

SECTION – PROJECT

Technical Specification, Section – Project
Substation Package-SS01 for extension of 400(GIS)/220(AIS)kV Dhalkebar(NEA) Substation under
Transmission system associated with Arun-3 HEP of SJVN Arun-3 Power Development Company Pvt.
Ltd. (SAPDC) Rev 00

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SECTION - Project

1.0 GENERAL

SJVN Arun-3 Power Development Company Pvt. Ltd. (SAPDC) is undertaking bay extension at 400(GIS)/220(AIS)kV Substation of Nepal Electricity Authority (NEA) at Dhalkebar in Nepal under Transmission system associated with Arun-3 HEP. POWERGRID is the consultant for the project and assisting SAPDC in execution of the project.

1.1 Associated Transmission System:

The Transmission system associated with Arun-3 HEP comprises of the following transmission lines and substations.

Substation

1. Extension of 400(GIS)/220(AIS)kV Dhalkebar(NEA) substation in Nepal

Transmission lines

1. 400kV Dhalkebar – Arun-3 HEP Double circuit Line (Quad Moose) of 170kM (approx.) length.
2. 400kV Dhalkebar – Bathnaha (Muzaffarpur-POWERGRID) Double Circuit (Quad Moose) Line of 42kM (approx.) length.

2.0 INTENT OF SPECIFICATION

- 2.1 This specification includes design, engineering, manufacture, fabrication, testing at manufacturers works, delivery, unloading at site, storage, erection, testing and commissioning at site for the extension of 400kV GIS switchyard and extension of 220kV AIS Switchyard including 400kV indoor SF6 gas insulated metal enclosed switchgear (GIS), 220kV AIS Switchyard, 400kV, 220kV Indoor/outdoor equipments, 400/220/33kV, 1x315MVA Three Phase Auto transformer, 420kV, 1x80MVAR 3-Phase Bus Reactor, 420kV, 2x63MVAR, 3-Phase Switchable Line Reactors, associated civil works, internal roads, drains, extension of 400kV GIS Hall, Switchyard Panel Room etc, 400kV GIS ducts for making connections with outdoor Auto Transformers, Reactors and 400kV overhead lines, 220kV XLPE Cable for connectivity of 220kV side of 1x315MVA Auto Transformer with the 220kV AIS bay, Control &

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protection, PLCC equipments and other electrical and mechanical auxiliary systems on turnkey basis for Extension of 400(GIS)/220(AIS)kV Dhalkebar(NEA) substation in Nepal under Substation Package associated with Transmission System for Arun-3 HEP.

2.2 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.

3.0 SCOPE OF WORK FOR SUBSTATION PACKAGE

A. Extension of 400(GIS)/220(AIS)kV Dhalkebar(NEA) Substation with the following bays:

- 2 nos. 400kV GIS bays for termination of Dhalkebar – Arun-3 HEP D/C Transmission Line.
- 2 nos. 400kV GIS bays for termination of Dhalkebar – Bathnaha(Muzaffarpur) D/C Transmission Line
- 1 no. 400kV GIS bay for 1 no. 315 MVA, 400/220/33kV, 3-Phase Auto transformer.
- 3 nos. 400kV GIS Tie Bays
- 1 no. 400kV GIS bay for 1 no. 420kV, 80MVAR, 3-Phase Bus Reactor.
- 2 nos. 400kV GIS bays for 420kV, 2x63MVAR, 3-Phase Switchable Line Reactors.
- 2 nos. 400kV GIS Bus Sectionalizer bays
- 1 no. 220kV AIS bay for inter-connection of 220kV side of 400/220/33kV Auto Transformer with 220kV Switchyard.
- 220kV XLPE Cable & accessories for the above inter-connection.

4.0 DETAILED SCOPE OF WORK FOR SUBSTATION PACKAGE

Detailed scope of work for each substation is brought out in subsequent clauses of this section:

4.1 **Extension of 400(GIS)/220(AIS)kV Dhalkebar(NEA) Substation:**

The Scope includes Design & engineering, manufacture, testing, supply to site, including transportation & insurance, unloading, storage, erection,

testing and commissioning of the following equipments and items complete in all respect:

l) **400 KV GIS SYSTEM**

The 420 kV SF6 gas insulated switchgear shall have one and a half breaker bus bar arrangement. The Switchgear shall be complete with all necessary terminal boxes, SF6 gas filling, interconnecting power and control wiring, grounding connections, gas monitoring equipment & piping and support structures along with base plate & foundation bolts for fixing the switchgear with raft foundations.

The SF6 gas insulated switchgear (50 Hz) shall be of the indoor metal-enclosed type, comprising of following modules:-

- (A) Extension of two sets of three phase, 400kV 5000A, 50kA for 1 Sec SF6 gas-insulated metal enclosed bus bars (Existing 400kV GIS Bus bar is NHVS, China make), each set comprising of :
- (a) Three nos. 5000A, individual bus bars enclosures running across the length of the switchgear for 4(four) diameters to interconnect each of the circuit breaker bay modules in one and half breaker bus system including extension piece module(s). Bidder shall design the interface arrangement to suit existing bus configuration (horizontal) so as to maintain the interconnection space between upcoming GIS and existing GIS as minimum as possible. (Details of existing bus arrangement is enclosed with the tender drawing)
 - (b) Three nos. Inductive potential transformers, complete with isolating switch.
 - (c) One no. 3-phase, single pole, group operated safety grounding switch, complete with manual and motor driven operating mechanisms.
 - (d) Gas monitoring devices, barriers, pressure switches, UHF PD sensors etc. as required.
 - (e) Local bay Control Cubicle (If required separately).
 - (f) **End Piece module with the test link for Future extension of Bus bar module:** The GIS shall be suitable for extension in future. Suitable Bus bar End Modules (or bus bar extension facility) for future GIS extension shall be provided by the contractor. Complete details of bus bar chambers, all necessary dimensions, cross section details, gas pressure details, conductor details etc. shall be provided by the contractor during detailed engineering stage.

