

## **SECTION -PROJECT**

<b><u>CLAUSE NO.</u></b>	<b><u>PARTICULARS</u></b>	<b><u>PAGE NO.</u></b>
<b>1.0</b>	<b>GENERAL</b>	<b>2</b>
<b>2.0</b>	<b>SCOPE</b>	<b>3</b>
<b>3.0</b>	<b>SPECIFIC EXCLUSIONS</b>	<b>28</b>
<b>4.0</b>	<b>PHYSICAL AND OTHER PARAMETERS</b>	<b>28</b>
<b>5.0</b>	<b>SCHEDULE OF QUANTITIES</b>	<b>28</b>
<b>6.0</b>	<b>BASIC REFERENCE DRAWINGS</b>	<b>29</b>
<b>7.0</b>	<b>DIFFERENT SECTIONS OF TECHNICAL SPECIFICATION</b>	<b>29</b>
<b>8.0</b>	<b>SPARES</b>	<b>30</b>
<b>9.0</b>	<b>SPECIFIC REQUIREMENT</b>	<b>31</b>

**ANNEXURE –I        LIST OF DRAWINGS.**

**ANNEXURE-II        BREAK-UP FOR MANDATORY SPARES**

**ANNEXURE-III       SPECIFICATION OF VISUAL MONITORING SYSTEM**

**ANNEXURE –IV       DESCRIPTION OF ITEMS OF BPS GIVEN IN SHORT**

**ANNEXURE-V        SPECIFIC REQUIREMENT-400/220KV TRANSFORMER**

## SECTION -PROJECT

### 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 mandate of "We will become a Global Transmission Company with Dominant Leadership in Emerging Power Markets with World Class Capabilities by:

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

1.2 POWERGRID is executing extension of 765kV Solapur, 765kV Aurangabad, 765kV Wardha, 400kV Khandwa, 400kV Rajgarh, 400kV Champa, 400/220kV Itarsi & 400/220kV Jabalpur substations under Western Region System Strengthening Scheme (WRSS-20).

#### 1.3 Associated Transmission System:

##### Western Region System Strengthening Scheme (WRSS-20)

##### (A): Provision of Bus Reactors at High Voltage Nodes in Western Region

Sl. No.	Name of the Substation	Proposed Bus Reactor (MVar)
1	Aurangabad 765kV	1x240 along with 765 kV bay
2	Solapur 765kV	1x240 along with 765 kV bay
3	Wardha 765kV	1x330 along with 765 kV bay
4	Khandwa 400kV	1x125 along with 400 kV bay
5	Rajgarh 400kV	1x125 along with 400 kV bay

##### (B): Provision of Bus Reactor at Champa Pool Split Section –Part A

Transmission Scheme	Detailed scope of works
<b>Provision of Bus Reactor at Champa Pool Split Bus Section –A</b>  400 kV, 1x125 MVAR Bus reactor Champa Pool Split Section –Part A	<ul style="list-style-type: none"><li>• 400 kV, 1x125MVAR along with 400 kV bay</li></ul>

**(C): Augmentation of transformation capacity in Western Region**

Transmission Scheme	Detailed scope of works
Augmentation of transformation capacity in Western Region	<b>Jabalpur 400/220 kV S/s</b> <ul style="list-style-type: none"><li>400/220kV, 500MVA, ICT along with associated 400kV &amp; 220kV bays</li></ul>
	<b>Itarsi 400/220 kV S/s</b> <ul style="list-style-type: none"><li>400/220kV, 500MVA, ICT along with associated 400kV &amp; 220kV bays</li></ul>

## **2 SCOPE**

**2.1** The scope of this specification covers the following;

### **2.1.1 Western Region System Strengthening Scheme (WRSS-20)**

**(I) Extension of 765kV Solapur S/S with provision of following bays as per single line diagram:**

- a) 765kV bay for one bank of 765 kV bus reactors formed with 3 numbers of 80 MVAR, 765/ $\sqrt{3}$ kV single phase reactors to be used as one (1) bank of 240MVAR. This Bus Reactor bank shall also be connected with existing spare unit of Reactor.

**(II) Extension of 765kV Aurangabad S/S with provision of following bays as per single line diagram:**

- a) 765kV bay for one bank of 765 kV bus reactors formed with 3 numbers of 80 MVAR, 765/ $\sqrt{3}$ kV single phase reactors to be used as one (1) bank of 240MVAR. This Bus Reactor bank shall also be connected with existing spare unit of Reactor.

**(III) Extension of 765kV Wardha S/S with provision of following bays as per single line diagram:**

- a) 765kV bay for one bank of 765 kV bus reactors formed with 3 numbers of 80 MVAR, 765/ $\sqrt{3}$ kV single phase reactors to be used as one (1) bank of 240MVAR. This Bus Reactor bank shall also be connected with existing spare unit of Reactor.

**(IV) Extension of 400kV Khandwa S/S with provision of following bays as per single line diagram:**

- a) 400kV bays for 01 no. 125MVAR, 3-Phase Bus Reactor.

**(V) Extension of 400kV Rajgarh S/S with provision of following bays as per single line diagram:**

- a) 400kV bays for 01 no. 125MVAR, 3-Phase Bus Reactor.

**(VI) Extension of 400kV Champa S/S (Bus Sec-A) with provision of following bays as per single line diagram:**

- a) 400kV bays for 01 no. 125MVAR, 3-Phase Bus Reactor.

**(VII) Extension of 400/220kV Itarsi S/S with provision of following bays along with ICT as per single line diagram:**

- a) 500MVA 400/220kV ICT
- b) 400kV bays for 01 no. 500MVA 400/220kV, 3-Phase ICT.
- c) 220kV bays for 01 no. 500MVA 400/220kV, 3-Phase ICT.

**(VIII) Extension of 400/220kV Jabalpur S/S with provision of following bays along with ICT as per single line diagram:**

- a) 500MVA 400/220kV ICT
- b) 400kV bays for 01 no. 500MVA 400/220kV, 3-Phase ICT.
- c) 220kV bays for 01 no. 500MVA 400/220kV, 3-phase ICT.

**2.1.2** Supply, erection, testing and commissioning of 765kV Reactors (along with 33kV Neutral CT) & 400kV Reactors are covered under separate package. However, following associated works are covered under the scope of this package:

- a) Civil works of 765kV & 400kV Reactors and ICTs.
- b) Overhead connection of HV bushings of 765kV & 400kV Reactors and ICTs to substation equipment.
- c) Formation of 765kV Auxiliary Bus and 145kV Neutral Bus of 765kV Reactors and their extension upto existing Auxiliary and neutral bus. Overhead connection of substation equipment with 765kV auxiliary bus & Neutral bus of 765kV Reactors.
- d) Connection of 765kV three phase Reactor bank with the existing spare reactor
- e) Supply, laying and termination of cables alongwith associated accessories from common marshalling box of 765kV Reactors to bay kiosks /Switchyard Panel Rooms/Control Room.

**2.2** The detailed scope of work is brought out in subsequent clauses of this section.

**2.2.1 Extension of 765kV Solapur Substation**

**2.2.1.1** Design, engineering, manufacture, testing and supply, including transportation & insurance, storage, erection, testing and commissioning of the following equipment/items, complete in all respects.

- a) 765kV Circuit Breakers, Isolators, Current Transformers, Bus Post Insulators, 624kV Surge Arresters.
- b) Auxiliary bus arrangement for HV connection, neutral formation and connection arrangement with spare reactor unit as detailed in the specification. Overhead connection of HV bushings of 765kV Reactors to substation equipment. Overhead connection of substation equipment with 765kV auxiliary bus of 765kV Reactors.
- c) Control Switching Device (as per BPS). CSD for existing tie bay Circuit Breaker is also in present scope.
- d) Complete Relay & Protection System as per Section-‘Control and Relay Panels’ for 765kV bays under present scope. Existing 765kV bus bar protection system is of make M/s ABB model REB 500. Bus bar bay modules for 1 no. 765kV bay under present scope already exist. Necessary modification, wiring & integration of same for completion of 765kV bus bar protection system are also under present scope.
- e) Existing 765kV substation is equipped with substation Automation system of M/s ABB make (based on IEC 61850). BCU for the bay (in existing half diameter) under present scope is required to be supplied and same shall be integrated by the contractor with the control & protection equipment to be provided under present scope of work for completion of substation automation system for said 765kV bay.

