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1.0 GENERAL

- 1.1. 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 mandate 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” as its mission.
- 1.2. Govt. of India has identified the Transmission scheme for **Conversion of 765KV Bus reactor bays to 2no. 765KV SLR Line bays at 765/400KV Raichur substation and shifting of existing 50MVAR Bus reactor at Nagarjunasagar substation to a new bay for termination of 1st circuit of Sagar-Nagarjunasagar 400KV quad D/c Line through RTM mode by POWERGRID.**
- 1.3. Scope of the transmission scheme to be implemented through RTM route are as under-
- **Shifting of existing 50MVAR Bus reactor at Nagarjunasagar substation to a new bay for termination of 1st circuit of Sagar-Nagarjunasagar 400KV quad D/c Line**
 - i) Shifting of existing 50 MVAR, 420 kV Bus Reactor at Nagarjunasagar to a new bay for termination of 1st circuit of Sagar-Nagarjunasagar 400KV quad D/c line and upgradation of entire existing 50MVAR bus reactor diameter equivalent quad moose capacity (from existing Bay No. 430 to new Bay No. 425).
 - ii) 400kV Bus Reactor Bay No-425 (for installation of shifted 50MVAR bus reactor in new diameter 425-426-427) – 1 No.
 - iii) 400kV line Bay No-427 (for termination of 400KV Sagar-Nagarjunasagar Ckt-II in new diameter 425-426-427 along with GIS bus duct and associated equipment) – 1 No.
 - iv) Existing equipment of DIA 428-429-430 shall be upgraded to 3150A capacity, except CB & CT (Except 428 R-ph CT), which are already upgraded.
 - v) 400KV Line Bay No-430 (for termination of 400KV Sagar-Nagarjunasagar Ckt-I upon upgradation of existing diameter 428-429-430) – 1 No.
 - **Conversion of 765KV Bus reactor bays to 2no. 765KV SLR Line bays at 765/400KV Raichur substation (for termination of Kurnool-V – Raichur 765KV D/c Line under the scheme “Transmission system for integration of Kurnool-V REZ Phase-I)**
 - i) 765KV Line bays – 2No.

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- ii) 765kV switchable reactor bay (Conversion)- 2 No.
- iii) NGR along with bypassing scheme – 2No.

- 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 the design philosophy. The bidder 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 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.

2.0 SCOPE:

2.1 The broad scope of this specification shall cover followings:

Station Name	400/220kV Nagarjunasagar Substation
Extension Voltage Level	400kV
Bus-Switching Scheme	One and a Half Breaker Scheme
Fault level	63kA/1sec

Station Name	765/400KV Raichur Substation
Extension Voltage Level	765kV
Bus-Switching Scheme	One and a Half Breaker Scheme
Fault level	50kA/1sec

2.2 The detailed scope of work of the substation package is brought out in subsequent clauses of this section.

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2.2.1 Extension of 400/220KV Nagarjunasagar substation:

2.2.1.1 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)** Existing 50MVAR Bus reactor-1 (Make BHEL make) at 430 bay is to be dismantled, Shifted and Re-erected to the new location at Bay No. 425 as marked in the GA Drawing attached alongwith tender drawings. Testing and commissioning of existing 50MVAR bus reactor-1 from Bay no. 430 to Bay No. 425 at Nagarjunasagar substation is under present scope of work only. The contractor shall also arrange the services of OEM representative (M/s BHEL) for dismantling and re-erection of the 50MVAR Bus Reactor. All associated work such as connection to switchyard bay, Dismantling and Re-installation of HVWS & Hydrant Protection of bus reactor, power & control cabling from common Marshalling box to Control Room, earthing of bus reactor, civil work for bus reactor foundation etc. are also under present scope of work.
- i) 400kV Bus Reactor Bay No-425 (for installation of shifted 50MVAR bus reactor in new diameter 425-426-427) – 1 No.
 - ii) 400kV line Bay No-427 (for termination of 400KV Sagar-Nagarjunasagar Ckt-II in new diameter 425-426-427 along with GIS bus duct and associated equipment) – 1 No.
 - iii) Existing equipment of DIA 428-429-430 shall be upgraded to 3150A capacity, except CB & CT (Except 428 R-ph CT), which are already upgraded.
 - iv) 400KV Line Bay No-430 (for termination of 400KV Sagar-Nagarjunasagar Ckt-I upon upgradation of existing diameter 428-429-430) – 1 No.
- B)** 400kV Circuit Breakers, Isolators, Current Transformers, Capacitive voltage transformers, Wave Traps, Bus Post Insulators and 336kV Surge Arresters.
- C)** Dismantling of existing 400kV equipment of the diameter 428 (isolators & MOM Box equipment along with support structure, Current Transformers along with support Structure and clamps & connectors shall be carried out by the bidders. All the dismantled materials shall be handed over to POWERGRID by the successful bidders.
- D)** Controlled Switching device (as per BPS).
- E)** **CONTROL, RELAY & PROTECTION SYSTEM (As per BPS):** Complete Control, Relay and Protection system (for bays under present scope) as per Section– Control and Relay Panels. Any modification required in the existing protection scheme is also included in the present scope.

