

VOLUME - II



**EPC PACKAGE WITH LAND FOR DEVELOPMENT OF UP
TO 500 MW (AC) SOLAR PV PROJECT ANYWHERE IN
THE STATE OF GUJARAT**

PART – 3
SHEET 1 of 36

SCOPE OF WORK & TECHNICAL SPECIFICATIONS

VOLUME – II

PART – 3

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SCHEDULE – IV LIST OF APPROVED MANUFACTURERS
1.0 Approved Vendor List

SL. No.	EQUIPMENT	VENDOR
1.	Inverters	1. ABB (Central and String) 2. Sungrow 3. Ingeteam 4. SMA 5. TMEIC/ TOSHIBA 6. Schneider 7. Huawei (String) 8. Sineng
2.	Solar PV Module	1. As per MNRE Guidelines applicable to Group captive Power plant
3.	String Combiner Box	1. Trinity Touch 2. Solaris 3. ABB 4. Hensel
4.	PV Connector	1. Multi Contact 2. Amphenol 3. Bizzlink 4. Phoenix contact
5.	Solar Cable	1. Lapp 2. Leoni 3. Helukabel 4. Siechem 5. Apar 6. KEI 7. KEC
6.	33kV HV Cables	1. KEI 2. Polycab 3. Torrent 4. KEC RPG cables 5. Universal


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SL. No.	EQUIPMENT	VENDOR
		6. Apar 7. Gemscab 8. Sterlite 9. CCI
7.	LV Cables	1. KEI 2. Polycab 3. Torrent 4. KEC RPG cables 5. Universal 6. Apar 7. Gemscab 8. Sterlite 9. CCI 10. LAPP 11. NICCO
8.	Inverter Duty Transformer	1. Raychem 2. Shilchar 3. Toshiba 4. Danish 5. Schneider 6. VoltAmp 7. T&R 8. CGL 9. ABB 10. Sudhir Power
9.	Power Transformer	1. Hitachi 2. GE 3. Siemens 4. Bharat Heavy Electricals Ltd. 5. Transformers & Electricals Kerala Ltd., Kerala. 6. Toshiba Transmission & Distribution Systems (India)
10.	Buchholz Relay	1. Instruments & Control 2. Yogya 3. Vital Instruments Pvt. Ltd. 4. EMB Control AB Sweden 5. Sukrut 6. A.J Services, Cedaspe Italy


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SL. No.	EQUIPMENT	VENDOR
11.	WTI, OTI	1. Precimeasure 2. Perfect Control 3. Qualitor AKM-Sweden 4. MESSKO Germany
12.	NIFPS	1. CTR 2. Vimal fire 3. M/s Tectonicus Service, (Nashik) 4. Indo tech
13.	MCCB/ MCB/ ELCB/ RCBO/RCCB	1. Siemens 2. ABB 3. Schneider 4. Merlin Gerin 5. GE AREVA 6. EATON 7. Allen Bradley
14.	Receptacles	1. MDS Legrand 2. Schneider 3. BCH Power
15.	HT switchgear & panel (33kV)	1. ABB 2. Sterling 3. Siemens 4. Schneider 5. GE 6. L&T 7. BHEL (Bhopal) 8. Trisquare 9. Technocraft
16.	Annunciator	1. Allen 2. Proton 3. Bharani Electronic 4. Shayadri Electro Control 5. Minilec 6. JVS Electronics
17.	L T Switchgear Panel, Control Panel, ACDB, DCDB, Annunciation Panel	1. L&T 2. ABB 3. Siemens 4. Legrand


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SL. No.	EQUIPMENT	VENDOR
		5. GE 6. Schneider 7. Trisquare 8. Technocraft 9. Sterling 10. Ohm energy management system private limited (Chennai)
18.	CT / PT (LT panel)	1. AE 2. C&S 3. Kappa 4. ABB 5. Pragati 6. GE 7. BHEL 8. Siemens 9. Narayana Powertech 10. Gilbert maxwell Intrans 11. Precise 12. Diana Electrical
19.	33kV CTs, PTs, CBCT, Neutral CT	1. Jyoti Switchgear Limited 2. AE 3. Pragati electricals 4. ECS 5. Insutech industry limited 6. Precise electricals
20.	Transformer Bushings (IDT)	1. Yash high voltage 2. CGL 3. As per Transformer OEM Approved
21.	Test terminal Blocks for meters and relays (TTB and RTB)	1. Dev 2. DIP 3. Deep electrical 4. Nelster Welcon 5. JVS electronics 6. Alstom
22.	Transformer Oil	1. Apar 2. Savita 3. Raj petro 4. Shell eastern petroleum limited


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SL. No.	EQUIPMENT	VENDOR
23.	Auxiliary Transformers	1. KAPPA 2. Voltech 3. TESLA 4. DANISH 5. CGL 6. Voltamp 7. Bharat BIJLEE 8. ABB 9. Inverter OEM Approved make
24.	UPS	1. Emerson 2. ABB 3. Hitachi Hirel Fuji Electric ConsulNeowatt private limited 4. EATON
25.	Battery Lead-Acid	1. Exide
26.	Battery Charger	1. Amarraraja 2. Caldyne 3. HBL 4. Statcon 5. Dubas 6. Chhabi 7. Emerson 8. Chloride 9. Hitahchi 10. HI-REL 11. Mass-Tech Control 12. Hoppecke Batterien 13. GMBH & CO KG 14. Saft india
27.	ESE Type Lightning Arrestor	1. Jeff Techno Solution 2. Storm master 3. OBLUM 4. LAMCO 5. GE 6. CGL 7. ELPRO 8. Sabo System 9. Indelec Prevectoron 10. Nimbus


