
VOLUME-II

TECHNICAL SPECIFICATION

FOR

765kV GIS Extension Substation Package SS158 for (a) Extn. of 765/400kV Sasaram (POWERGRID) S/S associated with ERES-51: Diameter completion at Sasaram (POWERGRID) S/s and (b) Extn. of 220kV Nalagarh (POWERGRID) S/S associated with Implementation of 2 nos. 220kV line bays (GIS) at 400/220kV Nalagarh (PG) S/s for the termination of 220kV D/c line from 220/132kV Kunihar S/s to Nalagarh S/s

POWERGRID CORPORATION OF INDIA LTD.
(A Government of India Enterprises)

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1. GENERAL

1.1 Preamble:

Power Grid Corporation of India Ltd. (POWERGRID), A Govt. of India Enterprise is responsible for Bulk Power Transmission of electrical energy from various central Govt. Power Projects to various utilities/ beneficiaries and interconnecting regional grids, operating and maintaining the National Electrical Grid of India. It is established with the mission of “We will become a Global Transmission Company with Dominant Leadership in Emerging Power Markets with World Class Capabilities by:

- a) World Class: Setting superior standards in capital project management and operations for the industry and ourselves.
- b) Global: Leveraging capabilities to consistently generate maximum value for all stakeholders in India and in emerging and growing economies.
- c) Inspiring, nurturing and empowering the next generation of professionals.
- d) Achieving continuous improvements through innovation and state-of-the-art technology.
- e) Committing to highest standards in health, safety, security and environment.”

1.2 POWERGRID is implementing the following transmission systems through RTM route.

- a) ERES-51: Diameter completion at Sasaram (POWERGRID) S/s
- b) Implementation of 2 nos. 220kV line bays (GIS) at 400/220kV Nalagarh (PG) S/s for the termination of 220kV D/c line from 220/132kV Kunihar S/s to Nalagarh S/s

1.3 The following elements are envisaged under the aforesaid schemes mentioned at clause no. 1.2 above:

- a) Extn. of 765/400kV Sasaram (POWERGRID) S/S
- b) Extn. of 220kV Nalagarh (POWERGRID) S/S

1.4 It is the intent of this specification to describe primary features, materials, and design & performance requirements and to establish minimum standards for the work. The specification is not intended to specify the complete details of various practices of manufactures/ bidders, but to specify the requirements with regard to performance, durability and satisfactory operation under the specified site conditions.

1.5 The work to be done under this specification shall include all labour, plant, equipment, material and performance of all work necessary for the complete installation and commissioning of switchyard. All apparatus, appliances, material and labour etc. not specifically mentioned or included, but are necessary to complete the entire work or any portion of the work in compliance with the requirements implied in this specification is deemed to be included in the scope of contractor.

1.6 Before proceeding with the construction work, the Contractor shall fully familiarize himself with the site conditions and General arrangements & scheme etc. Though the Employer shall endeavor to provide the information, it shall not be binding for the Employer to provide the same. The bidders are advised to visit the substation sites and acquaint themselves with the topography, infrastructure and also the design philosophy. The contractor shall be fully responsible for providing all equipment, materials, system and services specified or otherwise which are required to complete the construction and successful commissioning, operation & maintenance of the substation in all respects. All materials

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required for the Civil and construction/installation work including cement and steel shall be supplied by the Contractor.

Complete design (unless specified otherwise in specification elsewhere) and detailed engineering shall be done by the Contractor.

2. SCOPE OF WORK

The broad scope of this specification covers the following:

S. No.	Scope				
1.	Extn. of 765/400kV Sasaram S/S <u>765kV</u> • Switching Scheme: One and a Half breaker Scheme • Fault Level: 50 kA for 1 sec (for equipment under present scope) • Bus Reactor Bay: 01 No. • ICT Bay: 01 No. (01 no. of 765kV GIS ICT Feeder Bay shall be constructed for completion of 01 no. of diameter, which shall be utilized in future for termination of 765kV ICT) • All associate Tie bays: 01 Nos. • Creation of a new separate 765kV GIS Building at 765kV Voltage Level (for 1 No. Diameter under present scope) • Extension of existing 765kV AIS Main Bus-I & II through 765kV GIS Bus Duct to New 765kV GIS Building for interconnection with present scope 01 No. 765kV Diameters. • 765kV GIS bay configuration, for completion of 01 No. of diameter under present scope, is as per details given below: <table><tr><th>Configuration</th><th>Number of diameters</th></tr><tr><td>Bus Reactor-Tie-ICT* (Future)</td><td>1 (one)</td></tr></table> <i>Note (*): GIS modules for ICT bay shall be provided under present scope for diameter completion</i> <u>400kV</u> • Switching Scheme: One and a Half breaker Scheme • Fault Level: 63 kA for 1 sec (for equipment under present scope) • <i>Shifting of Sasaram - Daltonganj 400kV ckt 1 from Bay no. 409 to Bay No. 421 (currently utilized for BiharSharriif-IV T/L)</i> • Shifting of 400kV side of 765/400kV, 1500MVA ICT-1 from Bay no. 406 to Bay no. 409 • Upgradation of existing Jack buses and other associated equipment in the diameter 407-408-409 to suitable rating for termination of 765/400kV, 1500MVA ICT-1 <u>Notes:</u>	Configuration	Number of diameters	Bus Reactor-Tie-ICT* (Future)	1 (one)
Configuration	Number of diameters				
Bus Reactor-Tie-ICT* (Future)	1 (one)				

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	1) Existing 765kV Bus Reactor is currently only connected to 765kV Main Bus-II through AIS Bay Equipment. Under present scope of work, dismantling of aforesaid AIS Bay and connection of existing bus reactor with both 765kV Main Bus-I & Main Bus-II is envisaged through Extension of existing 765kV AIS Buses through GIS for construction of new 765kV one GIS diameter with 2 nos. of Main Bays & associated tie bay [i.e. Bus Reactor Bay for existing Bus Reactor – Tie Bay – ICT Bay for future (2nd) ICT] in new GIS building is envisaged.
2.	Extension of 220kV Nalagarh S/S <u>220kV</u> • 220kV Outdoor GIS bays for Line Feeder: 02 Nos. • Switching Scheme: Existing Double Main and Transfer Scheme. However, for Bay extension work under instant package outdoor GIS Double Main Scheme is envisaged. • Fault Level: 50 kA for 1 sec.

The detailed scope of work for Substation package SS-158 is brought out in subsequent clauses of this section.

2.1 Name of Substation: Extension of 765/400kV Sasaram Sub-Station

2.1.1 ELECTRICAL EQUIPMENTS, ELECTRICAL & MECHANICAL AUXILIARIES, COMMUNICATION EQUIPMENT, SWITCHYARD ERECTION EQUIPMENTS & ACCESSORIES:

Design, engineering, manufacture, testing at manufacturer's works, supply including transportation and insurance, unloading, storage, erection, testing and commissioning at site of following equipment & items, complete in all respects:

A. 765kV Gas Insulated Switchgear:

The SF6 gas insulated switchgear (50 Hz) shall be of the indoor metal-enclosed type.