Necessary interface & integration work for transferring data to WRLDC (RSCC) & NTAMC, Manesar is also under present scope.

The scope of contractor shall include but not limited to integration of IEDs under present scope of augmentation with existing substation automation and compatibility enhancement of same as required including updating of system database, displays, development of additional displays and reports as per requirement of WRLDC and Remote Control Centre NTAMC (Manesar)/RTAMC. Existing NTAMC SCADA is of M/s Alstom make (based on IEC 104 protocol). Bays under present scope are required to be integrated at the existing local NTAMC Gateway well.

Further, the integration of IEC61850 communication based monitoring equipment like On line dissolved Multi-Gas & Moisture analyzer, Insulating Oil drying system, Optical temperature sensor, for each unit of 765kV Reactor (to be provided in a separate contract) with substation automation system is also included in the present scope. Contractor shall also make available 220V DC redundant supply in 765kV Reactors Common MB for supply to Ethernet Switch.

- f) 1.1kV grade Power & Control cables along with complete accessories, including cabling from common marshaling box of 765kV Reactors to BMK/ Switchyard panel room.

- g) Fire protection system (HVW spray and hydrant system) for 765 kV, 1-Phase Reactors including extension of main water header from adjacent existing header.
- h) Lattice and pipe structures (galvanized): Towers, Beams and Equipment support structures except CB support structure, shall be provided as per Employer's drawings to be provided during detailed engineering. CB support structure shall be as per CB manufacturer's design. Design and drawings of non-standard items not covered above shall be prepared and put up for approval by the vendor during detailed engineering.
- i) Erection Hardware: Insulator strings hardware, Disc Insulators/Long Rod Insulators (as applicable), conductor(s), Al tube, bus-bar materials, cable trays & covers, Bay MB, spacers, clamps & connectors including equipment connectors, Junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels, Insulating mats, cable sealing arrangement, insulator guy arrangement, all accessories etc. as required.
- j) Earthmat already exists in the switchyard area under present scope (existing Earthmat layout drawing is enclosed). All the equipment (including 765kV Reactors), structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor.
- k) Earthing of Employer supplied 765kV Reactor along with associated equipment to employer's earthmat.
- l) Complete lighting and illumination for the switchyard area under present scope shall be provided by the contractor as per Bid price schedule (BPS).
- m) Augmentation of Visual Monitoring system for 765kV bays under the present scope. Existing system is of M/s Sony make. The provided system has to be integrated with existing system. The bidder shall provide 2 nos. Color IP camera with PAN, Tilt & Zoom facility suitably located in switchyard for monitoring of 765kV bay & equipment. 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 enhancement of exiting VMS system, as needed, shall be done to integrate visual monitoring for 765kV bays under present scope with existing Visual monitoring system of the station. A copy of specification for Visual Monitoring system is enclosed at Annexure-III, which shall be read only for the Augmentation scope of existing VMS system.
- n) Any other equipment/material required to complete the specified scope.

2.2.1.2 Design, engineering, manufacture, testing and supply including transportation & insurance, storage at site of mandatory spares.

2.2.1.3 Civil works - The scope of work shall include but shall not be limited to the following based on Employer supplied drawings -

- a) Foundation of 3X80MVAR, 765kV, 1-Phase Bus Reactor.
- b) Fire resistant walls between 765kV Reactors.
- c) Foundation of 765kV Towers and 765kV & 145kV Equipment Support Structures.
- d) Cable trenches along with covers including road/rail crossing, sump pits, culverts etc. However, cable trench layout including invert levels shall be prepared by the contractor. Existing Cable Trench layout drawings is enclosed at Annexure-I.
- e) All roads as shown in GA drawing including culverts. All roads shall be Concrete road.

2.2.1.4 Civil Work as per contractor's design and drawings for:

- a) Foundations for lighting panels, bay marshaling boxes, panels & control cubicles of equipments wherever required.
- b) (i) Removal, cleaning and washing of existing stone and re-spreading after doing anti-weed treatment as per Section-Civil Works is in the scope of contractor wherever stone is laid in the area under present scope.  
  
(ii) In the area under present scope where stone spreading does not exist, the same shall be provided after doing anti-weed treatment and PCC as per Section-Civil Works.
- c) Any other item/design/drawing for completion of scope of works.

## **2.2.2 Extension of 765kV Aurangabad Substation**

2.2.2.1 Design, engineering, manufacture, testing and supply, including transportation & insurance, storage, erection, testing and commissioning of the following equipment/items, complete in all respects.

- a) 765kV Circuit Breakers, Isolators, Current Transformers, Bus Post Insulators, 624kV Surge Arresters.
- b) Auxiliary bus arrangement for HV connection, neutral formation and connection arrangement with spare reactor unit as detailed in the specification. Overhead connection of HV bushings of 765kV Reactors to substation equipment. Overhead connection of substation equipment with 765kV auxiliary bus of 765kV Reactors.
- c) Control Switching Device (as per BPS). CSD for existing tie bay Circuit Breaker is also in present scope.
- d) Complete Relay & Protection System as per Section-‘Control and Relay Panels’ for 765kV bays under present scope. Existing 765kV bus bar protection system is M/s Alstom make P741. Bus bar bay modules for 1 no. 765kV bay under present scope already exist. Necessary modification, wiring

& integration of same for completion of 765kV bus bar protection system is also under present scope.

- e) Existing 765kV substation is equipped with substation Automation system of M/s Alstom make (based on IEC 61850). BCU for the bay (in existing half diameter) under present scope is required to be supplied and same shall be integrated by the contractor with the control & protection equipment to be provided under present scope of work for completion of substation automation system for said 765kV bay.

Necessary interface & integration work for transferring data to WRLDC (RSCC) & NTAMC, Manesar is also under present scope.

The scope of contractor shall include but not limited to integration of IEDs under present scope of augmentation with existing substation automation and compatibility enhancement of same as required including updating of system database, displays, development of additional displays and reports as per requirement of WRLDC and Remote Control Centre NTAMC (Manesar)/RTAMC. Existing NTAMC SCADA is of M/s Alstom make (based on IEC 104 protocol). Bays under present scope are required to be integrated at the existing local NTAMC Gateway well.

Further, the integration of IEC61850 communication based monitoring equipment like On line dissolved Multi-Gas & Moisture analyzer, Insulating Oil drying system, Optical temperature sensor, for each unit of 765kV Reactor (to be provided in a separate contract) with substation automation system is also included in the present scope. Contractor shall also make available 220V DC redundant supply in 765kV Reactors Common MB for supply to Ethernet Switch.

- f) 1.1kV grade Power & Control cables along with complete accessories, including cabling from common marshaling box of 765kV Reactors to BMK/ Switchyard panel room.
- g) Fire protection system (HVW spray and hydrant system) for 765 kV, 1-Phase Reactors including extension of main water header from adjacent existing header.
- h) Lattice and pipe structures (galvanized): Towers, Beams and Equipment support structures except CB support structure, shall be provided as per Employer's drawings to be provided during detailed engineering. CB support structure shall be as per CB manufacturer's design. Design and drawings of non-standard items not covered above shall be prepared and put up for approval by the vendor during detailed engineering.
- i) **Erection Hardware:** Insulator strings hardware, Disc Insulators/Long Rod Insulators (as applicable), conductor(s), Al tube, bus-bar materials, cable trays & covers, Bay MB, spacers, clamps & connectors including equipment connectors, Junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels, Insulating mats,



cable sealing arrangement, insulator guy arrangement, all accessories etc. as required.

- j) Earthmat already exists in the switchyard area under present scope (existing Earthmat layout drawing is enclosed). All the equipment (including 765kV Reactors), structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor.
- k) Earthing of Employer supplied 765kV Reactor alongwith associated equipment to employer's earthmat.
- l) Complete lighting and illumination for the switchyard area under present scope shall be provided by the contractor as per Bid price schedule (BPS).
- m) Augmentation of Visual Monitoring system for 765kV bays under the present scope. Existing system is of M/s Sony make. The provided system has to be integrated with existing system. The bidder shall provide 2 nos. Color IP camera with PAN, Tilt & Zoom facility suitably located in switchyard for monitoring of 765kV bays & equipment. 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 enhancement of exiting VMS system, as needed, shall be done to integrate visual monitoring for 765kV bays under present scope with existing Visual monitoring system of the station. A copy of specification for Visual Monitoring system is enclosed at Annexure-III, which shall be read only for the Augmentation scope of existing VMS system.
- n) Any other equipment/material required to complete the specified scope.