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SL. No.	EQUIPMENT	VENDOR
		11. Dmsgi
28.	GI Earth Wire	1. Usha Martin Ranchi 2. UIC Udyog Ltd Kolkata 3. Rumika Engineering company Vadodara 4. Ratlam Wires - Ratlam 5. Geekay Wire Ltd 6. Nirmal Wires Pvt. Ltd 7. Ramsarup Industrial.Corporation 8. Geekay wire Ltd Howrah, WB 9. Bedmutha Industries Ltd.(Nashik)
29.	Earthing Rod & Back filling compound	1. Ashlok 2. ERICO 3. JEF Techno
30.	SCADA	1. ABB 2. Rockwell 3. Siemens 4. Schneider 5. Honeywell 6. Emerson automation solution intelligent platforms 7. Phoenix Contact Electronics GmbH (Germany)
31.	PPC Controller with IOs	1. ABB, 2. Siemens, 3. Schneider
32.	Substation Automation System	1. HITACHI(Formerly ABB) 2. SIEMENS 3. GE
33.	Bay Control Unit (BCU)	1. Siemens 2. ABB/Hitachi 3. GE
34.	GPS Master Clock	1. Meinberg 2. SERTEL 3. SANDS 4. Qualitrol Hathaway


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SL. No.	EQUIPMENT	VENDOR
		5. Siemens 6. Masibus
35.	VoIP Phone	1. Alcatel-Lucent 2. MATRIX COMSEC 3. Cisco
36.	Firewall	1. Fortinet 2. Check Point 3. Palo Alto 4. SOPHOS
37.	Power Quality Meter	1. GE 2. ABB 3. Schneider 4. Siemens 5. Secure 6. A-eberle
38.	IEC-61850 protocol Ethernet Switches with FO port	1. SIEMENS (Ruggedcom) 2. CISCO 3. Hirschman 4. GarrettCom
39.	Network Switches-Redundant	1. Hrishmann 2. SIEMENS 3. Cisco 4. Brocade 5. GarrettCom
40.	Gateway	1. SIEMENS 2. MOXA 3. FORTINET 4. Checkpoint 5. SOPHOS 6. CISCO 7. PALO ALTO
41.	FOTE	1 ABB/Hitachi 2 GE 3 Tejas
42.	OPGW	1 Sterlite Technologies Ltd.


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SL. No.	EQUIPMENT	VENDOR
		2 ZTT India Pvt. Ltd., Andhra Pradesh 3 Apar Industries 4 LS Cable (India / Korea) 5 TG Advait India Pvt Ltd
43.	Approach Cable	1 Finolex 2 Aksh 3 HFCL 4 Sterlite 5 KEC 6 APAR 7 M/S Birla Cables 8 R&M (Switzerland) 9 Molex (UK) 10 Corning (USA)
44.	Hardware fittings for OPGW	1 Supreme & Co. 2 IAC Electricals 3 TAG Corporation
45.	Joint Box (SS 304)	1 GETCO/PGCIL approved
46.	Computers and Printers	1. DELL 2. HP 3. Canon 4. Ricoh HP 5. Brother
47.	Fibre Optic Cable	1. Helukabel 2. Lapp 3. KEC 4. RPG 5. Finolex 6. KEI 7. HFCL 8. Sterlite 9. Aksh,Apar 10. M/S Birla Cables 11. R & M 12. Molex,,Corning
48.	LAN cables with RJ45 connectors	1. Tyco 2. Digisol


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SL. No.	EQUIPMENT	VENDOR
		3. DLINK 4. Sterlite
49.	CCTV System	1. Honeywell 2. Hikvision 3. Bosch 4. Sony 5. Milestone
50.	HVAC System	1. BlueStar 2. Voltas 3. Carrier 4. Daikan
51.	Lighting Fixtures	1. Philips 2. CGL 3. Bajaj 4. Wipro 5. HPL 6. Havells
52.	DC Fuses	1. Cooper Bussmann 2. Mersen 3. GE
53.	Surge Protection Devices (for Solar system)	1. ABB 2. Citel 3. DEHNguard 4. Ferraz 5. Shawmut
54.	33kV termination Kit & Straight through joints	1. Raychem
55.	Protection Relays	1. ABB 2. Schneider 3. GE Alstom 4. Siemens
56.	Tariff Meters (ABT Meter)	1. Secure
57.	Electronic Digital Meters (A/V/pf/Hz./KWh)	1. ABB 2. Conzerv


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SL. No.	EQUIPMENT	VENDOR
		3. L&T 4. Automatic Electric 5. Rishabh 6. Secure 7. Schneider
58.	Control Cables	1. Polycab, 2. Apar, 3. Ravin, 4. Universal, 5. KEC RPG, 6. KEI, 7. Gloster, 8. Finolex, 9. SIECHEM,dynamic, 10. LAPP 11. RR cables
59.	Cable Glands, PVC shroud and Lugs	1. Comet 2. Jainson 3. Dowell 4. 3D
60.	LED Indicating Lamps	1. Altos 2. GE Power Control 3. L & T 4. ABB Schneider 5. Siemens 6. Teknik RASS Controls
61.	Cable trays	1. Indiana Grating 2. Rukmani Electrical 3. Vatco 4. Universal Engg 5. MDM Engineering & technologies 6. GM Engineers Vadodara 7. Bilmat EngineeringVadodara 8. Param Metal Pvt. Ltd. 9. R R Ispat 10. Akshar Energy Structures Pvt.Ltd
62.	Fire & Alarm System	1. Honeywell 2. Siemens 3. UK,Edward