- The existing 765kV switchyard is AIS type with Main Bus-I & Main Bus-II arranged in one and a half breaker bus bar arrangement.
- The 765kV bays under present scope shall be kept in a new 765kV GIS building and 765kV GIS Main Buses (of 4000A current rating) for proposed 765kV GIS bays under present scope, are to be extended from the respective existing 765kV AIS buses using SF6 to Air Bushings.
- Outdoor portion of 765kV GIS Main Buses (of 4000A current rating) running from 765kV SF6 to Air Bushings (located near existing AIS Main Buses) to the new GIS hall shall be measured from SF6 to Air Bushing to outer edge of the wall of the New GIS Building & shall be paid separately in running meter, against 765kV GIS Bus duct BPS item (of 4000A current rating) and the indoor portion of 765kV GIS Main Buses shall be covered under BPS item for 765kV GIS Bus Bar Module extension.

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- For 01 no. of 765kV ICT Bay {ICT-02(F) as per SLD drawing}, covered under present scope for diameter completion, shall be utilized in future. However, GIS Bus Duct for same shall be brought outside the GIS Building & terminated using SF6 to Air Bushing. Further, 765kV GIS Auxiliary Bus Bar module for this 765kV ICT Bay shall also be terminated using SF6 to Air Bushing for future connection with the existing AIS type 765kV Spare ICT Auxiliary Bus for layout arrangement shall be finalized during detailed engineering.
- For 765kV GIS **Auxiliary Bus module for Spare Reactor Connection** is covered under present scope. However, connection with spare reactor unit shall be done in future. GIS **Auxiliary Bus** shall be provided with End Piece (Interface) module suitably with isolating test link for future interconnection with spare Reactor. End piece (interface) module for Auxiliary Bus shall be in same alignment as Main Busbars. The above-provided end piece module shall be designed in such a way that the future GIS module may be tested without extending voltage to the existing bus by removing the test link.
- It is preferable that CB motor drives for GIS bays shall be AC power operated. In case the contractor offers DC power operated drives for their GIS, Contractor shall provide suitable AC-DC convertor for CB motor drive.

The Switchgear shall be complete with all necessary terminal boxes, SF6 gas filling, interconnecting power and control wiring, earthing materials, grounding connections, gas monitoring equipment & piping and support structures along with necessary base plate & foundation bolts. In addition, all necessary stairs, platforms, supports, fixed ladders and walkways etc. as required for operation & maintenance work shall also be provided.

- a) 800kV GIS Modules/Equipment as per BPS and description given in **Annexure-IV**.
- b) Controlled Switching Devices as per BPS.
- c) Mandatory Spares for 800kV GIS as per BPS.
- d) EOT crane for New 765kV GIS hall under present scope.
- e) Any other equipment/material required to complete the specified GIS scope of work.

B. Dismantling/Re-erection/Store Handing Over Works

Following works are under the present scope of the bidder:

- a) Existing 765kV Equipment (i.e. CB, Isolator, Earth switch, CT, BPI, associated erection hardware items, Junction Boxes, Cables, etc.) of Bus Reactor Bay along with its support structures (including chirping/cutting of foundation bolts of discarded foundations upto surface level) shall be dismantled and these shall be handed over to Sasaram store as per direction of POWERGRID Engineer In-Charge.

However, existing Surge Arresters & certain number of BPI shall be utilized in new GIS Bay arrangement as per layout requirement to be finalized during detailed engineering.

- b) Dismantling and re-erection of existing 3 nos. of 765kV Bus CVTs on Main Bus-I (along with its support structure, CVT Junction Box, etc.) as per layout requirement. Existing Power & Control Cables shall be utilized & shall be suitably re-routed for new location of 765kV Bus CVT. Additionally, any new Erection Hardware items (if required) for Dismantling & Re-erection of 765kV CVT are also deemed included under respective BPS item i.e. "Dismantling & re-erection of 765kV CVT"

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- c) Shifting of Sasaram - Daltonganj 400kV ckt 1 from Bay no. 409 to Bay No. 421 (currently utilized for BiharSharraf-IV T/L) as per tender drawings. Existing Line Side Equipment for Bay 421 Bay (currently marked as BiharSharraf-IV) shall be utilized for Daltonganj Bay post shifting arrangement.
- d) Existing Line Side Equipment (i.e. Isolator, Earthswitch, BPI, SA, CVT, WT, associated erection hardware items, Junction Boxes, Cables, etc.) of Bay 409 along with its support structures (including chirping/cutting of foundation bolts of discarded foundations upto surface level) shall be dismantled as per direction of POWERGRID Engineer In-Charge.
- e) Existing Bay Equipment (i.e. CB, Isolator, Earthswitch, BPI, CT, associated erection hardware items, Junction Boxes, Cables, etc.) of Bay 406 along with its support structures (including chirping/cutting of foundation bolts of discarded foundations upto surface level) shall be dismantled as per direction of POWERGRID Engineer In-Charge.
- f) The 400kV AIS equipment (CB, ISO, CT - with rated current rating of 3150A/3000A & BPIs) alongwith its support structure shall be dismantled during implementation as per para(d) & (e) above shall be utilized and re-erected (including support structure) under this scheme for 'Upgradation of bay equipment in the diameter 407-408-409 (Refer Table below)' and Re-configuration of 400kV ICT Bay and Daltonganj Bay as per tender drawings. Balance dismantled & unutilized AIS equipment (including Support Structures, cables, erection hardware items, etc.) shall be handed over to Sasaram store as per direction of POWERGRID Engineer In-Charge.

Bay No.	Equipment Name	Phase	Make	Rating
407	CT**	R/Y/B	TELK	2000/1
	CB**	R/Y/B	CGL	2000A / 420KV
	ISO-89A**	R/Y/B	ELPRO	2000A
	EARTH-89AE**	R/Y/B	ELPRO	NA
	ISO-89B**	R/Y/B	ELPRO	2000A
	EARTH-89BE**	R/Y/B	ELPRO	NA
408	CT (BUS-1 SIDE) **	R/Y/B	TELK	2000/1
	CT (BUS-2 SIDE)	R	AREVA	3000/1
	CT (BUS-2 SIDE)	Y/B	TELK	2000/1
	CB**	R/Y/B	CGL	2000A / 420KV
	ISO-89A	R/Y/B	SIEMENS	3150
	EARTH-89AE	R/Y/B	SIEMENS	NA
	ISO-89B**	R/Y/B	ELPRO	2000A
	EARTH-89BE**	R/Y/B	ELPRO	NA
409	CVT	R/Y/B	AREVA	4400pf
	ISO-89L	R/Y/B	SIEMENS	3150A
	EARTH-89LE	R/Y/B	SIEMENS	NA
	CT	R/Y/B	AREVA	3000/1
	CB	R/Y/B	GE	3150A / 420kV
	ISO-89A**	R/Y/B	ELPRO	2000A
	EARTH-89AE**	R/Y/B	ELPRO	NA

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	ISO-89B	R/Y/B	SIEMENS	3150A
	EARTH-89BE	R/Y/B	SIEMENS	NA

(**) Upgradation to 3000/3150A rating equipment is envisaged.

- g) For upgradation of bay equipment in the diameter 407-408-409, it is intended to utilize the existing foundations with suitable modifications/strengthening (as per requirement).
- h) Removal of Power and control cable associated with dismantled AIS equipment as per direction of POWERGRID's Engineer In-charge (except existing Power cables from BMK to Equipment MB required for Bay Upgradation in diameter 407-408-409).
- i) All unutilized, dismantled, or removed cables associated with equipment and/or junction boxes dismantled under the present scope shall be properly disconnected, sealed at both ends and suitably tagged for future identification.
- j) New junction box(es) wherever required, shall be provided for termination of cables, which shall be required for connection of 765kV & 400kV Equipment as envisaged under present scope of work.