2.2.2.2 Design, engineering, manufacture, testing and supply including transportation & insurance, storage at site of mandatory spares.

2.2.2.3 Civil works - The scope of work shall include but shall not be limited to the following based on Employer supplied drawings -

- a) Foundation of 3X80MVAR, 765kV, 1-Phase Bus Reactor.
- b) Fire resistant walls between 765kV Reactors.
- c) Foundation of 765kV Towers and 765kV & 145kV Equipment Support Structures.
- d) Cable trenches along with covers including road/rail crossing, sump pits, culverts etc. However, cable trench layout including invert levels shall be prepared by the contractor. Existing Cable Trench layout drawings is enclosed at Annexure-I.
- e) All roads as shown in GA drawing including culverts. All roads shall be Concrete road.

2.2.2.4 Civil Work as per contractor's design and drawings for:

- a) Foundations for lighting panels, bay marshaling boxes, panels & control cubicles of equipments wherever required.

- b) (i) Removal, cleaning and washing of existing stone and re-spreading after doing anti-weed treatment as per Section-Civil Works is in the scope of contractor wherever stone is laid in the area under present scope.
- (ii) In the area under present scope where stone spreading does not exist, the same shall be provided after doing anti-weed treatment and PCC as per Section-Civil Works.
- c) Any other item/design/drawing for completion of scope of works.

### **2.2.3 Extension of 765kV Wardha Substation**

2.2.3.1 Design, engineering, manufacture, testing and supply, including transportation & insurance, storage, erection, testing and commissioning of the following equipment/items, complete in all respects.

- a) 765kV Circuit Breakers, Isolators, Current Transformers, Bus Post Insulators, 624kV Surge Arresters.
- b) Auxiliary bus arrangement for HV connection, neutral formation and connection arrangement with spare reactor unit as detailed in the specification. Overhead connection of HV bushings of 765kV Reactors to substation equipment. Overhead connection of substation equipment with 765kV auxiliary bus of 765kV Reactors.
- c) Control Switching Device (as per BPS). CSD for existing tie bay Circuit Breaker is also in present scope.
- d) Complete Relay & Protection System as per Section-‘Control and Relay Panels’ for 765kV bays under present scope. Existing 765kV bus bar protection system is M/s ABB make REB 500. Bus bar bay modules for 1 no. 765kV bay under present scope already exist. Necessary modification, wiring & integration of same for completion of 765kV bus bar protection system is also under present scope.
- e) Existing 765kV substation is equipped with substation Automation system of M/s ABB make (based on IEC 61850). BCU for the bay (in existing half diameter) under present scope is required to be supplied and same shall be integrated by the contractor with the control & protection equipment to be provided under present scope of work for completion of substation automation system for said 765kV bay.

Necessary interface & integration work for transferring data to WRLDC (RSCC) & NTAMC, Manesar is also under present scope.

The scope of contractor shall include but not limited to integration of IEDs under present scope of augmentation with existing substation automation and compatibility enhancement of same as required including updating of system database, displays, development of additional displays and reports as per requirement of WRLDC and Remote Control Centre NTAMC (Manesar)/RTAMC. Existing NTAMC SCADA is of M/s Alstom make (based on IEC 104 protocol). Bays under present scope are required to be integrated at the existing local NTAMC Gateway well.

Further, the integration of IEC61850 communication based monitoring equipment like On line dissolved Multi-Gas & Moisture analyzer, Insulating Oil drying system, Optical temperature sensor, for each unit of 765kV Reactor (to be provided in a separate contract) with substation automation system is also included in the present scope. Contractor shall also make available 220V DC redundant supply in 765kV Reactors Common MB for supply to Ethernet Switch.

- f) 1.1kV grade Power & Control cables along with complete accessories, including cabling from common marshaling box of 765kV Reactors to BMK/ Switchyard panel room.
- g) Fire protection system (HVV spray and hydrant system) for 765 kV, 1-Phase Reactors including extension of main water header from adjacent existing header.
- h) Lattice and pipe structures (galvanized): Towers, Beams and Equipment support structures except CB support structure, shall be provided as per Employer's drawings to be provided during detailed engineering. CB support structure shall be as per CB manufacturer's design. Design and drawings of non-standard items not covered above shall be prepared and put up for approval by the vendor during detailed engineering.
- i) Erection Hardware: Insulator strings hardware, Disc Insulators/Long Rod Insulators (as applicable), conductor(s), Al tube, bus-bar materials, cable trays & covers, Bay MB, spacers, clamps & connectors including equipment connectors, Junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels, Insulating mats, cable sealing arrangement, insulator guy arrangement, all accessories etc. as required.
- j) Earthmat already exists in the switchyard area under present scope (existing Earthmat layout drawing is enclosed). All the equipment (including 765kV Reactors), structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor.
- k) Earthing of Employer supplied 765kV Reactor alongwith associated equipment to employer's earthmat.
- l) Complete lighting and illumination for the switchyard area under present scope shall be provided by the contractor as per Bid price schedule (BPS).
- m) Augmentation of Visual Monitoring system for 765kV bays under the present scope. Existing system is of M/s Sony make. The provided system has to be integrated with existing system. The bidder shall provide 2 nos. Color IP camera with PAN, Tilt & Zoom facility suitably located in switchyard for monitoring of 400kV bays & equipment. 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 enhancement of exiting VMS system, as needed, shall be done to integrate visual monitoring for 765kV bays under present scope with existing Visual monitoring system of the station. A copy of specification for Visual Monitoring system is enclosed at Annexure-III, which shall be read only for the Augmentation scope of existing VMS system.

- n) Any other equipment/material required to complete the specified scope.

2.2.3.2 Design, engineering, manufacture, testing and supply including transportation & insurance, storage at site of mandatory spares.

2.2.3.3 Civil works - The scope of work shall include but shall not be limited to the following based on Employer supplied drawings -

- a) Foundation of 3X110MVAR, 765kV, 1-Phase Bus Reactor.
- b) Fire resistant walls between 765kV Reactors.
- c) Foundation of 765kV Towers and 765kV & 145kV Equipment Support Structures.
- d) Cable trenches along with covers including road/rail crossing, sump pits, culverts etc. However, cable trench layout including invert levels shall be prepared by the contractor. Existing Cable Trench layout drawings is enclosed at Annexure-I.
- e) All roads as shown in GA drawing including culverts. All roads shall be Concrete road.

2.2.3.4 Civil Work as per contractor's design and drawings for:

- a) Foundations for lighting panels, bay marshaling boxes, panels & control cubicles of equipments wherever required.
- b)
  - (i) Removal, cleaning and washing of existing stone and re-spreading after doing anti-weed treatment as per Section-Civil Works is in the scope of contractor wherever stone is laid in the area under present scope.
  - (ii) In the area under present scope where stone spreading does not exist, the same shall be provided after doing anti-weed treatment and PCC as per Section-Civil Works.
- c) Any other item/design/drawing for completion of scope of works.

## **2.2.4 Extension of 400kV Khandwa Substation**

2.2.4.1 Design, engineering, manufacture, testing and supply, including transportation & insurance, storage, erection, testing and commissioning of the following equipment/items, complete in all respects.

- a) 400kV Circuit Breakers, Isolators, Current Transformers, Bus Post Insulators, 336kV Surge Arresters.

- b) Overhead connection of HV bushings of 400kV Reactor to substation equipment. Supply, laying and termination of cables alongwith associated accessories from marshalling box of 400kV Reactor to bay kiosks /Switchyard Panel Rooms/Control Room.
- c) Control Switching Device (as per BPS). CSD for existing tie bay Circuit Breaker is also in present scope.
- d) Complete Relay & Protection System as per Section-‘Control and Relay Panels’ for 400kV bay under present scope.

The Bus Bar protection for 400 kV Bays under present scope is existing, which is Electro-mechanical type BB protection having Main-I/ II current differential relay with BB group master trip relay of Alstom make Model-FAC34 (High Impedance, differential Relay). BB master trip relay (Gr A and Gr B) are present at site and currently used for 426 Tie bay which is now directly connected to Bus-II. Wiring modification needs to be done at site to augment 427 main bay under present scope.