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SL. No.	EQUIPMENT	VENDOR
		4. Autronica 5. schrack
63.	Fire Extinguisher	1. Cease Fire 2. Kanex 3. MinMax 4. Safex 5. Kanadia Fyr Fyter 6. Zenith 7. United Fire Equipment 8. Intime Fire Appliances
64.	Pyranometer	1. Kipp & Zonnen (SMP11)
65.	Wind Sensor	1. Theisclima 2. Met One Inc 3. NRG System 4. Thies Clima
66.	Wind Direction (WMS)	1. NRG System 2. Thies Clima
67.	Rainfall Sensor	1. NRG System 2. Thies Clima
68.	Ambient temperature sensor	1. Campbell Scientific
69.	Module temperature sensor	1. Campbell Scientific
70.	Soiling Station	1. Campbell Scientific
71.	WMS Data logger	1. Campbell Scientific 2. NRG System
72.	Cement	1. Ultratech 2. Dalmia 3. Ramco 4. ACC 5. Ambuja 6. Biral Gold 7. sanghi 8. JK Lakshmi


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SL. No.	EQUIPMENT	VENDOR
		9. siddhi 10. hathi 11. Hi-Bond 12. JSW cement 13. Nuvoco
73.	Admixtures / Water proofing compounds / Hardener	1. Dr. Fixit 2. Sika 3. BASF 4. Fosroc
74.	Reinforcement Steel	1. TATA 2. Jindal 3. SAIL 4. RINL
75.	Structural Steel	1. JSW 2. TATA 3. Essar 4. Jindal 5. SAIL 6. RINL
76.	Aluminum Door / Window Partition	1. Hindalco 2. Banco 3. Jindal
77.	All civil materials used for construction of Solar PV plant except Cement, Reinforcement steel, Structural steel.	Bidder to submit complete details along with specification for OWNER Approval. The material/detail submitted shall be of first quality.
78.	Handrail stainless steel	1. Tata 2. Jindal 3. SAIL
79.	Vitrified tiles/ Ceramic tiles-premium class	1. Nitco 2. Kajaria 3. Asian 4. RAK


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SL. No.	EQUIPMENT	VENDOR
		5. Somany 6. Johnson
80.	Acid resistant tiles	1. Johnson 2. kajaria 3. Somany
81.	Glass	1. Saint-Gibain 2. Modi Glass 3. ASHAI
82.	Door / Window fixtures (like lock, handle, closer etc.)	1. Godrej 2. Doma 3. Kich 4. Yale
83.	Panic Bar / Push bar (with safety sign display sticker)	1. Droma / As approve during Detail Engineering stage.
84.	Acrylic and emulsion paint, weather proofing paint	1. Asian 2. Indigo 3. burger
85.	Putty	1. Birla 2. Asian 3. burger
86.	Acid /epoxy resistant paint	1. Fosroc 2. Jotun
87.	Fireproof Sealant	1. Sika 2. Fosroc 3. Hilti
88.	Non Shrink grout	1. Sika 2. Fosroc 3. BASF 4. Pidilite
89.	PVC Water stop/water bar	1. Sika 2. Fosroc


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SL. No.	EQUIPMENT	VENDOR
90.	CI / FRP / RCC Manhole cover	As approve during Details Engineering stage
91.	False ceiling (Gypsum or Fiberglass board)	1. Armstrong 2. saint Gobain
92.	RCC pipe	As approve during Details Engineering stage (as per B.I.S standard)
93.	33KV Surge Arrester	1. Oblum 2. Elpro 3. Raychem 4. Lamco
94.	PRV / PRD	1. Atvus Industries, kolkata 2. Yogya 3. Vital Instruments Pvt. Ltd. 4. Sukrut
95.	Transmission Line Tower / Conductor / Insulator	1. GETCO Approved

Note:

- i) The final make selected out of the recommended makes listed above shall be subject to the Owner's approval during detailed Engineering.
- ii) Wherever the make is not specified for any items, the Bidder shall submit credential for vendors for relevant items / equipment, out of which Owner shall decide acceptance of vendor based on review of credentials. This shall have no price implication. Owner reserves the right to reject the proposed vendor without assigning any reason.
- iii) Bidder may suggest /request for approval of Additional vendor with credentials. Owner after review and verification, may consider the request of proposed additional vendor without any commitment and subject to overall vendor review with respect to tender specification requirements, vendor capability etc. Further owner reserves the right to reject the proposed vendor without assigning any reason.
- iv) It is to be noted that no time extension for completion of project will be granted on account of request for vendor(s) approval.


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SCHEDULE – V LIST OF SPARES FOR 5 YEAR O&M
1.0 Recommended Maintenance Tools and Tackles

- 1.1. Bidders shall furnish a list of recommended Maintenance Tools and Tackles which the Bidder considers necessary for the complete plant including those necessary during the O&M period. The Bidder shall maintain the tools and tackles as well as fault locating equipment during the complete O&M period. At the end of contracted O&M period, Bidder shall hand over all the tools and Tackles to GIPCL
- 1.2. The Bidder shall provide technically suitable tools and tackles for installation and erection of plant conforming to relevant BIS safety and technical standards for proper execution of work. Owner, in no way, shall be responsible for supply of any tools and tackles for implementation of the work and to carry out operation and maintenance activities.
- 1.3. One set of all special tools shall be furnished with each piece of equipment for dismantling, maintenance, adjustment, and calibration of the equipment. The tools shall be shipped in separate heavily constructed wooden boxes provided with hinged covers and padlock.