C. Air insulated switchgear (AIS) and Other Main Equipment

- a) 765kV & 400kV Circuit Breakers, Isolators, Current Transformer, Bus Post Insulators as per BPS.
- b) **CONTROL & PROTECTION SYSTEM**

765kV CRP

- The existing CRP Panel associated with the 765 kV Bus Reactor shall not be utilized under the present scope and shall remain installed inside the existing SPR for future use by POWERGRID. Complete New Control, Relay and Protection system (including provisions for GIS/GIB gas density monitor signals, 765kV Reactor Auxiliary Bus provision for Spares Reactor connection arrangements etc.) for 765kV bays under present scope as per Section– Control and Relay Panels shall be supplied under the present scope.
- Cables coming from existing Bus Reactor MB/CMB to existing CRP panels shall be removed and shall now be terminated in the new CRP panel being supplied under present scope as per requirement of CRP schematics. Further, any additional Power & Control cables required from existing Bus Reactor MB/CMB to new CRP panel as per requirement of CRP schematics shall also be covered the present scope of the bidder.
- Any new CRP Room with GIS Hall is not envisaged under present scope. CRP panels for 765kV bays {‘Protection and CB Relay Panels for 765kV Bus Reactor & associated Tie Bay’ and ‘CB Relay panel for ICT-02(F) Bay’} to be supplied under present scope shall be placed inside existing SPR-2 in the 765kV switchyard.
- The existing 765 kV bus bar protection scheme (duplicate) at Sasaram S/s is distributed type P741/743 of M/s GE make, and existing Busbar central units (P741) shall be suitably augmented for connection of bays under present scope. Supply and installation of Peripheral units for one number of 765kV diameter being constructed under present scope shall also be under the present scope of the bidder.

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- All necessary items & components as required for completion of augmentation of 765kV bus bar protection scheme for bays under present scope shall be provided and bidder to consider the cost of these items & components under respective BPS items

400kV CRP

Following is covered under the present scope of the bidder:

- (i) Existing CRP panel for Bay-409 shall not be utilized under the present scope and shall remain installed inside the existing SPR for future use by POWERGRID. After shifting 400kV ICT Bay from Bay 406 (i.e. MV side of 765/400kV ICT-1) to Bay 409, Existing CRP panel for Bay-406 shall now be utilized for ICT protection using Bay Equipment of Bay-409. All modifications (including new cabling) required in existing CRP panels of Bay 406 & Bay 408 (associated Tie Bay) shall be under present scope of the bidder.
- (ii) All modifications required in existing CRP panels after upgradation of Bay Equipment (CB, Isolator, CTs) for Bay Nos. 407 & Bay 408 (including new cables required between Equipment MB and CRP panels).
- (iii) Any modifications required in existing CRP panel of Bay-421 for utilization of same for 400kV Daltonganj T/L.
- (iv) The existing 400 kV bus bar protection scheme at Sasaram S/s is centralized type B90 of M/s GE make, and any modifications required in bus bar protection scheme for revised bay arrangements & equipment upgradation in 400kV switchyard as per tender drawings shall be responsibility of the bidder.

Necessary modifications including auxiliary / trip relays, wiring, etc. for completion of protection schemes as per Section – CRP (including any modification required in the existing protection scheme) is included in the present scope. Cost of complete scope regarding 400kV CRP as above, is deemed included under the BPS item “Modification in Existing CRP & SAS as per Technical Specifications”.

c) SUBSTATION AUTOMATION SYSTEM

Existing Sasaram Substation is equipped with substation automation system (based on IEC-61850) of M/s Siemens make. The present scope includes augmentation of existing substation automation system by providing bay IEDs along with associated equipment for the following bays (bays as defined in technical specification Section-Substation Automation System):

- 765kV Main Bays- 2 Nos
- 765kV Tie bays-1 No.

Under present scope, the Bidder shall include BCUs required for bays mentioned above, including all necessary hardware & software to integrate with the existing substation automation system. Price of above works shall be deemed included in SAS Augmentation BPS items for 765kV bays.

Further, modifications in existing substation automation system for revised bay arrangements & equipment upgradation in 400kV switchyard as per tender drawings shall be responsibility of the bidder.

Any changes in wiring/configuration, new wiring etc. required in the existing BCU for 400kV Bays including additional I/O Modules is also included in the present scope. The price for SAS modification of 400kV bays and SAS upgradation as above is deemed included under the BPS item

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“Modification in Existing CRP & SAS as per Technical Specifications.

The scope of bidder shall include but not limited to integration of IEDs under present scope of work with existing substation automation and capability enhancement of same as required (including any hardware), including License, up-dating of system database, displays, development of additional displays and reports as per requirement.

The necessary interface and integration work at Gateway for remote operation from RCC (Remote Control Centre) and transferring data to RLDC (RSCC)/NLDC through optical fiber based SDH communication link is also under present scope. However, no work is envisaged at remote end (RCC/RLDC/NLDC etc.) in the present scope.

d) LT Switchgear (Extension):

- Blank Vaults are already existing in 415V ACDB. Bidder shall be required to extended existing buses and supply & mount 6 Nos. of 63A MCCB (three pole with neutral link) for O/G Feeder (3 each in Sec-I & Sec-II).
- Blank Vaults are already existing in 220V DCDB-I & DCDB-II. Bidder shall supply & mount 4 Nos. of 32A DP MCB for O/G Feeder each of Existing 220V DCDB-I & DCDB-II.

e) AIR CONDITIONING & VENTILATION SYSTEM: Ventilation system for New 765kV GIS Hall is covered under present scope of work.

f) ILLUMINATION SYSTEM

LED based Lighting and illumination system for 765kV New GIS buildings (including ~~relay panel rooms &~~ AHU rooms) etc. shall be provided by the contractor. Illumination system shall be provided using the fixture types as specified in Technical Specification Section-Lighting System. Further, contractor shall submit lighting design calculations for finalizing the number of fixtures in the 765kV New GIS Building in line with Annexure-III (Specific Requirement, Rev-10).

g) CABLES

- 1.1kV grade Power & Control cables (and special cables, if any) along with complete accessories for works covered under the present scope.
- Any changes in existing cabling or new 1.1kV grade power & control cabling required for completion of Bay Equipment Upgradation in 400kV Diameter for Bays 407-408-409 is covered under the present scope of the bidder. Also refer clause number B(h) & B(i) under this section.
- Cable sizes shall be used as per Sizing of 1.1kV Power & Control cables specified at Annexure-S1 (Revised) attached with this section.

h) Fire Protection System

- (i) Extension of existing hydrant system from the nearest available existing header for New 765kV GIS building is envisaged under present scope of work. The cost of the same shall be deemed to be included under BPS item of Fire protection of system outside Pump House.
- (ii) Fire detection & Alarm system shall be provided for New 765kV GIS Hall including ~~CRP Rooms~~ AHU rooms. Further, integration of present scope Fire zone alarm & annunciation signals for New 765kV GIS Hall including ~~CRP Rooms~~ AHU rooms with the existing Fire Fighting Annunciation cum Alarm Panel & further integration with existing SAS is also covered under

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present scope of contractor. All necessary items/cables etc. including capacity enhancement/augmentation of existing Fire protection panels/AUX. BCUs as required for the above-mentioned work shall be provided by the contractor under present scope & cost of the same shall be deemed to be included under respective BPS items of Fire detection & Alarm system for GIS Buildings. Alternatively, for SAS integration, the present scope Fire protection signals can also be wired in BCUs being supplied under present scope

i) VISUAL MONITORING SYSTEM AS PER BPS

Augmentation of Visual Monitoring System (VMS) for area under present scope. The contractor shall provide 2 nos. of Fixed Color IP Camera suitably located in the new 765kV GIS building for monitoring bays and equipment under present scope.