Nagarjunsagar substation is non- automated, control panel based substation with RTU based system for remote operation from NTAMC. The CRP panels under present scope shall be kept in the new Switchyard panel room under present scope. The CRP panels under present scope shall be provided along with 4 Nos. BCU (One each for Bay 425, 426, 427 and 430). Control panel is not envisaged for bays under present scope. A

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common audible alarm from CRP shall be wired to the room where existing control panels are placed to alert operator for any alarms in present scope bays.

- a. Augmentation of 400KV bus bar protection for the bays under present scope:

Existing Busbar protection scheme: Decentralized

Make: M/s GE make

Model: P741-PU and P743-CU.

Architecture: Decentralized architecture.

- The Peripheral units (PU) for bays (425, 427, 430) under present scope are available at site.
- Necessary shifting /modification, wiring/cabling, augmentation and integration along with supply of Aux/Trip Relays etc for completion of 400KV Bus Bar protection is under present scope and same is to be quoted under respective item available in Installation schedule of BPS.
- Also, LBB protection for bay no. 425, 427 & 430 shall be configured and commissioned in the existing Bus bar bay peripheral unit for the bay.
- Separate LBB relay is to be provided for 426 tie bay as a part of new CRP.
- New CRP panels for 400kV bays under present scope i.e. for Sagar-Nagarjunasagar 400KV quad D/c line at 427 & 430 bays and 400KV reactor protection panel at 425 bay shall be provided.
- Contractor shall also carry out necessary modification works including wiring/cabling, shifting & integration as required, in existing 400kV Control & Relay panels, for integration of Bus reactor-1 at 425 bay and any necessary changes in ICT-3 at 428 bay under present scope.
- Nagarjunasagar S/s is non-automated, control panel-based substation with RTU based system for remote operation from NTAMC. The IEDs being supplied under present scope shall be integrated with NTAMC Gateway as per technical specification for NTAMC SCADA system enclosed at ANNEXURE-IV. No work is envisaged at remote control centre.
- M/s GE make D400 RTU is existing at Nagarjunasagar S/s for data transfer to RLDC. Under present scope, existing RTU shall be augmented for data transfer to RLDC for present scope bays. As sufficient input cards are not available in the RTU for present scope bays, 1no. Digital input card & 1no. Analog input card is to be provided. However necessary transducers for augmentation of analog signals shall be provided under present scope.
- New SPR rooms are to be constructed for the DIAs 425-426-427 & 428-429-430.
- Further, protection coupler / PLCC for the 400KV Sagar-Nagarjunasagar Double Circuit line shall be supplied by line developer, however, wiring between protection coupler and CRP for completion of tele protection scheme is covered under present scope.

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- F) CABLES (As per BPS):** 1.1 kV grade Power & Control Cables (and special cables, if any) along with complete accessories including cables for oil filtration units and cabling from common marshalling box of 400kV Bus Reactor to bay kiosks/ Relay Panel Room / Control Room. Power receptacle for oil filtration unit shall also be provided under present scope of work. New cables shall be provided for new equipment and CRP panels under present scope. Methodology for supply, installation & sizing of cables shall be as per Annexure-V.
- G) ERECTION HARDWARE (as per BPS):** Erection hardware of a bay shall include Insulator strings and hardware, Disc Insulators/Long Rod Insulators (as applicable), Conductor(s), Al tube, Cable Trays & covers, spacers, clamps & connectors (including terminal connectors for 400kV Bus reactor bushings), Junction box, earth wire, earthing material risers, auxiliary earth mat (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, cable gland & Lugs, all accessories etc. as required.
- Erection Hardware under respective BPS Item shall also cover the following:
 - a) Earthing of all the equipment including cable trenches, auxiliary earth mat for isolators etc., & scope shall include Earthing of 400KV Bus reactor by connecting them to the main Earthmat.
 - b) Twin HTLS shall be used for DIA 425-426-427 & 428-429-430. IPS tube for Equipment Interconnection in Dia 428-429-430 shall be replaced with 4.5 Inch IPS tube. Similarly the dropper for the dia shall also be upgraded to Quad Bersimis. In case of non-availability of auxiliary earth mats for existing isolators, the same shall be provided in the present scope of work.
- H) Main Earthmat: As per BPS**
- Main Earthmat shall be paid as per actual length executed at site. The main earth mat is existing in some areas under present scope. In areas under present scope, where main earth mat is not available, it shall be laid under present scope. All the equipment (including 400KV Bus reactor), structures, cable trenches, auxiliary earth mat for isolators/Earth Switches etc. to be earthed by risers connecting them to the Main Earthmat and the same shall be part of Erection Hardware.
- I) ILLUMINATION (As per BPS):** LED based Lighting and illumination system for the switchyard area under present scope and Switchyard panel room. Illumination system shall be provided using the fixture types as specified in Technical Specification Section-Lighting System.
- J) LIGHTNING PROTECTION (DSLPP):** The lightning protection (DSLPP) for area under present scope is to be provided by the contractor. The contractor shall design the lightning protection by utilizing the structures provided under present scope. If the existing structures are not adequate for Lightning Protection, then LM shall be