2.0 List of Mandatory Spares

- 2.1 The Bidder shall maintain an on-site inventory of the mandatory spares as listed below for smooth operation of the solar PV power plant. Mandatory spares are spares which are considered mandatory for trouble free operation of the plant and shall be maintained by the successful Bidder during the complete O&M period of five (5) years.
- 2.2 **The quantity mentioned in column Total Quantity shall be considered as the sum of each type and each make, same shall be supplied in proportion to the total supplied quantity for each Solar Project.**

SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
A.	SOLAR PV YARD			
1.	PV Connectors pair (Each Type)	%	1	For PV Module inter Connections and String Wiring
2.	Solar PV Module each type	%	0.5	
3.	Y- connectors pair	%	1	-
4.	String Combiner box (Each type)	Nos		
	String Combiner Box (Complete Assembly)	%	1	


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
	a) Fuses -Outgoing (Each Type & rating)	%	2	-
	b) Fuses - String (Each Type & rating)	%.	1	
	c) Isolator	%	2	-
	d) Surge Arrestor / SPD (DC)	%	2	-
5.	MMS – complete set (In Loose condition)	Set	1	-
	MMS-Fastener, Each Type	Sets	50	
	Fastener for Mounting Solar Panel	Sets	1000	
6.	Inverter (String Inverter, If applicable)	Lot	For 2 MW	
7.	Inverter (For Central Inverter, If applicable)			
	a) Inverter (One Complete Set) for Each Type / Each Rating / Each Make (Ready to replace condition / Interchangeable)	Nos.	1 for 75 MW and above Solar Project	
	b) IGBT Power Stack	Nos.	Upto 4 MW: 6 25 MW to 75 MW: 12 Above 75 MW: 18	-
	c) Negative Grounding Fuses	Nos.	Upto 4 MW: 2 25 MW to 75 MW: 12 Above 75 MW: 20	-
	d) Air Filter Set	set	Upto 4 MW: 1 25 MW to 75 MW: 3 Above 75 MW: 8	-
	e) DC contactor	Set	Upto 4 MW: 1 25 MW to 75 MW: 3 Above 75 MW: 8	


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
	f) AC Contactor	Nos	Upto 4 MW: 1 25 MW to 75 MW: 3 Above 75 MW: 8	
	g) Air Circuit breaker	Nos	Upto 4 MW: 1 25 MW to 75 MW: 2 Above 75 MW: 5	
	h) Parts of Air Circuit breaker			
	1. Closing Coil	Nos	6	
	2. Tripping coil	Nos	6	
	3. Spring charging motors	Nos	6	
	4. Aux. Contact Block	Nos	6	
	5. Set of Main Contacts	Sets	3	
	6. Set of Fix Contacts	Sets	3	
	7. Electronic protection unit of Breaker	Nos	3	
	i) DC Surge Protector	Nos	5	
	j) AC Surge Protector	Nos	5	
	k) Cooling fan	Nos	5	
	l) Inverter Fuses,	Nos	48	
	m) Electronics Modules/ Card/ Display	Nos	10	
	n) Current Transformer (or Sensor) /Voltage Transformer (or Sensor)	No	10	
	o) Connectors/FRC cable	Set	10	
	p) Aux AC/ DC Relays	Set	10	
	q) Aux Transformer for Fan	No	5	
8.	DC Solar Cables and Jointing Kits			
	a) string cable	%	1	


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
	b) DC Power Cables- SCB to Inverter	%	1	
	c) DC Power Cable Straight through Joint Kits, Each Size	Nos	10	
	d) DC Power Cable Lugs / termination kits for End termination.	Nos	15	
9.	ESE LA Surge Counter	Nos.	5	-
B.	ELECTRICAL SYSTEM SPARES			
1.	Inverter Transformers			
	a) Complete winding Temperature Indicating equipment (WTI)	Nos.	2	-
	b) Oil temperature indicator	Nos.	2	-
	c) CT of each type	Nos.	2	-
	d) Transformer oil	%	10	-
	e) Silica Gel Breather	Nos.	2	-
	f) Pressure relief device	Nos.	2	-
	g) Set of valves	Nos.	2	-
	h) Buchholz relay	Nos.	2	-
	i) HV bushing each type	Nos.	1	-
	j) LV bushing each type	Nos.	1	-
	k) Oil level gauge	Nos.	1	-
	l) Magnetic oil Gauge	Nos.	2	-
	m) Gasket set	Nos.	1	
	n) Air cell	Nos.	1	
	o) Prismatic Oil Level Gauge (POG) assembly	Sets	2	
	p) remote indication of each type and rating for WTI & OTI	Sets	2	
	q) WTI CT of each type and rating	set	1	
	r) Gas Collection Device assembly	Sets	2	
	s) Tap changer contacts	Nos	2	
2.	Dry type Auxiliary Transformers	Nos	1	
3.	33kV Switchgear			