The scope of the contractor shall include all items, Accessories, Line interface units, Fiber patch cards, Power supply units, Junction boxes, cables, Fiber optic cables, Hardware and software etc., as applicable to the product design, to meet functional requirements. Compatibility enhancement of VMS system, if needed, shall be done by the contractor under the present scope, without any additional cost Implication. Advisory on deployment of CCTV issued by Ministry of Electronics and Information Technology (MEITY) shall be followed

The cameras to be supplied under present scope to be integrated with existing NVR at site. The make of NVR & other details of existing VMS shall be provided at the time of detailed engineering. All SDK (Software development kit)/APIs (Application programming interface) are in the scope of bidder. Camera license in NVR shall be provided by Contractor.

j) ERECTION HARDWARE

- (i) This item of BPS includes Insulator strings and associated hardware fittings, Clamps & connectors, Conductor, Aluminum tubes, Bus bar and earthing materials risers, auxiliary earthmat (excluding main earth mat), Bay marshalling box, spacers, cable sealing arrangement, insulating mats, cable supporting angles/channels, Cable Pull pit, Cable trays & covers, Guy arrangement (including insulators and hardware), Earthwire, Junction box, buried cable trenches/pipes for equipment & lighting, all accessories, etc. as required
- (ii) Existing 400kV Jack Buses (Twin Conductor) shall be upgraded to (Quad conductor) under present scope. Associated Insulators, Strings Hardware(s), conductor(s), bus-bar materials, spacers, clamps & connectors, spacers shall be deemed to be included under erection hardware BPS Item “ERECTION H/W-420KV I-TYPE JACK BUS”. Dismantling of Erection Hardware associated with existing Jack Buses (Twin Conductor) handing over of the same to POWERGRID store is also deemed included under the subject BPS item.
- (iii) BPS Item “ERECTION H/W FOR MISCELLANEOUS WORK AS PER TECHNICAL SPECIFICATION” shall include the erection hardware items for following works covered under the present scope:

- Extension of existing 765kV Main Bus-I & Main Bus-II using GIS Bus duct

k) MAIN EARTH-MAT (As per BPS)

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- The main earthmat is already existing for switchyard area under the present scope. Existing Earthmat drawing shall be provided to the successful bidder during detailed engineering.
- All the equipment's (including re-erected equipment), structures, Buildings, cable trenches, auxiliary earthmat etc. under present scope shall be earthed by connecting them to the main Earthmat by the contractor. Cost against the same shall be deemed to be included in the respective BPS items under Erection Hardware.
- For 765kV GIS grounding inside the GIS building, contractor shall refer Annexure-S10 of Specific requirement, Rev 10 and the same shall be deemed to be included as Part of GIS equipment.

I) LIGHTNING PROTECTION (DSL P)

The **lightning protection (DSL P)** for area under present scope including GIS Buildings is to be provided by the contractor. The contractor shall design the lightning protection by utilizing the existing Structures & structures being provided under present scope. In case, additional structures (Lightning Masts) are required to meet the lightning protection, same shall be paid in metric tonnage. The associated civil works shall be payable as per relevant item of BPS, however, earthing of the LMs, buildings as required shall be deemed to be included as part of Erection Hardware BPS item for bays & no additional payment shall be admissible under this head.

2.1.2 Design, engineering, manufacture, testing, supply including transportation & insurance, unloading, storage, testing at site of Mandatory spares as per bid price schedule. The Break-up of Mandatory Spares for items except GIS Equipment shall be as per Annexure-II.

2.1.3 CIVIL WORKS & SUPPORT STRUCTURE

- A. The design of foundation shall be based on the soil investigation report and other parameters as per relevant IS codes & technical specification. The foundations may be open foundation or pile foundation as per the site requirement / soil report.
- B. The scope of civil work shall include but shall not be limited to the following based on **drawings developed by the contractor:**
- (i) **Cable Trenches:**
Cable trenches shall be constructed as per POWERGRID standard drawings provided in tender. However, Cable trench layout shall be prepared by vendor for approval of POWERGRID based on the standard sections.
 - (ii) **GIS Building:**
 - a) The Actual Length of GIS Hall shall be finalised based on the Substation requirement. The GIS layout shall be planned to suit the modular size of the GIS Hall. Accordingly, architectural drawings shall be prepared by the contractor as per actual dimensions and submitted for approval of employer.
 - b) The details pertaining to location of doors/ windows/ rolling shutters and entry / exit points shall be as per the attached drawing.
 - c) Complete Structural & Foundation Design and Drawings of the GIS Building shall be prepared by the contractor as per Technical Specifications and submitted for approval of employer.

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- d) Other details of the GIS Hall like architecture, finishing, joinery, drainage etc. shall be prepared by the contractor as per Technical Specifications and submitted for approval of employer.
- e) EOT crane shall be provided in the GIS Building as per relevant section of technical specification.
- f) All civil works including foundations associated with erection of SF6 gas insulated metal enclosed with switchgear along with its SF6 bus ducts upto the outer edge of the wall of GIS building. Civil works including all foundations for all equipment inside GIS building.
- g) The cable trenches inside GIS hall.
- h) Foundation for Bus duct supporting structures outside GIS Hall & GIS (SF6/Air) bushing.
- i) Indicative Drawing of GIS Hall is attached with the tender drawings for reference.

(iii) Other miscellaneous requirements & scope:

- a) Stone has already been laid in some portion of the switchyard area under present scope. In this area scope shall be Removal, cleaning and washing of existing stone, refurbishing additional stone (if required) and re-spreading after doing anti-weed treatment & PCC. However, Layout for the same shall be developed by the contractor.
A 75 mm thick Plain Cement Concrete (PCC) of mix ratio 1:5:10 shall be laid in the existing switchyard areas where dismantling has been carried out to complete the current scope of work. The PCC shall be finished to match the existing yard conditions.
- b) Modification of Structure & Foundation if required during detailed engineering.
- c) Foundation for lighting poles, bay marshalling boxes, panels and control cubicles wherever required. The cost of these foundations shall deemed to be included in erection/installation of corresponding item/ equipment of BPS.
- d) Dismantling of RCC foundation & Road.
- e) Dismantling & Re-Erection of fence: Existing Fence shall be dismantled and new fence shall be provided under present scope. Cost of dismantling and re-erection of Fence shall be payable in running meter (RM) as per BPS.
- f) Filling of portion of existing Pond & extension of existing pond as per layout requirement.
- g) Any other item/design/drawing required for successful completion of scope of works.