Bus bar Protection relays panels are located in control Room. Protection panels under present scope are to be located in control room. Necessary interface, wiring, supply of trip relays, auxiliary relays for interfacing with existing bus bar protection system is under present scope of work

- e) Existing 400kV substation is equipped with conventional control system. In case of control panel, no extra panel is required as already existing panel (Panel No K26) has future scope for the new Bus Reactor. Only TB and wiring modification needs to be done.  
The scope of contractor shall include but not limited to integration of IEDs under present scope of augmentation with existing NTAMC and compatibility enhancement of same as required including updating of system database, displays, development of additional displays and reports as per requirement of WRLDC and Remote Control Centre NTAMC (Manesar)/RTAMC. Existing NTAMC SCADA is of M/s Alstom make (based on IEC 104 protocol). Bays under present scope are required to be integrated at the existing local NTAMC Gateway as well. However existing BCU (for 425-426-427) is available at site so there is no need for extra BCU. Only wiring and database modification is required.
- f) 1.1kV grade Power & Control cables along with complete accessories, including cabling from marshaling box of 400kV Reactor to BMK/ Switchyard panel room.
- g) Fire protection system (HVW spray and hydrant system) for 400kV, 3-Phase Reactor including extension of main water header from adjacent existing header.
- h) Lattice and pipe structures (galvanized): Towers, Beams and Equipment support structures except CB support structure, shall be provided as per Employer’s drawings to be provided during detailed engineering. CB support structure shall be as per CB manufacturer’s design. Design and drawings of

non-standard items not covered above shall be prepared and put up for approval by the vendor during detailed engineering.

- i) Erection Hardware: Insulator strings hardware, Disc Insulators/Long Rod Insulators (as applicable), conductor(s), Al tube, bus-bar materials, cable trays & covers, Bay MB, spacers, clamps & connectors including equipment connectors, Junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels, Insulating mats, cable sealing arrangement, insulator guy arrangement, all accessories etc. as required.
  - j) Earthmat already exists in the switchyard area under present scope (existing Earthmat layout drawing is enclosed). All the equipment (including 400kV Reactor), structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor.
  - k) Earthing of Employer supplied 400kV Reactor alongwith associated equipment to employer's earthmat.
  - l) Complete lighting and illumination for the switchyard area under present scope shall be provided by the contractor as per Bid price schedule (BPS).
  - m) Augmentation of Visual Monitoring system for 400kV bays under the present scope. Existing system is of M/s Pelco make. The provided system has to be integrated with existing system. The bidder shall provide 2 nos. Color IP camera with PAN, Tilt & Zoom facility suitably located in switchyard for monitoring of 400kV bays & equipment. 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 enhancement of exiting VMS system, as needed, shall be done to integrate visual monitoring for 400kV bays under present scope with existing Visual monitoring system of the station. A copy of specification for Visual Monitoring system is enclosed at Annexure-III, which shall be read only for the Augmentation scope of existing VMS system.
  - n) Any other equipment/material required to complete the specified scope.
- 2.2.4.2 Design, engineering, manufacture, testing and supply including transportation & insurance, storage at site of mandatory spares.
- 2.2.4.3 Civil works - The scope of work shall include but shall not be limited to the following based on Employer supplied drawings -
- a) Foundation of 125MVAR, 400kV, 3-Phase Bus Reactor.
  - b) Fire resistant walls between 400kV Reactors.
  - c) Foundation for lattice & pipe structures.
  - d) Cable trenches along with covers including road/rail crossing, sump pits, culverts etc. However, cable trench layout including invert levels shall be

prepared by the contractor. Existing Cable Trench layout drawings is enclosed at Annexure-I.

- e) All roads as shown in GA drawing including culverts. All roads shall be Concrete road.

#### 2.2.4.4 Civil Work as per contractor's design and drawings for:

- a) Foundations for lighting panels, bay marshaling boxes, panels & control cubicles of equipments wherever required.
- b) (i) Removal, cleaning and washing of existing stone and re-spreading after doing anti-weed treatment as per Section-Civil Works is in the scope of contractor wherever stone is laid in the area under present scope.  
(ii) In the area under present scope where stone spreading does not exist, the same shall be provided after doing anti-weed treatment and PCC as per Section-Civil Works.
- c) Any other item/design/drawing for completion of scope of works.

### 2.2.5 Extension of 400kV Rajgarh Substation

#### 2.2.5.1 Design, engineering, manufacture, testing and supply, including transportation & insurance, storage, erection, testing and commissioning of the following equipment/items, complete in all respects.

- a) 400kV Circuit Breakers, Isolators, Current Transformers, Bus Post Insulators, 336kV Surge Arresters.
- b) Overhead connection of HV bushings of 400kV Reactor to substation equipment. Supply, laying and termination of cables alongwith associated accessories from marshalling box of 400kV Reactor to bay kiosks /Switchyard Panel Rooms/Control Room.
- c) Control Switching Device (as per BPS). CSD for existing tie bay Circuit Breaker is also in present scope.
- d) Complete Relay & Protection System as per Section-‘Control and Relay Panels’ for 400kV bays under present scope. Existing 400kV bus bar protection system is of make M/s ABB, model REB 500. Necessary bus bar bay modules (peripheral units) for 1 no. of 400kV bay under present scope shall be provided by contractor under present scope. Necessary modification, wiring & integration of same for completion of 400kV bus bar protection system is also under present scope.
- e) Existing 400kV substation is equipped with substation Automation system of M/s ABB make (based on IEC 61850). BCU for the bay (in existing half diameter) under present scope is required to be supplied and same shall be integrated by the contractor with the control & protection equipment to be provided under present scope of work for completion of substation automation system for said 400kV bay.

Necessary interface & integration work for transferring data to WRLDC (RSCC) & NTAMC, Manesar is also under present scope.

The scope of contractor shall include but not limited to integration of IEDs under present scope of augmentation with existing substation automation and compatibility enhancement of same as required including updating of system database, displays, development of additional displays and reports as per requirement of WRLDC and Remote Control Centre NTAMC (Manesar)/RTAMC. Existing NTAMC SCADA is of M/s Alstom make (based on IEC 104 protocol). Bays under present scope are required to be integrated at the existing local NTAMC Gateway well.

Further, the integration of IEC61850 communication based monitoring equipment like On line dissolved Multi-Gas & Moisture analyzer, Insulating Oil drying system, Optical temperature sensor, for each unit of 400kV Reactor (to be provided in a separate contract) with substation automation system is also included in the present scope. Contractor shall also make available 220V DC redundant supply in 400kV Reactors Common MB for supply to Ethernet Switch.

- f) 1.1kV grade Power & Control cables along with complete accessories, including cabling from marshaling box of 400kV Reactor to BMK/ Switchyard panel room.
- g) Fire protection system (HVW spray and hydrant system) for 400kV, 3-Phase Reactor including extension of main water header from adjacent existing header.
- h) Lattice and pipe structures (galvanized): Towers, Beams and Equipment support structures except CB support structure, shall be provided as per Employer's drawings to be provided during detailed engineering. CB support structure shall be as per CB manufacturer's design. Design and drawings of non-standard items not covered above shall be prepared and put up for approval by the vendor during detailed engineering.
- i) Erection Hardware: Insulator strings hardware, Disc Insulators/Long Rod Insulators (as applicable), conductor(s), Al tube, bus-bar materials, cable trays & covers, Bay MB, spacers, clamps & connectors including equipment connectors, Junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels, Insulating mats, cable sealing arrangement, insulator guy arrangement, all accessories etc. as required.
- j) Earthmat already exists in the switchyard area under present scope (existing Earthmat layout drawing is enclosed). All the equipment (including 400kV Reactor), structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor.
- k) Earthing of Employer supplied 400kV Reactor alongwith associated equipment to employer's earthmat.