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
	a) 33KV IDT breaker (Sub pooling Station)	Nos.	1	-
	b) 33KV Transmission line breaker	Nos	1	-
	c) ICOG Breaker (to be supplied only if diff than item no 33KV IDT breaker)	Nos	1	-
	d) Breaker complete set with operating mechanism and truck mounted	Nos.	1	-
	e) Closing Coil	Nos	6	-
	f) Tripping Coil	Nos	6	-
	g) Spring Charging Motors	Nos	6	-
	h) Aux. Contact Block	Nos	6	-
	i) Set of Main Contacts	Sets	3	-
	j) Set of Fix Contacts	Sets	3	-
	k) Bus bar support insulators	Nos.	12	-
	l) Aux. switch assembly, limit position switches, Local/Remote selector switch, breaker control switches ammeter selector switch, voltmeter selector switch	Nos.	2 of Each type	-
	m) Numerical Relays of each type used	Nos.	10%	-
	n) Clustered type LED	Nos.	10 of each colour	-
	o) CTs of each ratio & type	Set	2 of each rating	-
	p) VTs of each ratio & type	Set	2 of each rating	-
	q) MFM Meters of each type & rating	Nos.	2 of each rating	-
	r) Fuses /MCBs of each rating	Nos.	10% or min. 1 No.	-
	s) Surge Arrestor	Nos.	3 of each rating	-


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
	t) VT Fuse	Nos.	3 of each rating	
	u) Limit Switch for spring charging indication	Nos	5	
	v) Aux Contactors	Nos	10	
	w) Aux Switch Block	Nos	4	
	x) 33KV 3Cx500sqmm AL XLPE Armored Cable of Transmission line	%	1 or largest length used which ever is higher	
	y) 33KV cable from IDT to 33KV sub pooling switchgear	%	1 or largest length used which ever is higher	
	z) Termination Kit for 33KV 3Cx500sqmm AL XLPE Armored Cable of Transmission line	Nos.	Upto 4 MW: 1 25 MW to 75 MW: 3 Above 75 MW: 8	
	aa) Termination Kit for 33KV cable from IDT to 33KV sub pooling switchgear	Nos.	Upto 4 MW: 2 25 MW to 75 MW: 6 Above 75 MW: 16	
	bb) Jointing Kit for 33KV 3Cx500sqmm AL XLPE Armored Cable of Transmission line	Nos.	Upto 4 MW: 1 25 MW to 75 MW: 3 Above 75 MW: 8	
	cc) Jointing Kit for 33KV cable from IDT to 33KV sub pooling switchgear	Nos.	Upto 4 MW: 2 25 MW to 75 MW: 6	


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
			Above 75 MW: 16	
	dd) Annunciator	Nos	04	
	ee) Earthing Switch	Nos	03	
	ff) TTB (For meters)	Nos	02	
	gg) RTB (For relays)	Nos	02	
	hh) Trolley for Transmission line breaker	Nos	Upto 4 MW: 1 25 MW to 75 MW: 1 Above 75 MW: 2	
	ii) Trolley for sub pooling breaker	Nos	Upto 4 MW: 1 25 MW to 75 MW: 1 Above 75 MW: 2	
	jj) Hooter	Nos	02	
	kk) Space Heater, Thermostat, Door switch, Panel Handles, Hinges of each type	Nos	02	
	ll) Trip Circuit Supervision Relay for Breaker	No	Upto 4 MW: 1 25 MW to 75 MW: 2 Above 75 MW: 4	
	mm) Trip Circuit Supervision Relay for Master Trip Relay	No	Upto 4 MW: 1 25 MW to 75 MW: 2 Above 75 MW: 4	


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
	nn) DC Failure, AC Failure, Fuse Failure relay of each type.(If applicable)	Set	3	
	oo) Communication Probes / wires / connectors of each type for numerical relay	Set	2	
	pp) Gear box assembly for Spring Charging motor	Set	5% (Minimum 2 Nos)	
	qq) Panel hardware accessories like Gasket, Knobs, Door Locks, Handle, Hinges, filter, Power Terminal Block shroud, breaker shroud/shutters, etc. of each type	Set	4	
4.	LT System			
	a) MCCB (Complete set with handle, barrier, shroud etc.)	Nos	Upto 4 MW: 2 25 MW to 75 MW: 4 Above 75 MW: 6	-
	b) MCB	Nos	Upto 4 MW: 8 25 MW to 75 MW: 16 Above 75 MW: 20	-
	c) Contactor	Nos	06	-
	d) Timer	Nos	06	-
	e) MFM	Nos	02	-
	f) Indicating Lamp & Push Buttons	Nos	20	-
5.	Lighting System			
	a) Lighting fixtures	Nos.	5%	-
	b) Fuses/MCBs, contactors, auxiliary relays. Switches push buttons	Nos.	10% of each type	-


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
			and rating min. One	
	c) Occupancy Sensor	Lot	10%	
	d) Modular Switch board plates, switches sockets, boxes, fan regulator (if applicable), RJ45, Blanks etc. of each type, colour, rating.	Lot	10%	
	e) Lighting Distribution board components like MCBs, ELCBs, contactors, Power Switches, Control Switches, Fuse, Terminal Block, timers etc. of each type and rating.	Lot	10%	
6.	Battery System			
	a) SMPS for Inverter Station Chargers	Nos	02	-
	b) SMPS for sub pooling station chargers	Nos	02	-
	c) MCCB	Nos.	2 nos. of each type and rating	-
	d) Fuses /MCB	Set	5	-
	e) Indicating Metering Instrument	Set	2	-
	f) Dry Battery Cell	Set	20	-
	g) Inter Cell connector, Complete set for 1 battery bank with nut, bolt and washer	Set	1	-
	h) Inter Row connector, Complete set for 1 battery bank with nut, bolt and washer	Set	1	-
	i) SAN Container of Battery Bank with top cover (Empty)	Set	1	-
	j) Vent Plugs	Nos	20	-
	k) Electrolyte for 1 battery Bank	Nos	1	
C.	INSTRUMENTATION AND CONTROL SYSTEMS SPARES			
1.	SCADA & PPC			
	a) Power Supply modules / Cards	Nos.	2	-