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provided. LM shall be paid under MT rate quoted for steel structure in BPS. Earthing of LM shall be done by the contractor and same shall be deemed to be part of erection hardware for the bay.

K) FIRE PROTECTION SYSTEM (As per BPS):

a. The piping for fire protection system shall be extended from nearest available header. Further, Dismantling, shifting & re erection of existing HVWS system for 420kV, 50 MVAR Bus Reactor including supply of additional pipes, accessories etc. as required is also included under present scope. Any new item required or those damaged or rendered useless during relocation shall also be included in present scope. No supply item for is envisaged for HVWS shifting works. In case any minor item is required for the same, it shall be deemed to be included in service item for shifting of HVWS system.

b. Conventional type Smoke detection, Fire Extinguishers and augmentation of Fire alarm & Annunciation System for Switchyard panel Rooms under the present scope.

L) Augmentation of existing Visual Monitoring System (VMS) for area under present scope as per BPS.

Specification as described at Specific Requirement REV-10 to be referred to.

Visual Monitoring System (VMS) for area under present scope. Make of existing VMS software is Videonetics(2024R1). The provided system must be integrated with existing Video Monitoring software. The bidder shall provide 4nos. of IP cameras (As per approved VMS layout) with PAN, Tilt & Zoom facility suitably located in Outdoor switchyard in the present scope area. The scope of bidder shall include providing all Items, Accessories, Line Interface units, Fiber patch cords, Power supply units, Junction Boxes, Cables, Fiber Optic Cables, Hardware and Software, etc. as are applicable to the product design, to meet functional requirements. Compatibility and capability enhancement of exiting VMS system, if needed, shall be done to integrate present scope visual monitoring system with existing Visual monitoring system of the station.

M) AIR CONDITIONING SYSTEM (As per BPS): Air Conditioning System for Switchyard Panel Rooms.

N) TELECOMMUNICATION EQUIPMENT & PMU: As per BPS

- **TELECOMMUNICATION EQUIPMENT:**

- (i) Refer Annexure VI

- **PHASOR MEASUREMENT UNIT:**

- (i) Refer Annexure VII

O) 400kV Gas Insulated Switchgear:

- i) 400kV GIS Equipment description as per Specific requirement (REV-10).

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Under present scope, 400kV GIS bus ducts and 400kV SF6 to Air bushings are included for interconnection of for termination of 400KV Sagar-Nagarjunasagar Ckt-II in new diameter 425-426-427 as shown in Tender drawings.

Gas Insulated ducts shall be complete with all necessary terminal boxes, SF6 gas filling, grounding connections, gas monitoring equipment & piping and support structures along with necessary base plate & foundation bolts. In addition, all necessary portable ladders, supports etc as required for operation & maintenance work shall also be supplied.

LCC for monitoring of GAS tight chambers shall also be supplied. The LCC shall be placed in the Switchyard Panel Room under present scope.

GIS bus duct & SF6 to air bushing shall be suitable for installation in the open air, i.e. capable of withstanding wind, rain, dirt deposits, condensation and hoar frost.

Contractor shall submit the outdoor bus duct associated layouts after visiting the site and analyzing site conditions.

ii) Testing and Maintenance equipment: as per BPS

iii) Mandatory Spares for GIS: As per BPS & Technical Specification

iv) Any other equipment/material required to complete the specified GIS scope of work.

2.2.1.2 Design, engineering, manufacture, testing and supply including transportation & insurance, storage and testing at site of mandatory spares as per Bid Price Schedule (BPS).