C. The scope of civil work shall include but not be limited to the following based on **drawings developed by POWERGRID:**

- a) **Gantry tower & beam:** Gantry tower & beam shall be provided as per Employer's drawings during detailed engineering.
- b) **Equipment support structure:** Equipment support structure (except Support structure for Circuit Breaker shall be as per manufacturer's design which is deemed to be included in the cost of respective CB) shall be provided as per Employer's drawings during detailed engineering.
- c) **Foundation for Gentries & Equipment support structure:** The foundations of these structures including embedment/grouting of foundation bolts.
- d) **Concrete Road including Road Crossing:**
Concrete Road including approach road (if any), shall be constructed as per POWERGRID standard drawings provided in tender. However, Road layout shall be prepared by vendor for approval.
- e) **Drains:** Drain layout including peripheral drains if any required along the boundary shall be prepared by vendor and to be submitted for approval of POWERGRID based on the standard sections. Diversion of existing Nallah/ Surface runoff, if required, the design & drawing of drains

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shall be prepared by contractor along with the drain layout and same shall be submitted to POWERGRID for approval. Payment shall be made under respective items of BPS. The rate shall include the cost of all works such as excavation, PCC, RCC, Reinforcement Steel, screed concrete, plastering, NP-3 RCC Hume pipes in crossings, culverts, brick work etc. as per drawings and technical specifications.

- D. For buildings, complete civil work includes internal and external finishing, stone soling for flooring, plinth protection, drain along plinth protection, electrical conduit and junction boxes, fan boxes, Miscellaneous structural steel, Internal Cable Trenches, cable transit system etc. required to complete the building in all respect as per the drawing shall be payable in the plinth area rate. However, the quantity of earthwork (excavation, backfilling, disposal etc.), concrete (all types), reinforcement steel only shall be measured and paid under respective items under BPS.

2.1.4 Supply & Installation of Substation Design Software(s) at POWERGRID Corporate Centre, Gurgaon office as per technical specification attached at Annexure-VI. Further, As-Built layout of Sasaram Substation shall be prepared using the “3D Substation Design & Engineering Software” to be supplied under the subject package. Licenses of all Substation Design Software(s) provided under this contract shall be in the name of POWERGRID.

2.2 Name of Substation: Bay Extension at 400/220kV Nalagarh Sub-Station

2.2.1 ELECTRICAL EQUIPMENTS, ELECTRICAL & MECHANICAL AUXILIARIES, COMMUNICATION EQUIPMENT, SWITCHYARD ERECTION EQUIPMENTS & ACCESSORIES:

Design, engineering, manufacture, testing at manufacturer's works, supply including transportation and insurance, unloading, storage, erection, testing and commissioning at site the following equipment/items, complete in all respects:

A. 220kV Gas Insulated Switchgear:

The SF6 gas insulated switchgear (50 Hz) shall be of the outdoor metal-enclosed type. GIS Switchgear and controlgear shall be suitable for installation in the open air, i.e. capable of withstanding wind, rain, snow (if applicable), dirt deposits, condensation. The Switchgear shall be complete with all necessary terminal boxes, SF6 gas filling, interconnecting power and control wiring, grounding connections, gas monitoring equipment & piping and support structures along with necessary base plate & foundation bolts.

The existing 400/220kV Nalagarh Substation is of AIS type. The proposed extension for 220 kV Bays is to be done through outdoor GIS.

The 220kV GIS bays under present scope shall be placed outdoors at suitable location in 220 kV Switchyard. 220kV GIS Main Buses under present scope are to be extended from the existing 220kV AIS Buses.

- a) GIS Modules/Equipments as per BPS.
- b) Testing and Maintenance Equipment as per BPS (Bid Price Schedule).
- c) Outdoor GIS along with LCC panel shall be mounted on a common raised platform with the plinth height of 750mm from the FGL

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- d) Outdoor GIS shall have protective coating (suitable greasing and/or painting of the flanges/enclosures) for outdoor application with High Pollution Level environmental conditions. The sealing provided between flanges of various enclosures shall be such that long term tightness is achieved for outdoor duty. The Weatherproofing and corrosion protection for outdoor GIS shall be ensured by GIS manufacturer.
- e) It is preferable that GIS bay is dispatched from the factory in assembled form to the extent possible so that minimum assembly is done at site in order to facilitate assembly of few portions of the GIS at site. If necessary, for GIS assembly at site proper temporary dust free clean GIS assembly room shall be established.
- f) As the GIS is expected to be installed and erected outdoors, GIS manufacturer shall device the detailed GIS erection procedure for outdoor installation keeping in view the stringent requirement of clean environment and submit the same for approval.
- g) For outdoor GIS, manufacturer shall submit the maintenance procedures for the flange protection (e.g. the refill of grease) to avoid corrosion issues.
- h) LCC panels and GIS equipment marshalling boxes, operating mechanism boxes, and terminal boxes shall be provided with suitably extended canopies in all directions to protect critical components and connections.
- i) Outdoor Local Control Cabinet (LCC), GIS Equipment Marshaling boxes/operating mechanism boxes & terminal boxes shall be made of stainless steel of atleast 1.5 mm thick or aluminum enclosure of at least 1.6 mm thick and shall be dust, water and vermin proof. Stainless steel used shall be grade SS304 (SS316 for coastal area) or better and shall be type tested for at least IP-55 degree of protection.
- j) It is preferable that CB motor drives for GIS bays shall be AC power operated. In case the contractor offers DC power operated drives for their GIS, Contractor shall provide suitable AC-DC convertor for CB motor drive.
- k) The design of the outdoor GIS equipment for specified rating shall take into consideration the Cyclic temperature (and pressure) changes of the SF6 gas contained by the gas tight compartments, caused by the change of the loading current (the temperature rise of the high-voltage current carrying parts) or more frequently by the change of the solar radiation (the temperature rise of the enclosures).
- l) Any other equipment/material required to complete the specified GIS scope of work.

B. 220kV Air insulated switchgear (AIS) and Other Main Equipment

- a) 220 kV Isolators, CVT, Wave Trap, Bus Post Insulators (including BPI for WT) and 216kV Surge Arresters.

b) CONTROL & PROTECTION SYSTEM

Complete Control, Relay and Protection system for 220 kV bays under present scope as per Section– Control and Relay Panels.

The Existing 400/220 kV Nalagarh Substation is conventional Substation. Separate Control Panel with BCU is envisaged for 220 kV bays under present scope.

The existing 220 kV bus bar protection scheme at Nalagarh S/s is distributed type P741/743 of M/s GE make, and it shall be augmented for bays under present scope. Supply and installation of Peripheral unit is covered under the present scope.

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All necessary items & components as required for completion of augmentation of 220kV bus bar protection scheme for bays under present scope shall be provided and bidder to consider the cost of these items & components under respective BPS items

The Protection panel for bays under present scope shall be placed inside CRB Panel Room.

400/220kV Nalagarh S/s is a conventional type of Substation where data is being transferred to NTAMC/RLDC through RTU (C264). The data of bay under present scope shall also be transferred to NTAMC/RLDC through existing RTU (C264). As stated above, BCUs for control and monitoring of 220kV bay are to be supplied under present scope. The present scope shall also include:

- a) Interface between BCUs and existing RTU for 220kV Bay under present scope.
- b) The necessary interface equipment and augmentation/integration work for transferring data to RLDC/NLDC through optical fiber based SDH communication link is also under present scope.
- c) The necessary interface equipment and augmentation/integration work for control and monitoring through RTAMC/NTAMC through optical fiber based SDH communication link is also under present scope.
- d) No work is envisaged at remote end (RLDC/NLDC/RTAMC/NTAMC etc.) in the present scope.

c) CABLES

1.1kV grade Power & Control cables (and special cables, if any) along with complete accessories. Methodology for “Supply, installation & sizing of 1.1kV Power & Control cables” shall be as per Specific requirement at Annexure-S1(Revised).

d) ILLUMINATION SYSTEM

LED based Outdoor Illumination (As per BPS). Illumination system shall be provided using the fixture types as specified in Technical Specification Section-Lighting System.

e) ERECTION HARDWARE

This item of BPS includes Insulators, Strings Hardware(s), conductor(s), Al tube, bus-bar materials, spacers, clamps & connectors, spacers, Junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels Cable pull pit, cable trays & covers, Insulating mats, cable sealing arrangement, all accessories etc. as required.