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
	b) I/O Cards (Each Type)	Nos.	5%	-
	c) Network Cards /Ethernet Switches	Nos.	5%	-
	d) Communication system spares of each type	Nos.	5%	-
	e) Data Bus Cable	Nos.	3%	-
	f) Main Data Bus and Data Bus Controller	Nos.	3%	-
	g) Fiber Optic Cable Converter/De-converter Unit (applicable if remote I/O module is supplied)	Nos.	3%	-
	h) Connecting cable (any FRC, OFC Patch Cord) and plugs	Nos.	3%	-
	i) Firewall	Nos	1	-
	j) Each Type of Electronics card for PPC system	No	1	-
	k) All other electronic modules	Nos.	3%	-
	l) All type of converter (RS-232 to RS-485, RS-232 to Ethernet, RS-485 to Ethernet, RS-485 to Optical) each type	Nos	3%	-
	m) Communication SPD for RS-485, Each Type	Nos	3%	-
	n) Ethernet CAT6 (outdoor duty)	Rm	100	-
	o) RS 485 Cable Armored	Rm	100	-
	p) Lugs & glands -Various Sizes	Lum Sum	1 Lot	-
2.	CCTV			
	a) Camera with power supply, Ethernet Switch	Nos.	1 of each kind as complete unit	-
	b) Power supply adaptor for CCTV and Media Convertor	Nos.	Upto 4 MW: 2 25 MW to 75 MW: 3	For each Type of Power Supply requirement


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
			Above 75 MW: 5	
	c) Cable for Power Supply of CCTV	%	1 or largest length used which ever is higher	
3.	WEATHER MONITORING STATION			
	a) Pyranometer	Nos.	01	-
	b) SMPS of data logger	Nos	1	
	c) Each Type of Electronics Card	Nos	1	
4.	Fiber Optic System/FIBRE OPTIC CABLE			
	a) Fiber Optic cable	Mtrs.	Upto 4 MW: 100 25 MW to 75 MW: 500 Above 75 MW: 1000	-
	b) FOTE (each type card)	Set	1	
	c) OPGW Cable	Drum	1	
	d) Approach Cable (Longest length cable)	Lot	1	
	e) OPGW Fittings (each type)	set	1	
5.	UPS			
	Electronics Cards/Displays, Each Type	No	1	In case of UPS of different type/rating, Spares to be managed for each type/rating.
	Capacitor, Each Type	No	1	
	Contactors/Relay, Each Type	No	1	
	Cooling Fan, Each Type	No	3	
	IGBT/ Thyristor/SCR, Each Type	Set	1	


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
	Fuse, Each Rating	Set	1	
D.	Robotic Module Cleaning System			
	Robot	Nos	Upto 4 MW: 2 25 MW to 75 MW: 5 Above 75 MW: 10	
	Electronic Cards/Controller Module, Each type	Nos	Upto 4 MW: 2 25 MW to 75 MW: 5 Above 75 MW: 10	
	Sensor, Each Type	Nos	Upto 4 MW: 2 25 MW to 75 MW: 5 Above 75 MW: 10	
	Mop/Brush	Nos	Upto 4 MW: 20 25 MW to 75 MW: 40 Above 75 MW: 80	
	Bearing/Roller/Wheels	Nos	50	
E.	Tracker			
	Tracking Motor /Hyd system assembly	Nos	Upto 4 MW: 2 25 MW to 75 MW: 5 Above 75 MW: 10	
	Electronic Cards, Each type	Nos	Upto 4 MW: 2 25 MW to 75 MW: 3	


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
			Above 75 MW: 5	
	Sensor/ limit switch Each Type	Nos	Upto 4 MW: 2 25 MW to 75 MW: 3 Above 75 MW: 5	
	Battery (Each type, rating and make)	Nos	Upto 4 MW: 2 25 MW to 75 MW: 5 Above 75 MW: 10	
	Charging Module	Nos	Upto 4 MW: 2 25 MW to 75 MW: 5 Above 75 MW: 10	
F.	Module Cleaning System			
	Each Type of Pipe	Mtr	100	
	Elbow, Tee and Coupling, Each Size	Nos	50	
	Isolation Valve, Each Size	Nos	50	
	Electric Motor & Pump	Set	02	
G.	Fire Alarm Systems			
	Electronic Modules, Each Type	%	2	
	Fire Detector, MCP, Each Type	%	10	
	Hooter	%	3	
H.	Ventilation system (HVAC)			
	Drive Motor	No	1	
	Blower with Shaft and bearings etc.	Set	1	
	Panel type air pre-filter for complete AHU system	Set	1	
	Spare for AHU Electrical panel like , Aux. relays, protective relays, Auxiliary	Set	1	