- l) Complete lighting and illumination for the switchyard area under present scope shall be provided by the contractor as per Bid price schedule (BPS).
  - m) Augmentation of Visual Monitoring system for 400kV bays under the present scope. Existing system is of M/s Pelco make. The provided system has to be integrated with existing system. The bidder shall provide 2 nos. Color IP camera with PAN, Tilt & Zoom facility suitably located in switchyard for monitoring of 400kV bays & equipment. 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 enhancement of exiting VMS system, as needed, shall be done to integrate visual monitoring for 400kV bays under present scope with existing Visual monitoring system of the station. A copy of specification for Visual Monitoring system is enclosed at Annexure-III, which shall be read only for the Augmentation scope of existing VMS system.
  - n) Any other equipment/material required to complete the specified scope.
- 2.2.5.2 Design, engineering, manufacture, testing and supply including transportation & insurance, storage at site of mandatory spares.
- 2.2.5.3 Civil works - The scope of work shall include but shall not be limited to the following based on Employer supplied drawings -
- a) Foundation of 125MVAR, 400kV, 3-Phase Bus Reactor.
  - b) Fire resistant walls between 400kV Reactors.
  - c) Foundation for lattice & pipe structures.
  - d) Cable trenches along with covers including road/rail crossing, sump pits, culverts etc. However, cable trench layout including invert levels shall be prepared by the contractor. Existing Cable Trench layout drawings is enclosed at Annexure-I.
  - e) All roads as shown in GA drawing including culverts. All roads shall be Concrete road.
- 2.2.5.4 Civil Work as per contractor's design and drawings for:
- a) Foundations for lighting panels, bay marshaling boxes, panels & control cubicles of equipments wherever required.
  - b)
    - (i) Removal, cleaning and washing of existing stone and re-spreading after doing anti-weed treatment as per Section-Civil Works is in the scope of contractor wherever stone is laid in the area under present scope.
    - (ii) In the area under present scope where stone spreading does not exist, the same shall be provided after doing anti-weed treatment and PCC as per Section-Civil Works.
  - c) Any other item/design/drawing for completion of scope of works.

## **2.2.6      Extension of 400kV Champa Substation**

2.2.6.1      Design, engineering, manufacture, testing and supply, including transportation & insurance, storage, erection, testing and commissioning of the following equipment/items, complete in all respects.

- a)      400kV Circuit Breakers, Isolators, Current Transformers, Bus Post Insulators, 336kV Surge Arresters.
- b)      Overhead connection of HV bushings of 400kV Reactor to substation equipment. Supply, laying and termination of cables alongwith associated accessories from marshalling box of 400kV Reactor to bay kiosks /Switchyard Panel Rooms/Control Room.
- c)      Control Switching Device (as per BPS). CSD for existing tie bay Circuit Breaker is also in present scope.
- d)      Complete Relay & Protection System as per Section-‘Control and Relay Panels’ for 400kV bays under present scope. Existing 400kV bus bar protection system is of make M/s ABB, model REB 670. The same shall be augmented by the contractor by providing necessary auxiliary relays, trip relays, wiring etc. for completion of bus bar protection system for bays under present scope of work.
- e)      Existing 400kV substation is equipped with substation Automation system of M/s ABB make (based on IEC 61850). BCU for the bay (in existing half diameter) under present scope already exists at site and same shall be integrated by the contractor with the control & protection equipment to be provided under present scope of work for completion of substation automation system for said 400kV bay.

Necessary interface & integration work for transferring data to WRLDC (RSCC) & NTAMC, Manesar is also under present scope.

The scope of contractor shall include but not limited to integration of IEDs under present scope of augmentation with existing substation automation and compatibility enhancement of same as required including updating of system database, displays, development of additional displays and reports as per requirement of WRLDC and Remote Control Centre NTAMC (Manesar)/RTAMC. Existing NTAMC SCADA is of M/s Alstom make (based on IEC 104 protocol). Bays under present scope are required to be integrated at the existing local NTAMC Gateway well.

Further, the integration of IEC61850 communication based monitoring equipment like On line dissolved Multi-Gas & Moisture analyzer, Insulating Oil drying system, Optical temperature sensor, for each unit of 400kV Reactor (to be provided in a separate contract) with substation automation system is also included in the present scope. Contractor shall also make available 220V DC redundant supply in 400kV Reactors Common MB for supply to Ethernet Switch.

- f) 1.1kV grade Power & Control cables along with complete accessories, including cabling from marshaling box of 400kV Reactor to BMK/ Switchyard panel room.
- g) Fire protection system (HVW spray and hydrant system) for 400kV, 3-Phase Reactor including extension of main water header from adjacent existing header.
- h) Lattice and pipe structures (galvanized): Towers, Beams and Equipment support structures except CB support structure, shall be provided as per Employer's drawings to be provided during detailed engineering. CB support structure shall be as per CB manufacturer's design. Design and drawings of non-standard items not covered above shall be prepared and put up for approval by the vendor during detailed engineering.
- i) Erection Hardware: Insulator strings hardware, Disc Insulators/Long Rod Insulators (as applicable), conductor(s), Al tube, bus-bar materials, cable trays & covers, Bay MB, spacers, clamps & connectors including equipment connectors, Junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels, Insulating mats, cable sealing arrangement, insulator guy arrangement, all accessories etc. as required.
- j) Earthmat already exists in the switchyard area under present scope (existing Earthmat layout drawing is enclosed). All the equipment (including 400kV Reactor), structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor.
- k) Earthing of Employer supplied 400kV Reactor alongwith associated equipment to employer's earthmat.
- l) Complete lighting and illumination for the switchyard area under present scope shall be provided by the contractor as per Bid price schedule (BPS).
- m) Augmentation of Visual Monitoring system for 400kV bays under the present scope. Existing system is of M/s Sony make. The provided system has to be integrated with existing system. The bidder shall provide 2 nos. Color IP camera with PAN, Tilt & Zoom facility suitably located in switchyard for monitoring of 400kV bays & equipment. 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 enhancement of exiting VMS system, as needed, shall be done to integrate visual monitoring for 400kV bays under present scope with existing Visual monitoring system of the station. A copy of specification for Visual Monitoring system is enclosed at Annexure-III, which shall be read only for the Augmentation scope of existing VMS system.
- n) Any other equipment/material required to complete the specified scope.

- 2.2.6.2 Design, engineering, manufacture, testing and supply including transportation & insurance, storage at site of mandatory spares.
- 2.2.6.3 Civil works - The scope of work shall include but shall not be limited to the following based on Employer supplied drawings -
- a) Foundation of 125MVAR, 400kV, 3-Phase Bus Reactor.
  - b) Fire resistant walls between 400kV Reactors.
  - c) Foundation for lattice & pipe structures.
  - d) Cable trenches along with covers including road/rail crossing, sump pits, culverts etc. However, cable trench layout including invert levels shall be prepared by the contractor. Existing Cable Trench layout drawings is enclosed at Annexure-I.
  - e) All roads as shown in GA drawing including culverts. All roads shall be Concrete road.
- 2.2.6.4 Civil Work as per contractor's design and drawings for:
- a) Foundations for lighting panels, bay marshaling boxes, panels & control cubicles of equipments wherever required.
  - b) (i) Removal, cleaning and washing of existing stone and re-spreading after doing anti-weed treatment as per Section-Civil Works is in the scope of contractor wherever stone is laid in the area under present scope.  
  
(ii) In the area under present scope where stone spreading does not exist, the same shall be provided after doing anti-weed treatment and PCC as per Section-Civil Works.
  - c) Any other item/design/drawing for completion of scope of works.

## **2.2.7 Extension of 400/220kV Jabalpur Substation**

- 2.2.7.1 Design, engineering, manufacture, testing and supply, including transportation & insurance, storage, erection, testing and commissioning of the following equipment/items, complete in all respects.
- a) 500 MVA, 400/220/33kV, 3-Phase Autotransformer.
  - b) 400kV & 220kV Circuit Breakers, Isolators, Current Transformers, BPIs and 336kV & 216kV Surge Arresters.
  - c) Control Switching Device (as per BPS).
  - d) Complete Relay & Protection System as per Section-'Control and Relay Panels' for 400kV & 220kV bays under present scope. Existing 400kV bus bar protection system is of make M/s ABB model REB 670. Bus bar bay modules for 2 nos. 400kV bays under present scope already exist. Necessary modification, wiring & integration of same for completion of 400kV bus bar protection system are also under present scope. Further, existing 220kV Bus bar protection system needs to be augmented for 01 no 220kV bay under

present scope. Necessary interface, supply of trip relays, auxiliary relays, bus bar bay modules, modification, wiring & integration of same for completion of 220kV bus bar protection system is also under present scope.