220kV Jack Bus (Quad conductor) for Main Bus-2 is already existing. However, 220kV Jack Bus (Quad conductor) for Main Bus-1 is under present scope. Associated Insulators, Strings Hardware(s), conductor(s), bus-bar materials, spacers, clamps & connectors, spacers, shall be deemed to be included under erection hardware.

f) MAIN EARTH-MAT (As per BPS)

The existing main earthmat shall be extended by the contractor for the area under the present scope of work. Payment against main earthmat shall be regulated as per actual length laid at site.

All the equipment's, structures, cable trenches etc. shall be earthed by connecting them to the main Earthmat by the contractor. The cost of the same shall be deemed to be included in respective BPS items of Erection Hardware.

g) Fire Protection System

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Fire Alarm & Annunciation System as per TS for existing 400/220kV Nalagarh substation is under present scope. Suitable fire detection system using smoke detectors and/or heat detectors shall be provided.

The existing Fire Alarm and Annunciation System shall be renovated under the present scope. Existing Fire Alarm and Annunciation Panels shall be replaced, and all necessary rewiring, modifications, integration, testing and commissioning works shall be carried out for complete and satisfactory operation of the system. Adequate number of fire protection zones shall be provided in the annunciation System for replacement of the existing annunciation system. For this purpose, the annunciation system shall be designed considering a maximum of Ten (10) fire protection zones. All materials, equipment, accessories and activities required for the above works shall be deemed included in the scope and quoted cost.

h) LIGHTNING PROTECTION (DSLPL)

DSLPL Protection for switchyard extension area (under present scope) including calculation of Direct Stroke Lightning Protection (DSLPL) is to be provided by the contractor. DSLPL protection is to be proposed, optimized & provided by contractor utilizing Tower structures, Shield wire & spikes under the present scope.

i) VISUAL MONITORING SYSTEM AS PER BPS

Augmentation of Visual Monitoring System (VMS) for area under present scope. The contractor shall provide 2 nos. of Color IP camera with PAN, Tilt & Zoom facility suitably located in the switchyard for monitoring of bays and equipments under present scope.

The scope of the contractor shall include all items, Accessories, Line interface units, Fiber patch cards, Power supply units, Junction boxes, cables, Fiber optic cables, Hardware and software etc., as applicable to the product design, to meet functional requirements. Compatibility enhancement of VMS system, if needed, shall be done by the contractor under the present scope, without any additional cost Implication.

The cameras to be supplied under present scope to be integrated with existing NVR at site. The make of NVR & other details of existing VMS shall be provided at the time of detailed engineering. All SDK (Software development kit)/APIs (Application programming interface) are in the scope of bidder. Camera license in NVR shall be provided by Contractor.

j) TELECOMMUNICATION EQUIPMENT & PMU: QUANTITY AS PER BPS

1.0 Tele-communication equipment:

The broad Scope of the procurement of FO based Communication Equipment shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading, handling, storage, installation, termination, testing, training and demonstration for acceptance, commissioning and documentation for:

- i) SDH Equipment along with suitable interfaces and line cards.
- ii) All cabling, wiring, Digital Distribution frame patch facilities and interconnection to the supplied equipment at the defined interfaces.
- iii) System integration of all supplied subsystems.

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- iv) Integration with the existing communication system based on SDH and PDH of employer.
- v) Integration of supplied subsystem with SCADA system, PLCC equipment, PABX of RLDC/SLDC, VOIP (SIP compliant) for voice.
- vi) Fibre Optic Approach Cable (FOAC) along with associated hardware set and Fibre Optic Distribution Panel (FODP).
- vii) Integration of new Communication equipment in the existing regional UNMS through regional NMS. All required support to existing NMS and UNMS vendor for integration of new Communication equipment.

2.0 PMU:

- i) The broad Scope of the procurement of PMU shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading, handling, storage, installation, termination, testing, integration and demonstration for acceptance, commissioning, and documentation for PMU as per BPS
- ii) The PMUs shall comply with the latest version of IS 60255-118-1-2018 and IEEE C 37.118.2 protocols.
- iii) The PMUs shall be integrated with Phasor data Concentrator (PDC) at Regional Load Dispatch Centre (RLDC)/ State Load Dispatch Centre (SLDC).
- iv) The Bidder shall provide technical support at substation end for seamless integration of PMU with PDC at RLDC/SLDC. The integration work at RLDC/SLDC end will not be under the scope of the Bidder. The existing PDC software/application at RLDC/SLDC is of M/s GE make.
- v) Each of the PMUs supplied in this project shall support measurement of voltage and current of at least 2 feeders/bays.
- vi) All cabling and interconnections for extension of CT/CVT, Digital inputs from the Line Bays, ICTs/Reactors/STATCOM bays up to PMU panel for measurement by PMU, shall be in the scope of the Bidder. Accordingly, the associated 1.1KV Control cables as required for Non-Adjacent Inter- Control and Relay panel (CRP) CT /PT connections & Digital input connections to PMU panel shall also be under the Bidder's scope. The scope of these cabling work (supply, laying & termination), as applicable in subject project, shall be deemed to be included in price of PMU equipment.
- vii) Validity of Type Test for PMU shall be as per CEA Guidelines January 2026.

2.2.2 Design, engineering, manufacture, testing, supply including transportation & insurance, unloading, storage, testing at site of Mandatory spares as per bid price schedule. The Break-up of Mandatory Spares for items except GIS Equipment shall be as per Annexure-II.

2.2.3 CIVIL WORKS & SUPPORT STRUCTURE

A. The design of foundation shall be based on the soil investigation report and other parameters as per relevant IS codes & technical specification. The foundations may be open foundation or pile foundation as per the site requirement / soil report.

B. The scope of civil work shall include but shall not be limited to the following based on drawings developed by the contractor:

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- (i) Structure and Foundation of non-Standard structures (if any) envisaged during detailed engineering. The design of foundation shall be based on the soil investigation report and other parameters as per relevant IS code & technical specification.
- (ii) **Site levelling work:** The item site levelling work includes Contouring of levelling area of present scope within the substation boundary as per technical specification. The final area of levelling area shall be decided during detailed engineering.
- a) The Quantity of earthwork cutting & filling borrowed earth and FGL shall be proposed by vendor for approval of POWERGRID based on the approved contour level drawing and site HFL data.
- b) Mode of measurement of this item is in Cum of earthwork as per BOQ and technical specification. The contouring of the plot area in scope as per technical specification is also deemed to be included in quoted rates of this item.
- c) HFL data duly verified by POWERGRID Site is required to be arranged by contractor for finalization of FGL (Finished Ground Level).
- (iii) **Soil investigation (02 bore log) :-**

Soil investigation (If required) needs to be conducted as per the technical specification. The necessary soil investigation layout and final soil report shall be proposed by vendor for approval of POWERGRID.