2.2.1.3 CIVIL WORKS & SUPPORT STRUCTURE:

Lattice and pipe structures (galvanized):

- In the bid price schedule Tower, Beam and equipment support structures are indicated in Metric Ton (MT) and shall be paid as per respective items of BPS. In case of equipment support structure, the attachment of stool and fixing of MOM box etc. shall be taken care by the contractor as per the requirement of the equipment.
- The support structure for Circuit Breaker shall be as per manufacturer's design & shall be deemed to be included in the cost of respective CB.
- The fabrication drawings of towers and beams shall be provided by Employer during detailed engineering. In case POWERGRID provides the Single Line Diagram (SLD) of the structures, contractor shall prepare the fabrication drawing based on the SLD and submit for approval. However, POWERGRID may ask the Contractor to prepare the design and drawings of structures. In such case, Contractor shall prepare design and drawings and put up for Employer's approval. The design shall be payable as per relevant item of BPS.
- Design and drawings of items (if any) not covered above shall be prepared and put up for approval by the Contractor during detailed engineering.

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- Proto-corrected drawings and Bill of Materials of all structures like towers, beams, equipment support structures etc. shall be in the scope of Contractor.
- The proto corrected drawings along with BOM are to be witnessed and certified by the contractor. Certified proto corrected drawings along with BOM shall be submitted to POWERGRID for information only. Contractor shall provide editable soft copies of drawings (including Proto-corrected Shop-floor DWG in AUTOCAD) & BOMs during detailed engineering.

Civil works:

1. 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.
2. The scope of civil work shall include but shall not be limited to the following based on drawings developed by **POWERGRID**:
 - a. Stone Packing (if required) beneath foundations etc. coming up on filled up earth.
 - b. Cable trenches, road, drains- The sectional details of cable trench, road, road crossings, drains etc. shall be provided by POWERGRID. However, cable trench layout, road layout & drain layout including invert levels shall be developed by the contractor.
 - c. Switchyard fencing and switchyard gate.
 - d. Structure and foundation for all tower, beam and all equipment support structures.
 - e. Foundation of Reactors including rail cum road, unloading platform, jacking pad, Oil pit/ common oil pit, pulling block, gratings etc. as per technical specification.
 - f. Reactor Firewall Drawing
 - g. Switchyard Panel Room.
 - h. Strengthening of existing rail for shifting of reactor
3. The scope of civil work shall include but shall not be limited to the following based on drawings developed by the **CONTRACTOR**:
 - a. Site levelling work
 - The item site levelling works includes Contouring of levelling area as per technical specification. The final area of levelling shall be decided during detailed engineering.
 - 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.
 - 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.
 - HFL data duly verified by POWERGRID Site is required to be arranged by

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contractor for finalization of FGL (Finished Ground Level).

- b. Stone spreading and anti-weed treatment in the switchyard. A layout for the same shall be developed by the contractor.
- c. Providing & laying of non-woven Geo-synthetics fabric of minimum 200 GSM in separation layer between sub grade and stone spreading in switchyard.
- d. Switchyard drains and peripheral drains (along the plot boundary). Preparation of storm water drainage layout using POWERGRID standard sections.
- e. Slope Protection Works: Sectional details of drystone pitching/ RCC retaining wall etc. and slope protection layout drawing shall be prepared by the contractor.
- f. Dismantling of existing structure (Deluge Valve, water tank etc.) if required.
- g. Foundation for lighting poles, bay marshalling boxes, panels and control cubicles of equipment's wherever required.
- h. Any other item/design/drawing for completion of scope of works.

2.3 Extension of 765/400KV Raichur substation:

- 2.3.1 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) 765kV VOLTAGE CLASS AIS EQUIPMENT (As per BPS):** 765kV Circuit Breakers, Isolators, Current Transformers, Capacitive voltage transformers, Wave Traps, Bus Post Insulators and 624kV Surge Arresters.
 - B) 145kV VOLTAGE CLASS AIS EQUIPMENT (As per BPS):** 145kV Circuit Breakers and BPIs as per BPS.
 - C)** 145kV air core NGR (Ohmic rating will be provided during detailed Engineering).
 - D)** Controlled Switching device (as per BPS).
 - E)** Existing Circuit breakers at Bay nos. 708, 709 & 718 are to be dismantled and to be replaced with the new 765kV, 3150A, 50kA Circuit Breaker(3-Phase) with closing resistor (with support structure).
 - F)** Dismantling of existing 765kV BPI equipment along with support pipe structure and clamps & connectors shall be carried out by the bidder's scope. All the dismantled materials shall be handed over to POWERGRID. The vacated space after dismantling of 765KV BPI shall be used for erection of 765kV Circuit Breaker.
 - G)** Dismantling of existing civil foundation of 765kV BPIs to facilitate foundation of 765kV CB structure shall be under scope of bidder.
 - H)** The bushings of existing 765KV Bus Reactor-I & II are connected through the bus pipe. This connection arrangement shall be modified with the flexible jumpers for ease of

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reactor maintenance works, and these modification works are included in the present scope. The existing BPI (near reactor switching breaker location) which will be made spare after dismantling may be used for the proposed flexible connection with reactor.