- e) Existing 400/220kV Jabalpur substation is equipped with conventional control system. Control panels matching with existing panel are required to be provided for bays under present scope with suitable integration to the existing system.  
The scope of contractor shall include but not limited to integration of IEDs under present scope of augmentation with existing NTAMC and compatibility enhancement of same as required including updating of system database, displays, development of additional displays and reports as per requirement of WRLDC and Remote Control Centre NTAMC (Manesar)/RTAMC. Existing NTAMC SCADA is of M/s Alstom make (based on IEC 104 protocol). Bays under present scope are required to be integrated at the existing local NTAMC Gateway as well. However existing BCU (for 425-426-427) is available at site so there is no need for extra BCU. Only wiring and database modification is required.
- f) Digital RTCC panel with 5 Nos. digital RTCC relays. The scope includes integration of present scope ICT and existing two nos. 400/220kV ICTs with this RTCC panel.
- g) 1.1kV grade Power & Control cables along with complete accessories, including cabling from marshaling box of 400/220kV Transformer to bay kiosks /Switchyard panel room /control room and 3.5CX300 Sqmm XLPE Cable for oil filtration socket near 400/220 kV ICT .
- h) Fire protection system including HVWS & Hydrant system for 400/220kV, 3-Phase Autotransformers and Smoke detection, Fire alarm & Annunciation System for Switchyard panel Rooms. The piping for firefighting protection system shall be extended from piping near existing 400/220 kV ICT#2.
- i) Air Conditioning System for Switchyard Panel Room.
- j) Lattice and pipe structures (galvanized): Towers, Beams and Equipment support structures except CB support structure, shall be provided as per Employer's drawings to be provided during detailed engineering. CB support structure shall be as per CB manufacturer's design. Design and drawings of non-standard items not covered above shall be prepared and put up for approval by the vendor during detailed engineering.
- k) Erection Hardware: Insulator strings hardware, Disc Insulators/Long Rod Insulators (as applicable), conductor(s), Al tube, bus-bar materials, cable trays & covers, Bay MB, spacers, clamps & connectors including equipment connectors, Junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels, Insulating mats, cable sealing arrangement, insulator guy arrangement, all accessories etc. as required.

- l) Earthing of bays & ICT under present scope. Main earthing grid of already existing switchyard area is to be extended to the bays under present scope (existing Earthmat layout drawing is enclosed). All the equipment (including 400/220kV ICT), structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor.
- m) Complete lighting and illumination for the switchyard area under present scope shall be provided by the contractor as per Bid price schedule (BPS). Illumination for the switchyard Panel Rooms, shall be provided by the contractor as per Bid price schedule (BPS).
- n) Augmentation of Visual Monitoring system for 400kV bays under the present scope. Existing system is of M/s Pelco make. The provided system has to be integrated with existing Video Monitoring software. The bidder shall provide 2 nos. Color IP camera with PAN, Tilt & Zoom facility suitably located in switchyard for monitoring of 400kV bays & equipment. 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 enhancement of exiting VMS system, as needed, shall be done to integrate visual monitoring for 400kV bays under present scope with existing Visual monitoring system of the station. A copy of specification for Visual Monitoring system is enclosed at Annexure-III, which shall be read only for the Augmentation scope of existing VMS system.
- o) Any other equipment/material required to complete the specified scope.
- p) Jabalpur Substation has space constraints and the present scope of work as shown in GA & SLD is to be executed in the available space as per the site conditions. Bidders are advised to visit the site so as to acquaint themselves of the site conditions.

2.2.7.2 Design, engineering, manufacture, testing and supply including transportation & insurance, storage at site of mandatory spares.

2.2.7.3 Civil works - The scope of work shall include but shall not be limited to the following based on Employer supplied drawings -

- a) Foundation of 500MVA, 400/220kV, 3-Phase Auto Transformer.
- b) Fire resistant walls between 400/220kV Auto Transformer.
- c) Foundation of 400kV & 220 kV Equipment Support Structures, 400kV & 220 kV Towers
- d) Cable trenches along with covers including road/rail crossing, sump pits, culverts etc. However, cable trench layout including invert levels shall be prepared by the contractor. Existing Cable Trench layout drawings is enclosed at Annexure-I.
- e) All roads as shown in GA drawing including culverts. All roads shall be Concrete road.

2.2.7.4 Civil Work as per contractor's design and drawings for:

- a) Foundations for lighting panels, bay marshaling boxes, panels & control cubicles of equipments wherever required.
- b) (i) Removal, cleaning and washing of existing stone and re-spreading after doing anti-weed treatment as per Section-Civil Works is in the scope of contractor wherever stone is laid in the area under present scope.  
(ii) In the area under present scope where stone spreading does not exist, the same shall be provided after doing anti-weed treatment and PCC as per Section-Civil Works.
- c) Any other item/design/drawing for completion of scope of works.

## **2.2.8 Extension of 400/220kV Itarsi Substation**

- 2.2.8.1 Design, engineering, manufacture, testing and supply, including transportation & insurance, storage, erection, testing and commissioning of the following equipment/items, complete in all respects.

### **I. 400kV Gas Insulated Switchgear & other associated equipments**

The existing 400kV switchyard at Itarsi S/S is AIS type with one and a half breaker Switching Scheme, D-type layout. The proposed bays are to be extended from existing 400kV AIS system to GIS system as per the tender GA & SLD drawings enclosed at Annexure-I.

420 kV SF6 gas insulated switch gear shall be of **outdoor** type having arrangement and switching scheme as indicated in the tender drawings. The outdoor type Switchgear (50 Hz) 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 SF6 gas insulated switch gear (50 Hz) shall be of the outdoor metal- enclosed type, comprising of following modules:-

- (a) **420kV, 40kA** for 1 second, SF6 gas-insulated metal enclosed **Outdoor ICT bay module** (Main/Tie), each set comprising of the following:-
  - (i) One (1) number 3-phase, 3150A, SF<sub>6</sub> insulated circuit breaker without PIR complete with operating mechanism.
  - (ii) Three (3) numbers 1-phase, 3000A, 5-core, multi ratio, current transformers duly distributed on both side of circuit breaker.
  - (iii) Two (2) numbers 3-phase, 3150A, group operated isolator switches, complete with manual and motor driven operating mechanisms.
  - (iv) Two (2) numbers 3-phase, group operated safety grounding switches, complete with manual and motor driven operating mechanisms.
  - (v) 3150A, single phase SF6 ducts for interconnection of above mentioned elements.
  - (vi) Gas monitoring devices, barriers, pressure switches, UHF PD sensors etc. as required.
  - (vii) Local Control Cubicle (if applicable).

**One end of this module should be capable of connecting with 420kV, 4000A GIB**

**(Main Bus) and other end to the Tie/Main Bay module mentioned above as applicable (Refer Tender GA drawing).**

In addition all necessary supports, ladders etc. for operation & maintenance work shall also be supplied.

**(b) 420kV Gas Insulated Bus (GIB) Ducts:-**

420 kV, 3000A, single phase enclosure SF6 gas ducts including support structure from GIS module to center line of SF6/Air Bushing shall be three single phase (isolated) for interconnection for extension of 400kV AIS Main Bus-I & II and for interconnection to switchyard equipment (AIS) associated with ICT bay as shown in GA/ SLD drawing.

The 420kV SF6 gas insulated bus (GIB) ducts shall be complete with all necessary SF<sub>6</sub> gas filling, interconnecting power and control wiring, grounding connections, gas monitoring devices, barriers, pressure switches, UHF PD sensors, piping & support structures.

SF6 gas ducts used outside the GIS modules are covered under this item. The GIB duct length shall be optimized further without affecting the switchyard arrangement and bay orientation and also any of the functional requirements specified.

**(c) 420kV Gas Insulated SF6 to Air Termination:-**

420 kV 3000A, 1-Ph SF6/air bushings along with terminal connectors & support structure for outdoor connections to connect GIS bay with ICT and for outdoor connections to extend 400kV AIS Main Bus I & II to GIS as per SLD and GA drawing.

(d) Testing and Maintenance Equipments as per **BPS** (Bid Price Schedule).

(e) Mandatory Spares for GIS as per **Technical Specification Section GIS: Rev 5**.