Mode of measurement of this item is Lumpsum as per BOQ.

- (iv) **Design, engineering and execution of all civil works as per specification, complete in all respect for GIS Platform.**
- Foundation for outdoor GIS platform for 220 KV GIS bay. The foundation shall be of block type.
 - The dimensions of GIS platform foundation shall be decided during detailed engineering based on the equipment layout and requirement of technical specification.
 - Foundation for Bus duct supporting structures & GIS (SF6/Air) bushing.
The structures and foundation bolts is deemed to be included in GIS supply. The items related with foundation works shall be measured in respective items viz, excavation , PCC, RCC, reinforcement steel in BPS.
 - All civil works including foundations associated with erection of SF6 gas insulated metal enclosed with switchgear along with its SF6 bus ducts.
- (v) **Slope Protection Works & Retaining Walls:** Design & Drawings pertaining to slope protection works & retaining walls (if required) shall be finalized during detailed engineering and same shall be measured under respective line items of BPS.
- (vi) Stone spreading and anti-weed treatment including PCC in the switchyard for area under present scope. Layout for the same shall be developed by the contractor.
- (vii) Removal, cleaning and washing of existing stone, refurbishing additional stone (if required) and re-spreading after doing anti-weed treatment & PCC is also in the present scope. Extra gravel (if required) matching with the existing substation required for completion of the scope of work shall also be in contractor's scope.
- (viii) **Other miscellaneous requirements & scope:**

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- Foundation for lighting poles, bay marshalling boxes, panels and control cubicles wherever required. The cost of these foundations shall be included in erection/installation of corresponding item/ equipment of BPS.
- Dismantling work (If any) .
- Any other item/design/drawing required for successful completion of the scope of works

C) The scope of civil work shall include but not be limited to the following based on drawings developed by POWERGRID:

(i) RCC Road including Road Crossing: -

Road including approach road (if any), shall be constructed as per POWERGRID standard drawings provided in tender. However, Road layout shall be prepared by vendor and submitted to POWERGRID for approval.

(ii) Cable Trenches:

- a) Cable trenches along with covers including road/rail crossing, sump pits, culverts etc. shall be constructed as per POWERGRID standard drawings provided in tender.
- b) However, Cable trench layout shall be prepared by vendor for approval of POWERGRID based on the cable trench sections available in Tender Drawings.
- c) Mode of measurement: Cable Trenches shall be measured in running meters. The rate shall include the cost of all works such as excavation, PCC, RCC, Reinforcement Steel, Miscellaneous Structural Steel, inserts, embedment, NP-3 RCC Hume pipes in crossings etc. Cable Trench together with its cover shall be measured in running meter for payment purposes.

(iii) Drains

- a) Diversion of existing nallah/Storm water surface run off - drain layout shall be prepared by contractor based on the drain sections available in Tender drawings and to be submitted for approval of POWERGRID.
- b) Mode of measurement: Drains shall be measured in running meter. The rate shall include the cost of all works such as excavation, PCC, RCC, Reinforcement Steel, screed concrete, plastering, MS grating, **NP-3 RCC Hume pipes** in crossings etc. as per drawings and technical specifications.

(iv) Gantry tower and beam Structure

Structure drawings of 220 kV Towers and beams.

(v) Foundations of Towers:

Foundations of 220 kV Towers. The foundations of these structures are including of embedment/grouting of foundation bolts.

(vi) Equipment Support Structures:

220kV Equipment support structures except support structures for Circuit Breaker. The Support structure for Circuit Breaker shall be as per manufacturer's design.

(vii) Foundations of Equipment Support Structure:

220 kV Equipment support structure foundations. The foundations of these structures are including of embedment/grouting of foundation bolts.

3. SPECIFIC EXCLUSIONS

The following items of work are specifically excluded from the scope of the specification:

- a) Employer's site office

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b) Approach road to Substation

4. PHYSICAL AND OTHER PARAMETERS OF THE SUBSTATION

4.1 LOCATION OF SUBSTATION: as indicated below

S. No.	Name of Substation	Name of State	Nearest Railway Station
1	400/220kV Nalagarh	Himachal Pradesh	Chandigarh Railway Station
2	765/400kV Sasaram Substation (Pusauli S/S)	Bihar	Pusauli Railway Station

4.2 METEOROLOGICAL DATA: Meteorological data are as below:

S. No.	Name of Sub-station	Altitude	Snow fall	Seismic Zone	Wind Zone	Min./Max. Ambient Temperature	Coastal Area Consideration
1	400/220kV Nalagarh	Less than 1000 meter above mean sea level (MSL)	NIL	As per IS 1893	As per IS 875 Part 3	0/50 degree centigrade	NO
2	765/400kV Sasaram Substation (Pusauli S/S)						

5. SCHEDULE OF QUANTITIES

The requirement of various items/equipments and civil works are indicated in Bid price Schedules.

All equipments/items, Structures and civil works for which quantities has been given in the BPS shall be payable on unit rate basis. During actual execution, any variation in such quantities shall be paid based on the unit rate under each item incorporated in Letter of award.

Wherever the quantities of items/works are indicated in Set/LOT/LS, the bidder is required to estimate the quantity required for entire execution and completion of works and incorporate their price in respective Bid price schedules. For erection hardware items, Bidders shall estimate the total requirement of the works and indicate module-wise lump sum price bay wise and include the same in relevant Bid price schedules. Any material/works for the modules not specifically mentioned in the description in BPS, as may be required shall be deemed to be included in the module itself.

No cost compensation shall be considered on account of “Set/LOT/LS” items in any case if number of bays specified in section project remains unchanged.

Bidder should include all such items in the bid proposal sheets, which are not specifically mentioned but are essential for the execution of the contract. Item which explicitly may not appear in various schedules and are required for successful commissioning of substation shall be included in the bid price and shall be provided at no extra cost to Employer.

6. BASIC REFERENCE DRAWINGS

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The substation shall be designed considering current ratings as indicated below-

Sl. No	Description of bay	400/220kV Nalagarh	765/400kV Sasaram S/S	
		220 kV	765kV	400kV
1.	Bus Bar	3000A	4000A	-
2.	Line Bay	1600A	-	3150A
3.	ICT Bay	-	3150A	3150A
4.	Bus Reactor Bay	-	3150A	-

The reference drawings, which form a part of the specifications, are given at Annexure-I. The contractor shall maintain the phase to earth clearance, phase to phase clearance and sectional clearances, clearances between buses, bus heights but may alter the locations of equipment to obtain the statutory electrical clearances required for the substation.

The enclosed drawings give the basic scheme, layout of substation, substation buildings, associated services etc. In case of any discrepancy between the drawings and text of specification, the requirements of text shall prevail in general. However, the Bidder is advised to get these clarified from Employer.

7. DIFFERENT SECTIONS OF TECHNICAL SPECIFICATION

Employer has standardized its technical specification for various equipment and works for different voltage levels. Items which are not applicable for the scope of this package as per schedule of quantities described in BPS, the technical specification for the items should not be referred to. For the purpose of present scope of work, technical specification shall consist of following sections and they should be read in conjunction with each other.