- I)** Necessary modifications in the existing SPR cable trench shall be carried out for installation of new line protection panels, SDH & DTPC / Panel panels.

J) CONTROL, RELAY & PROTECTION SYSTEM (As per BPS):

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

- a. Augmentation of existing protection scheme & supply of new panels as per BPS:

- Supply, Installation, testing and commissioning of Line protection panels for 2nos. 765KV line bays. These new panels are to be installed in the existing SPRs.
- Any modification required in the existing protection scheme to convert existing Bus reactor protection scheme to line reactor protection scheme shall be quoted under the item “MODIFICATION OF EXISTING CRP AS PER TS” of BPS. Also, Modification required for integration of new line protection scheme and new CB relay panel for Line Reactor with existing protection scheme shall be quoted under this item. Further, Integration of New IEDs for Line protection being supplied with Existing 61850 based SAS shall also be included under this item.
- Necessary modifications in the existing SPR cable trench shall be carried out for installation of new line protection panels, SDH & DTPC / Panel panels.
- Necessary modifications in existing reactor protection panels and SAS shall be carried out for inclusion NGR bypass scheme and same shall be quoted under the item “Modification in Existing CRP & SAS for NGR Bypass.” Of BPS.
- Further, protection coupler / PLCC for the 765KV Raichur-Kurnool-V Double Circuit line shall be supplied by line developer, however, wiring between protection coupler and CRP for completion of tele protection scheme is covered under present scope.

- b. Augmentation of Substation Automation System: for bays as per BPS (bay as defined in technical specification, Section-Substation Automation System):

- Existing substation is equipped with substation automation system (based on IEC-61850) of M/s GE make. The Substation Automation System shall be augmented for the bays under present scope.
- It shall be the responsibility of the contractor to successfully integrate the BCUs and protection IEDs with existing substation automation system (which is based on IEC 61850) including updating of system database, displays, and development of additional displays and reports as per

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requirement for the bays covered under present scope. Additional license for SAS is not envisaged under the present scope.

- Necessary interface equipment and integration work at existing substation for transferring data to NTAMC, Backup NTAMC, RTAMC for Remote operation and to RLDC (RSCC) /NLDC (for supervision) through optical fibre based SDH communication link is also under present scope. However, no work is envisaged at remote end (RLDC/NLDC/NTAMC/RTAMC etc) under the present scope.

K) CABLES (As per BPS): 1.1 kV grade Power & Control Cables (and special cables, if any) along with complete accessories. Methodology for supply, installation & sizing of cables shall be as per Annexure-V.

L) ERECTION HARDWARE (as per BPS): Erection hardware of a bay shall include Insulator strings and hardware, Disc Insulators/Long Rod Insulators (as applicable), Conductor(s), Al tube, Cable Trays & covers, spacers, clamps & connectors (including terminal connectors for NGR), Junction box, earth wire, earthing material risers, auxiliary earth mat (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, cable gland & Lugs, all accessories etc. as required.

- Erection Hardware under respective BPS Item shall also cover the following:

a) Earthing of all the equipment including cable trenches, auxiliary earth mat for isolators etc., & scope shall include Earthing of NGRs by connecting them to the main Earthmat.

M) Main Earthmat: As per BPS

Main Earthmat shall be paid as per actual length executed at site. The main earth mat is existing in some areas under present scope. In areas under present scope, where main earth mat is not available, it shall be laid under present scope. All the equipment (including NGRs), structures, cable trenches, auxiliary earth mat for isolators/Earth Switches etc. to be earthed by risers connecting them to the Main Earthmat and the same shall be part of Erection Hardware.

N) ILLUMINATION (As per BPS): LED based Lighting and illumination system for the switchyard area under present scope and Switchyard panel room. Illumination system shall be provided using the fixture types as specified in Technical Specification Section-Lighting System.

O) LIGHTNING PROTECTION (DSLPP): The lightning protection (DSLPP) for area under present scope is to be provided by the contractor. The contractor shall design the lightning protection by utilizing the structures provided under present scope. If the existing structures are not adequate for Lightning Protection, then LM shall be provided. LM shall be paid under MT rate quoted for steel structure in BPS. Earthing

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of LM shall be done by the contractor and same shall be deemed to be part of erection hardware for the bay.