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

**(II) Air Insulated Switchgear & other associated equipments**

- a) 500 MVA, 400/220/33kV, 3-Phase Autotransformer.
- b) 400kV Isolator, 220kV Circuit Breakers, Isolators, Current Transformers, 400kV & 220kV BPI and 336kV & 216kV Surge Arresters.
- c) Control Switching Device (as per BPS).
- d) Complete Relay & Protection System as per Section-‘Control and Relay Panels’ for 400kV & 220kV bays under present scope. Existing 400kV & 220kV bus bar protection system is of make M/s ABB, model REB 670. The bay units for the bays under present scope already exist. The same shall be augmented by the contractor by



providing necessary auxiliary relays, trip relays, wiring etc. for completion of bus bar protection system for bays under present scope of work.

Bus bar Protection relays panels (both 400 kV & 220 kV) are located in Control Room. Protection panels under present scope are to be located in Switchyard panel room.

- e) Existing 400kV substation is equipped with substation Automation system of M/s Siemens make (based on IEC 61850). Contractor shall provide BCUs for 2 nos. of 400kV bays and 1 no. 220 kV bays (bay as defined in technical specification, Section - Substation Automation System) under the present scope including all necessary hardware and software to integrate the same with existing Substation Automation System.

Necessary interface & integration work for transferring data to WRLDC (RSCC) & NTAMC, Manesar is also under present scope.

The scope of contractor shall include but not limited to integration of IEDs under present scope of augmentation with existing substation automation and compatibility enhancement of same as required including updating of system database, displays, development of additional displays and reports as per requirement of WRLDC and Remote Control Centre NTAMC (Manesar)/RTAMC. Existing NTAMC SCADA is of M/s Alstom make (based on IEC 104 protocol). Bays under present scope are required to be integrated at the existing local NTAMC Gateway well.

Further, the integration of IEC61850 communication based monitoring equipment like On line dissolved Multi-Gas & Moisture analyzer, Insulating Oil drying system, Optical temperature sensor, for the 400/220kV Transformer with substation automation system is also included in the present scope.

- f) The integration of present scope ICT with existing Digital RTCC panel is in present scope. All required cabling, wiring for the same shall be included in the scope.
- g) 1.1kV grade Power & Control cables along with complete accessories, including cabling from marshaling box of 400/220kV Transformer to bay kiosks /Switchyard panel room /control room and 3.5CX300 Sqmm XLPE Cable for oil filtration socket near 400/220 kV ICT .
- h) Fire protection system including HVWS & Hydrant system for 400/220kV, 3-Phase Autotransformers and Smoke detection, Fire alarm & Annunciation System for Switchyard panel Rooms. The piping for firefighting protection system shall be extended from piping near existing 400/220 kV ICT#2.
- i) Air Conditioning System for Switchyard Panel Room.
- j) Lattice and pipe structures (galvanized): Towers, Beams and Equipment support structures except CB support structure, shall be provided as per Employer's drawings to be provided during detailed engineering. CB support structure shall be as per CB manufacturer's design. Design and drawings of non-standard items not covered above shall be prepared and put up for approval by the vendor during detailed engineering.

- k) Insulator strings hardware, Disc Insulators/Long Rod Insulators (as applicable), conductor(s), Al tube, bus-bar materials, cable trays & covers, Bay MB, spacers, clamps & connectors including equipment connectors, Junction box, earthwire, earthing material risers, auxiliary earthmat (excluding main earth mat), buried cable trenches/pipes for equipment & lighting, cable supporting angles/channels, Insulating mats, cable sealing arrangement, insulator guy arrangement, all accessories etc. as required.
  - l) Earthing of bays & ICT under present scope. Main earthing grid of already existing switchyard area is to be extended to the bays under present scope (existing Earthmat layout drawing is enclosed). All the equipment (including 400/220kV ICT), structures, cable trenches, auxiliary earthmat for isolators etc. shall be earthed by connecting them to the main Earthmat by the contractor.
  - m) Complete lighting and illumination for the switchyard area under present scope shall be provided by the contractor as per Bid price schedule (BPS). Illumination for the switchyard Panel Rooms, shall be provided by the contractor as per Bid price schedule (BPS).
  - n) Augmentation of Visual Monitoring system for 400kV & 220 bays under the present scope. Existing system is of M/s PELCO make. The provided system has to be integrated with existing Video Monitoring software. The bidder shall provide 3 nos. Color IP camera with PAN, Tilt & Zoom facility suitably located in switchyard for monitoring of 400kV & 220kV bays & equipment. 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 enhancement of exiting VMS system, as needed, shall be done to integrate visual monitoring for 400kV & 220kV bays under present scope with existing Visual monitoring system of the station. A copy of specification for Visual Monitoring system is enclosed at Annexure-III, which shall be read only for the Augmentation scope of existing VMS system.
  - o) Any other equipment/material required to complete the specified scope.
- 2.2.8.2 Design, engineering, manufacture, testing and supply including transportation & insurance, storage at site of mandatory spares.
- 2.2.8.3 Civil works - The scope of work shall include but shall not be limited to the following based on Employer supplied drawings -
- a) Foundation of 500MVA, 400/220kV, 3-Phase Auto Transformer.
  - b) Fire resistant walls between 400/220kV Auto Transformer.
  - c) Foundation of 400kV & 220 kV Equipment Support Structures, 400kV & 220 kV Towers.
  - d) Cable trenches along with covers including road/rail crossing, sump pits, culverts etc. However, cable trench layout including invert levels shall be prepared by the contractor. Existing Cable Trench layout drawings is enclosed at Annexure-I.
  - e) All roads as shown in GA drawing including culverts. All roads shall be Concrete road.
  - f) Switchyard Panel Rooms

2.2.8.4 Civil Work as per contractor's design and drawings for:

- a) Foundations for lighting panels, bay marshaling boxes, panels & control cubicles of equipments wherever required.
- b) (i) Removal, cleaning and washing of existing stone and re-spreading after doing anti-weed treatment as per Section-Civil Works is in the scope of contractor wherever stone is laid in the area under present scope.  
(ii) In the area under present scope where stone spreading does not exist, the same shall be provided after doing anti-weed treatment and PCC as per Section-Civil Works.
- c) Any other item/design/drawing for completion of scope of works.

**2.3** Design, engineering, manufacture, testing, supply on FOR destination site basis including transportation & insurance, storage at site of mandatory spares for items mentioned in the bid price schedule (BPS) & as per break-up at Annexure-III.

**2.4** 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 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 based on conceptual tender drawings.

**2.5** The Contractor shall also be responsible for the overall co-ordination with internal/external agencies, project management, training of Employer's manpower, loading, unloading, handling, moving to final destination for successful erection, testing and commissioning of the substation/switchyard.

**2.6** 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 protection, electrical and physical clearance diagrams, Control and protection schematics, wiring and termination schedules, design of fire fighting 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.

**2.7** 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.

- 2.8 Employer has standardized its technical specification for various equipments 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

- a) Employer's site office and stores.
- b) Contouring & Site Leveling.
- c) Boundary wall along substation property line
- d) Approach Road upto Sub-station boundary.
- e) Soil Investigation & Measurement of soil resistivity
- f) Supply & Installation of 765kV & 400kV Reactors
- g) Cabling from Individual MB to Common MB of 765kV Reactors

## 4 PHYSICAL AND OTHER PARAMETERS

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

S. No	Name of Substation	Name of State	Nearest Rail Head
1	Solapur	Maharashtra	Solapur
2.	Aurangabad	Maharashtra	Aurangabad
3.	Wardha	Maharashtra	Wardha
4.	Khandwa	M.P.	Khandwa
5.	Rajgarh	M.P.	Rajgarh
6.	Champa	Chhattisgarh	Champa
7.	Jabalpur	M.P.	Jabalpur
8.	Itarsi	M.P.	Itarsi

### 4.2 Meteorological data

The meteorological data of the substations shall be furnished to successful bidder. However, for design purposes, ambient temperature should be considered as 50 degree centigrade and altitude to be considered as 1000 mtrs.

## 5 SCHEDULE OF QUANTITIES

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

All equipments/items 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 Lot/Set, 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.

The detailed bill of quantities of the mandatory spares for which break up is not given in the bid price Schedules are indicated at Annexure-II of this part.