Sl. No.	Description	Revision
1.	Section- Project	Rev 00
2.	Section- General Technical Requirement	Rev 16
3.	Section- Gas Insulated Switchgear (GIS)	Rev 05A
4.	Section Switchgear -CB	Rev 12
5.	Section- Switchgear- Isolator	Rev 13
6.	Section-Switchgear- Instrument Transformer	Rev 12
7.	Section-Switchgear- Surge Arrester	Rev 13
8.	Section- Power & Control Cable	Rev 06
9.	Section- Lighting System	Rev 07
10.	Section- Fire Protection System	Rev 06
11.	Section- LT Switchgear	Rev. 05
12.	Section- Air Conditioning System	Rev 04
13.	Section- Switchyard Erection	Rev 10
14.	Section- Structure	Rev 07
15.	Section- Civil Works with corr slip-1	Rev 12
16.	Section- Control & Relay Panel	Rev 09
17.	Section- Substation Automation System	Rev 04

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18.	Section-PLCC	Rev 05
19.	Section – PMU	Rev. 01
20.	Section-Telecommunication Systems	Rev. 06

In case of any discrepancy between Section-PROJECT and Section-GTR and other technical specifications on scope of works, Section-PROJECT shall prevail over all other sections.

In case of any discrepancy between Section-GTR and individual sections for various equipment, the requirement of individual equipment section shall prevail.

In case of any discrepancy between the Main body of Section-Project and Annexure(s) of Section-Project, provisions specified in Main body of Section-Project shall prevail.

8. MANDATORY SPARES

Mandatory Spares shall be included in the bid proposal by the bidder. The prices of these spares shall be given by the Bidder in the relevant schedule of BPS and shall be considered for evaluation of bid. It shall not be binding on the Employer to procure all these mandatory spares.

The bidder is clarified that no mandatory spares shall generally be used during the commissioning of the equipment. Any spares required for commissioning purpose shall be arranged by the Contractor. The unutilized spares if any brought for commissioning purpose shall be taken back by the contractor.

Wherever spares in BPS/Technical Specification have been specified as “each type/each rating/each type & rating”: If the offered spare/spares is sufficient to replace the respective main equipment of all types/ratings, then such offered spare/spares shall be acceptable. It implies that common spare/spare set fulfilling the spare requirement of all types/ratings shall also be acceptable, provided it is configurable at site itself without special assistance of OEM.

Mandatory Spares, wherever mentioned, are envisaged for the equipment/items being supplied under the main equipment heads under present scope meeting the requirements of Technical Specifications. The component/sub-component of an equipment/item specified in BPS under Mandatory Spare, which is not applicable as per the offered design of respective main equipment, shall not be referred to.

Detailed break-up for Mandatory spares of other equipment's shall be as per **Annexure-II**.

9. SPECIFIC REQUIREMENT

9.1 Relevant/applicable clauses of Specific Requirements as mentioned at C/ENGG/SPEC/SEC-PROJECT/SPECIFIC REQUIREMENT Rev. no. 10 (attached as Annexure-III) shall also be referred for specified scope of work. Any discrepancy between clause 9.0 Section-PROJECT and Specific Requirements as mentioned at C/ENGG/SPEC/SEC-PROJECT/SPECIFIC REQUIREMENT Rev. no. 10 (attached at Annexure-III) on scope of works, the requirement stipulated at clause 9.0 of section project shall prevail.

9.2 GIS Modules/Equipment description given in Annexure-IV shall be referred. 765kV & 220kV GIS Modules/Equipment description provided at Annexure-S11 of Specific Requirements as mentioned at

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C/ENGG/SPEC/SEC-PROJECT/SPECIFIC REQUIREMENT Rev. no. 10 (attached as Annexure-III) stands deleted.

- 9.3 At Nalagarh S/S, to meet the requirement of Bus Transfer Duty for GIS Bus Disconnectors, Bus connection to the GIS line bay modules shall be connected with AIS Isolator Bus Coupling arrangement.
- 9.4 Minimum specified creepage distance for insulator string/ longrod insulators/ outdoor bushings, including SF6 to Air Bushing shall be 31 mm/kV.
- 9.5 Establishment of CCTV System for Construction Monitoring of entire switchyard shall be as Sl. No. A.7 of SPECIFIC REQUIREMENT Rev. no 10 enclosed at Annex-III.
- 9.6 In Section-GTR and other technical specifications, the term 'Employer' and/or 'Purchaser' may be read as Employer.
- 9.7 Requirement Specified at clause no 29 of Section CRP Rev 9 for STANDALONE DISTURBANCE RECORDER (for 765 KV Feeders only) stands deleted.
- 9.8 Specific Requirement (Rev 10) clause L.6 stands deleted.
- 9.9 Specific Requirement (Rev 10) clause L.7 stands deleted.
- 9.10 Specific Requirement (Rev 10) clauses under S. No. A for Section: GTR Rev 15 stands deleted.
- 9.11 Clause no 4.1.6 of SAS Rev 04 is amended below:

Firewall and Router

There shall be two sets of Firewall and Routers which shall be connected to a LAN. This LAN shall be different than the IEC 61850 LAN. The substation firewall and router shall be suitable for the substation environment and shall comply with the requirements for IEC 61850-3. Contractor shall provide 2 nos. Firewalls; one No. Main & one No. Standby having electrical ethernet interfaces/ports and placed between FOTE & SAS gateways, NTAMC switch etc. at the substation. All ethernet based applications (e.g. PMU, AMR, VOIP, SAS/SCADA etc.) shall be terminated in the firewall ports directly. Each port of firewall shall work as a separate zone. Firewall shall be hardware based with functionality of Block/Allow/drop and IPSec VPN (network encryption). Minimum 16 Nos. of ports/interfaces shall be provided in each firewall (i.e. Main & Standby) Contractor can use either single firewall or multiple firewalls to meet this interfaces requirement, each for main as well as standby firewall. Minimum throughput of firewall shall be 300 Mbps. The Firewall shall be managed/ configured as standalone at present and shall also have compatibility to manage/configure through Centralized Management Console (CMC) remotely in future.

The substation firewall shall have the following features:

- IP firewall features such as Address/port inspection and filtering - Shall be stateful firewall - Shall support upto 4 Ethernet switches 10/100 Mbps - Shall support IPv4 and IPv6 - Shall have IP sec/VPN with 3DES/AES encryption - Shall have NAT - Shall have syslog capability - Shall be NERC compliant
- Shall have hot- standby operation with similar router

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The substation routers shall have the following features: - Routing protocols such as OSPF and support for IPv4 and IPv6 - 8 Ethernet interfaces of 10/100 Mbps - Hot standby operation with a similar router - Support IEEE 802.3u, 802.1p, 802.1Q, 802.1d, 802.1w, - Traffic prioritization for routed IP flows/ports The substation firewall and router can be a single device.

Deployed Firewall & Routers shall act as Cyber Security System in compliance with CEA (Cyber Security in Power Sector) Guidelines, 2021 and CEA (Cyber Security in Power Sector) Regulation, from its date of publication/ notification and their amendments thereof.

9.12 The requirement for Enclosure tightness test at low and high temperature for SF₆-filled CTs of 145kV and above voltage rating, as specified in Clause No. 6.0 (a)(x) of Section: Instrument Transformer (Rev 12), stands deleted.

9.13 Alternate Option of Polymer Type BPI (up to 400kV voltage level) in addition to Porcelain BPI:

Polymer BPI as an alternate to Porcelain BPI is acceptable for support applications (Except for Isolators & Wave Traps) and the Technical specifications for polymer BPI is attached at Annexure- V.