P) Augmentation of existing Visual Monitoring System (VMS) for area under present scope as per BPS.

Specification as described at Specific Requirement REV-10 to be referred to.

Visual Monitoring System (VMS) for area under present scope. Make of existing VMS software is Videonetics(2024R1). The provided system must be integrated with existing Video Monitoring software. The bidder shall provide 3 nos. of IP cameras (As per approved VMS layout) with PAN, Tilt & Zoom facility suitably located in Outdoor switchyard in the present scope area. The scope of bidder shall include providing all Items, Accessories, Line Interface units, Fiber patch cords, Power supply units, Junction Boxes, Cables, Fiber Optic Cables, Hardware and Software, etc. as are applicable to the product design, to meet functional requirements. Compatibility and capability enhancement of exiting VMS system, if needed, shall be done to integrate present scope visual monitoring system with existing Visual monitoring system of the station.

Q) TELECOMMUNICATION EQUIPMENT & PMU: As per BPS

- **TELECOMMUNICATION EQUIPMENT:**

- (i) **Refer Annexure VI**

- **PHASOR MEASUREMENT UNIT:**

- (ii) **Refer Annexure VII**

R) 765kV Gas Insulated Switchgear:

765kV GIS bus ducts (complete with all necessary terminal boxes, SF6 gas filling, grounding connections, gas monitoring equipment & piping and support structures along with necessary base plate & foundation bolts), 765kV SF6 to Air bushings (including support structures) for interconnection of termination of 765KV Krishnagiri-Raichur Ckt-I in 709 line bay (diameter 707-708-709) as shown in tender GA drawings shall be supplied, installed and commissioned through the other substation package.

2.3.2 Design, engineering, manufacture, testing and supply including transportation & insurance, storage and testing at site of mandatory spares as per Bid Price Schedule (BPS).

2.3.3 CIVIL WORKS & SUPPORT STRUCTURE:

Lattice and pipe structures (galvanized):

- In the bid price schedule Tower, Beam and equipment support structures are indicated in Metric Ton (MT) and shall be paid as per respective items of BPS. In case of

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equipment support structure, the attachment of stool and fixing of MOM box etc. shall be taken care by the contractor as per the requirement of the equipment.

- The support structure for Circuit Breaker shall be as per manufacturer's design & shall be deemed to be included in the cost of respective CB.
- The fabrication drawings of towers and beams shall be provided by Employer during detailed engineering. In case POWERGRID provides the Single Line Diagram (SLD) of the structures, contractor shall prepare the fabrication drawing based on the SLD and submit for approval. However, POWERGRID may ask the Contractor to prepare the design and drawings of structures. In such case, Contractor shall prepare design and drawings and put up for Employer's approval. The design shall be payable as per relevant item of BPS.
- Design and drawings of items (if any) not covered above shall be prepared and put up for approval by the Contractor during detailed engineering.
- Proto-corrected drawings and Bill of Materials of all structures like towers, beams, equipment support structures etc. shall be in the scope of Contractor.
- The proto corrected drawings along with BOM are to be witnessed and certified by the contractor. Certified proto corrected drawings along with BOM shall be submitted to POWERGRID for information only. Contractor shall provide editable soft copies of drawings (including Proto-corrected Shop-floor DWG in AUTOCAD) & BOMs during detailed engineering.

Civil works:

1. 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.
2. The scope of civil work shall include but shall not be limited to the following based on drawings developed by **POWERGRID**:
 - a. Stone Packing (if required) beneath foundations etc. coming up on filled up earth.
 - b. Cable trenches, road, drains- The sectional details of cable trench, road, road crossings, drains etc. shall be provided by POWERGRID. However, cable trench layout, road layout & drain layout including invert levels shall be developed by the contractor.
 - c. Switchyard fencing and switchyard gate.
 - d. Structure and foundation for all tower, beam and all equipment support structures.
 - e. NGR foundation drawing based on foundation plan submitted by the agency.
3. The scope of civil work shall include but shall not be limited to the following based on drawings developed by the **CONTRACTOR**:
 - a. Site levelling work
 - The item site levelling works includes Contouring of levelling area as per technical specification. The final area of levelling shall be decided during

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detailed engineering.