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
	Contactors, Main Contactor, Power MCB / MCCB, Power Switch/ SFU, Push Buttons, Control Switches, Indicating Lamps, Annunciator, Control MCB, Control Fuses with carrier base and links, Timers, Power and Control Terminal Blocks etc. of each type & rating			
I.	List of Special Tools and Tackles as per clause no. 1.1			
	a) Precision DC Clamp meter Make Fluke- 325 / 319	no	Upto 4 MW: 2 25 MW to 75 MW: 5 Above 75 MW: 10	
	b) Digital Multimeter- 1500 V DC make Fluke	no	Upto 4 MW: 2 25 MW to 75 MW: 4 Above 75 MW: 6	
	c) Portable Drill – upto 10 mm make Bocsh / Stanley	no	2	
	d) Air blower – 820 W portable Bosch / Stanley	no	Upto 4 MW: 2 25 MW to 75 MW: 5 Above 75 MW: 10	
	e) Vacuum Cleaner, 1100 W Industrial Eureka Forbes	no	Upto 4 MW: 2 25 MW to 75 MW: 4 Above 75 MW: 6	
	f) Electrical Tool Kit Stanley / Taparia	no	Upto 4 MW: 4 25 MW to 75 MW: 8	


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SL. No.	ITEM / EQUIPMENT	Unit	Total Quantity	Description
			Above 75 MW: 12	
	g) Mechanical Tool Kit Stanley / Taparia	no	Upto 4 MW: 4 25 MW to 75 MW: 8 Above 75 MW: 12	
	h) Portable hand Grinder 4" make Bosch / Stanley	no	Upto 4 MW: 2 25 MW to 75 MW: 4 Above 75 MW: 6	
	i) All Special tools recommended by Equipment manufacturers	Lot	1	

NOTE:

1. Spares requirement for any equipment/system not specified above, the Bidder shall supply the spares for the supplied system / sub-System / instruments as per the manufacturer's recommendation.
2. The Bidder shall provide absolute numbers of spares based on percentage of installed items as agreed above after final design approval.
3. (1)The suggested spares are the minimum requirement of GIPCL. The Bidder shall ensure sufficient spares beyond the suggested spares list to maintain its contractual obligations.
(2) Bidder shall furnished recommended spare list as a part of design/drawing approval stage.
(3) Wherever % indicated in Mandatory spares list, Total installed quantity of each type shall be considered for calculation of % of spare of each type.
(4) For rounding of upper side number shall be considered for quantity of item.
(5) All the mandatory spares may be kept at site with record of use by Contractor during O&M. Used items shall be replenished by Contractor time to time. All mandatory spares items shall be handed over to GIPCL after completion of O&M period.


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SCHEDULE-VI PROCEDURE FOR PERFORMANCE GUARANTEE (PG) TESTING
PART A: OPERATIONAL ACCEPTANCE TEST (OAT) PROCEDURE
Performance Ratio (PR) - Test Procedure

1. Performance Ratio as determined through the PR test procedure specified here should not be less than 75% for Operational Acceptance Test (OAT).
2. The Performance Ratio test to prove the guaranteed performance parameters of the power plant shall be conducted at site by the Contractor in presence of the Owner. The Contractor's Engineer shall make the plant ready to conduct such tests. The Operational Acceptance Test shall be commenced, within a period of one (1) month after successful Commissioning and, there will be continuous monitoring of the performance for 30 days. Any extension of time beyond the above one (1) month shall be mutually agreed upon. These tests shall be binding on both the parties to the Contract to determine compliance of the equipment with the guaranteed performance parameters. This monitoring will be performed on the site under the supervision of the Owner/ Owner's engineer.
3. The test will consist of guaranteeing the correct operation of the plant over 30 days, by the way of the efficiency rate (performance ratio) based on the reading of the energy produced and delivered to the grid and the incident solar radiation (Average of all the pyranometers shall be considered for calculation of PR). During this period of 30 days, any 5 (five) instances preferably during 11:00 to 14:00 hrs. of 15 (fifteen) minutes shall be taken to calculate the instantaneous Performance Ratio of 15 minutes block as per the formula given below in Point No. 5. If the PR of these fives instances is above 75%, then Operational Acceptance Test (OAT) shall be considered successful.
4. PR shall be demonstrated against the installed DC capacity.
5. The efficiency or performance ratio (PR) of the PV plant is calculated as follows (according to IEC 61724).

5.1 Performance Ratio (PR) = YA / YR

Where;

YA = Final (actual measured) PV system yield in kilo-watt hours (kWh) at the point of measurement during the testing period, and



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YR = Reference yield calculated as the product of the average insolation of all the pyranometers on the plane of the collector (i.e., PV modules) in kWh/m² during the testing period and the installed DC capacity of the plant in kW.

= [Insolation on the plane of the collector (i.e., PV modules) in kWh/m² during the testing period] x Installed DC capacity

= (kWh/m²) x Installed DC capacity

5.2 Monitoring System for PR Verification

The following instrumentation will be used to determine the Solar Plant Performance:

- a) ABT main meter at the delivery point (POI) i.e. MGVCL/GETCO Substation as applicable for point of measurement for energy yield (YA).
- b) Power meter for each inverter for reference only.
- c) Calibrated pyranometer to determine irradiance on the plane of array (with a target measurement uncertainty of $\pm 2\%$).
- d) Calibrated pyranometer to determine irradiance on horizontal plane (with a target measurement uncertainty of $\pm 2\%$).
- e) Thermocouples to measure module temperature with a measurement uncertainty of $\pm 1^\circ\text{C}$ (for reference only).
- f) Shielded ventilated thermocouple with a measurement accuracy of $\pm 1^\circ\text{C}$ (for reference only).
- g) An anemometer mounted on a 10 m mast to measure wind speed (without additional shadowing on modules).
- h) Data measurement shall be witnessed in the format mutually agreed before the start of PR test by GIPCL and the Contractor jointly for the said period.
- i) The Contractor shall show the specified PR for Operational Acceptance.

