the material.	sq.m	10	3222.45	32224.50

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S.No.	Voltage Class (kV)	Type	Description	Unit	Qty.	Unit Rate (Rs.)	Total (Rs.)
32			Unloading, storage & handing over of Essential/ Mandatory spares/Maintenance equipments to Customer as per Annexure-A .	Lot	1	81000.00	81000.00
33			Supply & fixing of Equipment fixing hardware. Brief specification is as follows - 1. Bolts - Class 5.6 of IS:1367 (part 3) - 1991 (M12-M33, 30-145mm lg. & fully threaded). 2. Nuts - Class 5 of IS:1367 (part 6) - 1980. 3. Plain Washers - A type conforming to IS: 2016-1967.	kg	75	121.62	9121.61
34			Supply & Mounting of Phase Color Discs, Danger Plate and Identification Plates for bays & Equipments as per IS:2551; 1982 & IS:5; 1978.	Lot	1	70000.00	70000.00
35			Watch and ward of stored / erected material at project site and storage area or any other locations as per instruction of site in charge (round the clock security by authorised service agency consisting of armed guard)	Months	12	33786.40	405436.80
36			Dismantling & re-erection of terminal connector wherever equipment installation is not in scope of contractor. Connectors shall be provided by PGCIL/BHEL. Any other ETC work related to equipment is not in the scope of this BOQ. (Eqpmt details: 400kV Isolators (3-ph) - 1 nos)	Nos. of Eqpmts	1	823.10	823.10
37	AIR CONDITIONING SYSTEM (Only Unloading, Storage and shifting is in scope of ETC Contractor)					-	
37.1	-	Air Conditioning System	Unloading, storage and carrying of AC units from storage area to Switchyard Panel Room (Weight of each AC unit shall be approx. 220Kg)	No	2	168.93	337.86
38	FIRE FIGHTING SYSTEM (Only Unloading, Storage is in scope of ETC Contractor)					-	
38.1	-	Fire Fighting System	Hydrant System, HVW Spray System, Fire Detection and Alarm System, Fire Extinguishers (Refer Annexure-D for details)	Lot	1	17760.00	17760.00
Total Amount (Rs.)							45,61,952.22
Following also forms the scope of ETC work in addition to above, but not limited to this.							
1	This is a percentage rate tender. 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 (Annexure-I) attached with this BOQ.						
2	Loading / Unloading, verification, handling, shifting to & from stores, proper storage, assembly, installation, pre-commissioning test and commissioning tests (As per Powergrid/BHEL FQP) are included in the scope. Necessary skilled electrician & labour to be provided by ETC contractor to OEM during testing & commissioning.						
3	All the drawings and documents as per Annexure-1 shall be followed for ETC work.						
4	Annexure- 2 (Powergrid Technical Specification, Section - Switchyard Erection (R9)) shall be followed for ETC work. All pre/commissioning activities and works work for substation equipment shall be carried out in accordance with Employer's "Pre- Commissioning procedures for Switchyard Equipments (Doc. No. D-2-01-03-01-03)" by the contractor. Test results in the prescribed formats shall be duly filled by the contractor and shall be submitted to Powergrid/BHEL in soft form (CD or Pen Drive)						
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, metallics, post insulator, connectors (expansion/rigid tubular for AI.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	Completere ETC package is under the scope of bidder. All TNP including oil filtering machine, cranes etc. required to complete the job shall be provided by bidder only.						
14	Supervision of erection, Testing & commissioning of one no. Isolator of each type shall be done by supplier. Necessary manpower support, tools, tackles etc shall be in the scope of ETC contractor.						
15	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 sucessful 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.)						
15.1	DCRM (OPERATIONAL ANALYZER)						
15.2	Contact Resistance Measurement kit (CRM)						
15.3	Capacitance and Tan delta measurement Kit						
15.4	Dew Point Measurement kit						
15.5	5kV/1kV Megger						
15.6	Primary current Injection Kit						
15.7	Secondary current/Voltgae Injection kit						
15.8	1Ph Variac						
15.9	Multimeters						
15.10	Clamp on meter						
15.11	Relay test kit						
16	The scope of supply items as mentioned in the above BOQ are tentative. Items shall be supplied by Contractor as per exact site requirements only.						
17	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.						

(ANNEXURE-II)

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

PRICE SCHEDULE FORMAT

SUB: RECEIPT OF EQUIPMENT/ MATERIAL AT SITE, UNLOADING, INSPECTION, VERIFICATION, STORAGE, UP-KEEPING DURING STORAGE, ERECTION, TESTING, COMMISSIONING AND HANDING OVER OF 400/220kV SUBSTATION EXTENSION AT TUMKUR (VASANTANARSAPUR) IN KARNATAKA

- (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 400/220kV SUBSTATION EXTENSION AT TUMKUR (VASANTANARASAPUR) IN KARNATAKA

SI No.	Description	Amount (Rs.)
1	Total Amount for ETC work of 400/220kV sub-station extension at Tumkur (Vasantanarsapur) in Karnataka (Annexure-I)	45,61,952.22
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.	