- 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.
 - 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.
 - HFL data duly verified by POWERGRID Site is required to be arranged by contractor for finalization of FGL (Finished Ground Level).
- b. Stone spreading and anti-weed treatment in the switchyard. A layout for the same shall be developed by the contractor.
- c. Switchyard drains and peripheral drains (along the plot boundary). Preparation of storm water drainage layout using POWERGRID standard sections.
- d. Slope Protection Works: Sectional details of drystone pitching/ RCC retaining wall etc. and slope protection layout drawing shall be prepared by the contractor.
- e. Dismantling of existing structure (Deluge Valve, water tank etc.) if required.
- f. Foundation for lighting poles, bay marshalling boxes, panels and control cubicles of equipment's wherever required.
- g. Any other item/design/drawing for completion of scope of works.

- 2.4 For buildings (if any), the complete civil works including internal and external finishing, stone soling for flooring, plinth protection, drain along plinth protection, electrical conduit and junction boxes, fan boxes, 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 the earthwork (excavation, backfilling, disposal etc.), concrete (all types), reinforcement steel, shall be measured and paid under respective items under BPS.
- 2.5 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 the 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
- 2.6 The Contractor shall also be responsible for the overall co-ordination with internal/external agencies, project management, loading, unloading, handling, moving to final destination for successful erection, testing and commissioning of the substation/switchyard.
- 2.7 Design of substation and its associated electrical & mechanical auxiliaries systems includes preparation of single line diagram, electrical layout, foundation & cable - trench layouts (including invert levels), erection key diagrams, direct stroke lightning

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protection, electrical and physical clearance diagrams, Control and protection schematics, wiring and termination schedules, design of firefighting system, outdoor lighting/illumination and other relevant drawings & documents required for engineering of all facilities within the fencing to be provided under this contract, are covered under the scope of the Contractor.

- 2.8 Any other items not specifically mentioned in the specification, but which are required for erection, testing and commissioning and satisfactory operation of the substation are deemed to be included in the scope of the specification unless specifically excluded.
- 2.9 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.

3 SPECIFIC EXCLUSIONS

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

400/220kV Nagarjunasagar SS Extn:-

- a. Employer's site office and stores.
- b. Transit Camp
- c. Approach Road outside substation boundary wall
- d. ACDB & DCDB Extension

765/400kV Raichur SS Extn:-

- a. Employer's site office and stores.
- b. Transit Camp
- c. Boundary Wall
- d. Approach Road outside substation boundary wall
- e. ACDB & DCDB Extension

4.0 PHYSICAL AND OTHER PARAMETERS

4.1 Location of the Substation – The location of substation is indicated below:

Sr. No	Name of Substation	Name of State	Nearest Rail Head
1.	400/220KV Nagarjunasagar SS	Andhra Pradesh	Macherla
2.	765/400KV Raichur SS	Karnataka	Raichure

4.2 Meteorological data - The meteorological data are as below

Name of Substation	400/220KV Nagarjunasagar SS	765/400KV Raichur SS
Altitude	Less than 1000 meter above mean sea level (MSL)	
Snow fall	NIL	
Seismic Zone	NBC 2016	
Wind Zone	NBC 2016	
Min./Max. Ambient Temperature	0 / 50 degree centigrade	
Coastal Area consideration	No	

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5.0 SCHEDULE OF QUANTITIES

The requirement of various items/equipment 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 required for successful commissioning of substation shall be included in the bid price and shall be provided at no extra cost to Employer.

6.0 BASIC REFERENCE DRAWINGS

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

Name of the Substation	765KV Level	Voltage	400KV Level	Voltage
400/220KV Nagarjunasagar Substation	—		63KA for 1 Sec	
765/400KV Raichure substation	50KA for 1 Sec		—	

- b) Plot plan and coordinates of substation land shall be provided to the successful bidder during detailed engineering.
- c) The reference drawings, which form a part of the specifications, are given at Annexure-I. The bidder 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 and 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.

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- d) It is responsibility of contractor to develop general arrangement drawing, layout drawings, single line drawing, foundation & cable trench layout, erection key diagram & all other layout drawings for present scope of work.

7.0 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.

1	Section-Project	Rev 00
2	Section-General Technical Requirement (GTR)	Rev 15
3	Section-Switchgear- CB	Rev 12
4	Section-Switchgear- ISO	Rev 13
5	Section-Switchgear- Instrument Transformer	Rev 12
6	Section-Switchgear- Surge Arrester	Rev 13
7	Section-Power and Control Cables	Rev 06
8	Section-Lighting System	Rev 07
9	Section-Fire Protection System	Rev 06
10	Section-Air Conditioning System	Rev 04
11	Section-Switchyard Erection	Rev 10
12	Section- Structures	Rev 07
13	Section-Civil Works	Rev 12 (With (correction slip - 1)
14	Section-Control and Relay Panels	Rev 09
15	Section-Substation Automation System	Rev 04
16	Section-765KV Reactor (For NGR)	Rev 08
17	Section-420KV Reactor (For Shifting & Installation works)	Rev 11
18	Section-GIS	Rev 05A
19	Section-PLCC	Rev-5
20	Section-PMU	Rev-1
21	Section-Telecommunication system	Rev-5

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, requirement of individual equipment section shall prevail.