PART B: ANNUAL TARGETED GENERATION TEST PROCEDURE

1. Weather stations with calibrated pyranometers shall be installed by the Contractor at the location mutually agreed by the Contractor and GIPCL. The test report for the calibration shall be submitted by the Contractor for approval by GIPCL. The calibration should be traceable to a national / international laboratory. The output of this pyranometer shall be logged in the SCADA system.
2. In case the pyranometer is found to be working erratically then immediately the Contractor shall take necessary steps to rectify and / or recalibrate the instrument to the satisfaction of GIPCL. However, for the dispute period for which such error has occurred and until the



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instrument is recalibrated to the satisfaction of GIPCL, data from any one of the following lists of sources as decided by GIPCL will be used:

- i. A separate pyranometer installed by the Owner near the site, if available
- ii. Average of two closest solar power projects, as identified by GIPCL
- iii. Nearest MNRE weather station

3. “Actual Delivered Energy” from the plant supplied by the Contractor shall be noted (at ABT main meter installed at POI, i.e. MGVCL/GETO Substation as applicable) for every month and summed up for entire year. For this purpose, the net delivered energy at the metering point shall be considered.
4. The Contractor shall share with GIPCL all the irradiation, generation, etc. parameters details and all other factors necessary for GIPCL to corroborate the estimate. GIPCL has the right to cross verify data submitted by the Contractor by all possible means / sources.

Following factors may be noted for computing the PR and Targeted Generation Test:

- a) Effect due to variation in annual insolation shall only be considered for computing the PR/Targeted Generation.
- b) Effect due to variation of meteorological parameters e.g., ambient temperature, module temperature, wind speed, humidity etc. shall not be considered.
- c) **Generation loss due to grid outage (or power evacuation restriction by Grid authority which is beyond the control of Contractor or any other factors beyond the control of contractor for justified reasons accepted by GIPCL):** The measured global solar radiation of the period of the outage of the power evacuation system shall be excluded to calculate average global solar radiation for the period of PR and Annual Targeted Generation test.
- d) In case, the GHI is not available because of instrumentation or SCADA problem, the corresponding insolation and generation shall be excluded from the time block for estimation of loss of generation and test shall be extended for the same outage period.
- e) The degradation for the second and third year of generation shall be 0.7% annually.
- f) In case the actual irradiation for particular year on annual basis is higher than given in the tender the Targeted Generation (Corrected Targeted Generation) shall also increase proportionately (subject to capacity for evacuation of power at POI i.e MGVCL/GETCO Substation as applicable).


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- g) The Performance test shall be considered based on NEEGG submitted by the Bidder in offer considering the site-specific irradiation data (Source: SOLARGIS)
- h) In case the actual irradiation for particular year on annual basis is lower than given in the Bid then the Targeted Generation (Corrected Targeted Generation) shall be reduced proportionately.
- i) In case Bidder is not able to achieve the corrected targeted generation then the penalty @ Rs. 3.33 / kWh shall be applicable (Plus GST).
- j) In case bidder has generated higher generation than Targeted Generation then incentive shall be applicable (@ Rs. 0.40/kWh which is including GST).

Bidder is free to propose his design of the solar plant including solar plant layout, solar block sizing, inverter sizing, inverter-transformer sizing etc. to match the guaranteed units generation. Bidder shall also submit the PVSYST simulation report.

The example for calculation of annual Targeted Generation is as follows.

Example: NEEGG Targeted generation submitted by contractor is 21,02,40,000 kwh for 100 MW (AC) Solar Project and reference GHI submitted by contractor is 1863 kwh/m² per annum.

Illustration - 1: In case actual annual cumulative GHI is 1950 kWh/m²

Corrected Target Generation for first year = $(210240000 \times 1950) / 1863 = 22,00,57,971$ KWh/annum

Case-1: If actual Generation is higher than Corrected Generation then applicable incentive (@Rs.0.40/kWh) is payable by GIPCL to the Contractor.

As example if Actual Generation is 23,00,00,000 KWh then incentive shall be payable to the bidder for additional generation

Additional Generation = $(23,00,00,000 - 22,00,57,971) = 99,42,029$ KWh
 Incentive Payable to the Contractor by GIPCL
 = 9942029×0.40
 = Rs. 39,76,812/- (including GST)

Case-2: If actual generation is lower than Corrected Generation then applicable penalty @Rs.3.33/kWh plus GST shall be payable by Contractor to the GIPCL / GIPCL shall recover the penalty from running bill or available bank guarantees.

VOLUME - II



**EPC PACKAGE WITH LAND FOR DEVELOPMENT OF UP
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If Actual Generation is 220000000 KWh then penalty shall be payable by the bidder to GIPCL

Loss of Generation = $(220057971 - 220000000) = 57,971$ KWh
Penalty to be paid to GIPCL by the Contractor
 $= 57,971 \times 3.33$
 $= \text{Rs. } 1,93,043/-$ (Plus GST)

Illustration – 2: In case actual annual cumulative GHI is 1800 kWh/m²

Corrected Target Generation for first year = $(1800 \times 210240000) / 1863 = 20,31,30,435$
KWh/annum

Incentive and penalty shall be applicable as given in above illustration – 1.