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 BASIC REFERENCE DRAWINGS**

**6.1** 765kV Aurangabad, 765kV Solapur, 765kV Wardha, 400kV Khandwa, 400kV Rajgarh, 400kV Champa, 400/220kV Itarsi, 400/220kV Jabalpur substations are with breaker and half switching scheme having I type layout arrangement at Aurangabad, Solapur, Wardha, Khandwa & Rajgarh substation, while D-type arrangement at 400kV Champa, Itarsi & Jabalpur substation. 220kV Itarsi & Jabalpur have DMT scheme.

**6.2** 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, 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**

For the purpose of present scope of work, technical specification (Vol. II) shall consist of following sections and they should be read in conjunction with each other.

- |    |   |           |
|----|---|-----------|
| a) | Section-Project.                                  | (Rev.00)  |
| b) | Section-General Technical Requirements            | (Rev.14)  |
| c) | Section- 400kV Transformer                        | (Rev 11)  |
| d) | Section- Switchgear- CB                           | (Rev 11)  |
| e) | Section- Switchgear- ISO                          | (Rev 11A) |
| f) | Section- Switchgear-INST (Instrument Transformer) | (Rev 11)  |
| g) | Section- Switchgear- Surge Arrester               | (Rev 11)  |

h)	Section-Gas Insulated Switchgear	(Rev.05)
i)	Section-Power and Control Cables	(Rev.06)
j)	Section-Lighting System	(Rev.07)
k)	Section-Fire Protection System	(Rev.06)
l)	Section-Air Conditioning System	(Rev.04)
m)	Section-Switchyard Erection	(Rev.10)
n)	Section-Structure	(Rev.06)
o)	Section- LT Switchgear	(Rev.05)
p)	Section-Sub-Station Civil Works	(Rev.11A)
q)	Section-Control, Relay & Protection Panels	(Rev.09)
r)	Section-Substation Automation System	(Rev.04)

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 equipments, requirement of individual equipment section shall prevail.

## **8 MANDATORY SPARES**

The 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 of 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.

## **9 SPECIFIC REQUIREMENT**

- 9.1** For locking of Reactor tank on foundation, two parallel plates of 200mm wide and 32mm thick shall be embedded on both sides of outer rail.
- 9.2** The bidder is required to quote the price of isolator(s) with the insulator as an integral part of the Isolator(s). In case the price of insulators and metalics for isolator(s) are quoted separately by the bidder, the total price quoted by the bidder for such insulators shall be considered as the lump sum price of

insulators required for the specified quantity of isolator(s) under the subject package(s). In such an event the quantity of insulators indicated by the bidder shall be treated as the quantity estimated by the bidder.

- 9.3 Erection, testing and commissioning of Reactors, Transformers, Circuit breakers, Isolators, Substation automation system, Control & protection panels, etc. shall be done by the contractor under the supervision of respective equipment manufacturers. Charges for the above supervision shall be included by the bidder in the erection charges for the respective equipment in the BPS.
- 9.4 The layout drawing for connection arrangement of 765kV Reactors shall be made in such a way that existing spare unit of Reactor can be connected in place of faulty unit without physically shifting it from its location. For this purpose, HV Auxiliary bus & neutral bus of existing spare unit are to be extended upto the units under present scope which could be connected through flexible conductor / rigid bus and connectors when spare unit is required to be connected.
- 9.5 Cabling of already existing spare unit of 765kV Reactors with isolator switching arrangement shall be in such a way that spare unit of reactor can be connected in place of faulty unit without physically shifting and all the control, protection, indication signals of spare unit shall be brought in common marshaling box of all the banks by the reactor supplier. From CMB all the control, protection and indication signals of R, Y, B and Spare units shall be transferred to Control panels/SCADA under the present scope. Change-over of spare unit signals with faulty unit shall be done through C & R panels / SCADA level by substation contractor under the present scope.
- 9.6 Impedance relay function shall also be provided for Power transformer back-up protection in addition to other protections specified for Transformer (HV & IV) protection in technical specification, Section-CRP, Rev-09. Specification of Transformer impedance relay function shall be similar to that specified for Reactor back-up impedance protection.
- 9.7 Nuts, Bolts and washers for all non standard structures shall be payable as per BPS.
- 9.8 The architecture drawing & details of the Switchyard panel room is enclosed along with tender drawing. The civil construction drawing for above shall be furnished during detail engineering.
- 9.9 In case of 765kV Quad jumpers from 39m height to Isolators, guy insulator assembly consisting of composite insulator alongwith necessary hardware is to be installed and anchored with the ground to reduce the load on isolator (wherever applicable) as per the drawing enclosed with tender document.
- 9.10 The cable sizes specified at clause no. 1.1.4 of Section-Power & Control Cables Rev-6 are minimum required. In case, more nos. of runs or larger sizes of

cables are required between two points based on design calculations, same shall deemed to be included by bidder

- 9.11** Clause No. 4.2 of Section: Power & Control Cables (Rev 6) is amended as:  
“Standard lengths for each size of power and control cables shall be 500/1000 meters. However, to avoid cable wastage and cable jointing at site , non-standard lengths of each size of Power & control cable may also be acceptable subject to maximum length of 1000 meters(+ 5% tolerance).”
- 9.12** Appendix-V “Vendor List for Fire Protection Package” of section Fire Protection (Rev 6) stands deleted.
- 9.13** The diameter of main header pipe to be extended for fire protection system shall be same as that of the existing pipe in case of extension wherever required.
- 9.14** The lighting fixtures for switchyard may be mounted on Gantry structures/Lighting mast or on lighting poles to be provided by the contractor.
- 9.15** The fault level of all the equipments to be supplied under present scope shall be following:-

S. No.	Name of Substation	Fault level
1.	765kV Solapur	40kA for 1sec
2.	765kV Aurangabad	40kA for 1sec
3.	765kV Wardha	40kA for 1sec
4.	400kV Khandwa	40kA for 1sec
5.	400kV Rajgarh	40kA for 1sec
6.	400kV Champa	50kA for 1sec
7.	400/220kV Jabalpur	40kA for 1sec
8.	400/220kV Itarsi	40kA for 1sec

- 9.16** The short description has been used in the bid price schedule. The details of all such short description are given in Annexure-V of this Section-Project. The bidder shall refer these detailed descriptions for clarity.
- 9.17** In the Sub-station automation system, each gas tight compartments of 400kV GIS shall be monitored individually per phase basis. However, for GIS compartment for GIB outside GIS hall 3-phase monitoring is acceptable. In case it is not possible to monitor the gas tight compartment individually in one BCU, the contractor shall supply additional BCU for the monitoring without any additional cost implication to POWERGRID.
- 9.18** New clause 24.21 added under Section “GTR Rev 14” as mentioned below:

**Technical requirement for 400kV GIS bays at 400kV Itarsi S/S:**

- (i) The manufacturer whose 400kV GIS bays are offered must have designed, manufactured, type tested (as per IEC or equivalent standard),



supplied and supervised erection & commissioning of at least two (2) nos. Gas Insulated Switchgear (GIS) circuit breaker bays@ of 345kV or above voltage class in one (1) GIS Substation or Switchyard during the last seven (7) years and these bays must be in satisfactory operation# for at least two (2) years as on the date of NOA.

(ii) Alternatively, the manufacturer, who have established manufacturing and testing facilities in India and not meeting the requirements stipulated in (i) above, can also be considered provide that

(a) Atleast one no. 400kV or above voltage level GIS Circuit Breaker bay@ must have been manufactured in the above Indian works based on the technological support of the Collaborator(s) and either supplied or type tested the above GIS bay (as per IEC) as on the date of NOA.

(b) The collaborator(s) meets the requirements stipulated in (i) above. A valid collaboration agreement for technology transfer / license to design, manufacture, test and supply 400kV or above voltage level GIS equipment in India, shall be submitted.

(c) The Collaborator(s) shall furnish performance guarantee for an amount of 10 % of the ex-works cost of such equipment(s) and this performance guarantee shall be in addition to Contract Performance Guarantee to be submitted by the bidder.

**Note :-**

*In case of an Indian GIS manufacturer who has not conducted the type testing of 400kV GIS manufactured in India but the parent company or subsidiary company or group company have conducted the type testing of 400kV GIS manufactured at their works, the type test reports of the parent company or subsidiary company or group company shall be acceptable provided that the design is same.*