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

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case of any discrepancy between BPS and other sections, BPS shall prevail over the other sections of the technical specifications. However, for rating of the BPS items, associated Section-Project shall prevail & is to be referred to.

8.0 MANDATORY SPARES

The prices of mandatory 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 of these mandatory spares. The bidder is clarified that no mandatory spares shall 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 has been specified as “each type/each rating/each type & rating”: If the offered spare/spares are 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.

9.0 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-II**) 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-II) on scope of works, the requirement stipulated at clause 9.0 of section project shall prevail.

9.2 **Clause No. “New Annexure-13” of Sl. No. B.25 of Specific requirement, Rev no. 10 (attached as Annexure-II) stands deleted.**

9.3 “Minimum specified creepage distance for insulator string/ longrod insulators/ outdoor bushings shall be 31 mm/kV”.

9.4 **Clause under Sl. No. A.5. of SPECIFIC REQUIREMENT (REV NO 10), Clause No. 9.2 of Section GTR rev 15 is modified as follows:**

The reports for all type tests as per technical specification shall be furnished by the Contractor along with equipment / material drawings. However, type test reports of similar equipments/ material already accepted in POWERGRID shall be applicable for all projects with similar requirements. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by POWERGRID/representative authorized by

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POWERGRID/representative of Utility /representative of accredited test lab/ representative of The National Accreditation Board for Certification Bodies (NABCB) certified agency shall also be acceptable. Unless otherwise specified elsewhere, the type test reports submitted shall be of the tests conducted within the years specified below from the originally scheduled last date of bid submission (Soft Copy). In case the test reports are of the test conducted earlier than the years specified below from the original scheduled last date of bid submission (Soft Copy)., the contractor shall repeat these test(s) at no extra cost to the Employer: -

S. No.	Name of Equipment	Validity of type test (in years)
1	Power Transformer	10
2	LT Transformer	10
3	Shunt Reactor/Series Reactor /Neutral Grounding Reactor	10
4	OLTC	10
5	Bushing of Power Transformers/Reactors	10
6	Fittings and accessories for Power transformers & Reactors	10
7	Circuit Breaker	15
8	Isolator	15
9	Lighting Arrester	15
10	Wave Trap	15
11	Instrument transformer	15
12	GIS & Hybrid GIS	15
13	LT Switchgear	10
14	Cable and associated accessories	10
15	Relays/BCU/Process Interface units /Standalone Merging unit	10
16	Capacitors	10
17	Battery and Battery charger	10
18	Conductor & Earth wire	10
19	Insulators (Porcelain/Glass)	10
20	Composite Insulators	10
21	PLCC	10

Note:- For all other equipment's validity of type test shall be 10 years from the originally scheduled last date of bid submission (Soft Copy).

Equipment shall be supplied from the same manufacturing work, where from the sample unit was manufactured and successfully type tested as per relevant standard.

Further, where offered equipment is based on the design of technology transfer of Parent organization / Joint Venture (JV), type test reports of Parent organization / Joint Venture (JV) shall also be acceptable for the initial period of 03 years from the date of establishment manufacturing facility for offered equipment provided that the design, material, and manufacturing process of the offered equipment are identical to those of the type-tested sample of the original facility. In such cases, while submitting the Type Test Reports, the Original Equipment Manufacturer (OEM), shall furnish an undertaking with it declaring that there is

No change in the Design,

No change in the material,

No change in manufacturing process, and

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No amendment/revision in the relevant standard as regard to type test conditions, since the type test In case of own manufacturing plant at different location within India, the type test of the original manufacturing works shall also be acceptable for the equipment manufactured and supplied from the different location subject to the following conditions:

The relevant standard does not bar the same,

The equipment being manufactured at different locations shall be identical in design, drawings, specifications, ratings to that of the type tested sample in the original facility (where it was manufactured and successfully type tested),

The equipment being manufactured at different locations shall be identical in material & critical components, manufacturing process/ practices, and quality control to that of the type tested sample in the original facility (where it was manufactured and successfully type tested),

Also, while submitting the Type Test Reports, the Original Equipment Manufacturer (OEM), shall furnish an undertaking for above conditions (i), (ii) and (iii).

Further, in the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification or any/all type tests not carried out, same shall be carried out without any additional cost implication to the Employer.

The Contractor shall intimate the Employer the detailed program about the type tests at least two (2) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.