Extension piece shall be designed such that during HV test on new GIS, existing GIS can be isolated.

- (g) The detailed drawings for existing 400kV Bus bar extension module (Bus bar Interface module) of NHVS make are enclosed at **Annexure-XI**.

(B) 420 kV, 50kA for 1 second, SF6 gas-insulated metal enclosed Bus Sectionalizer bay module each set comprising of :-

- (a) One No. 3-phase, 5000A, SF6 insulated circuit breaker With/Without PIR (As per Bid price schedule), complete with operating mechanism.
- (b) Three Nos. 1-phase, 5000A, 6-core, multi ratio, current transformers duly distributed on both side of circuit breaker as per single line diagram.
- (c) Two Nos. 3-phase, 5000A, single pole, group operated isolator switches, complete with manual and motor driven operating mechanisms.
- (d) Two Nos. 3-phase, single pole group operated safety-grounding switches, complete with manual and motor driven operating mechanisms.
- (e) Gas monitoring devices, barriers, pressure switches, UHF sensors etc. as required.
- (f) Local Bay Control Cubicle.

(C) 420 kV, 50kA for 1 second, SF6 gas-insulated metal enclosed Line feeder bay module each set comprising of :-

- (a) One No. 3-phase, 3000A, SF6 insulated circuit breaker With/Without PIR (As per Bid price schedule), complete with operating mechanism.
- (b) Three Nos. 1-phase, 3000A, 6-core, multi ratio, current transformers duly distributed on both side of circuit breaker as per single line diagram.

- (c) Three Nos. 3-phase, 3000A, single pole, group operated isolator switches, complete with manual and motor driven operating mechanisms.
 - (d) Three Nos. 3-phase, single pole group operated safety-grounding switches, complete with manual and motor driven operating mechanisms.
 - (e) One No. 3-phase, single pole, high speed fault make grounding switch, complete with group operated manual and motor driven operating mechanisms.
 - (f) Three Nos. 1-phase, 3000A, SF6 ducts inside GIS Hall (up to the outer edge of the wall of GIS Hall) .
 - (g) Gas monitoring devices, barriers, pressure switches, UHF sensors etc. as required.
 - (h) Local Bay Control Cubicle.
- (D) 420 kV, 50kA for 1 sec, SF6 gas insulated ICT feeder bay module each comprising of :-
- (a) One No. 3-phase, 2000A, SF6 gas insulated circuit breaker with Controlled Switching Device & without PIR, complete with operating mechanism.
 - (b) Three Nos. 1-phase, 2000A, 6-core, multi ratio, current transformers duly distributed on both side of circuit breaker as per single line diagram.
 - (c) Two Nos. 3-phase, 2000A, single pole, group operated isolator switches complete with manual and motor driven operating mechanisms.
 - (d) Three Nos. 3-phases, single pole, group operated safety grounding switches complete with manual and motor driven operating mechanisms.
 - (e) Three Nos. 1-phase, 2000A, single pole operated isolator switches complete with manual and motor driven operating mechanisms.
 - (f) Three Nos. 1-phase, single pole operated safety-grounding switches complete with manual and motor driven operating mechanisms.

- (g) Three nos. 1-phase, 2000A, SF6 ducts inside GIS Hall (up to the outer edge of the wall of GIS Hall).
 - (h) Gas monitoring devices, barriers, pressure switches, UHF sensors etc. as required.
 - (i) Local Bay Control cubicle.
- (E) 420 kV, 50 kA for 1 sec, SF6 gas insulated Bus Reactor bay module each comprising of :-
- (a) One No. 3-phase, 2000A, SF6 gas insulated circuit breaker with Controlled Switching Device & without PIR, complete with operating mechanism.
 - (b) Three Nos. 1-phase, 2000A, 6-core, multi ratio, current transformers duly distributed on both side of circuit breaker as per single line diagram.
 - (c) Three Nos. 3-phase, 2000A, single pole, group operated isolator switches complete with manual and motor driven operating mechanisms.
 - (d) Four Nos. 3-phases, single pole, group operated safety grounding switches complete with manual and motor driven operating mechanisms.
 - (e) Three nos. 1-phase, 2000A, SF6 ducts inside GIS Hall (up to the outer edge of the wall of GIS Hall).
 - (f) Gas monitoring devices, barriers, pressure switches, UHF sensors etc. as required.
 - (g) Local Bay Control cubicle.
- (F) 420 kV, 50 kA for 1 sec, SF6 gas insulated Switchable Line Reactor bay module each comprising of :-
- (a) One No. 3-phase, 2000A, SF6 gas insulated circuit breaker with Controlled Switching Device & without PIR, complete with operating mechanism.
 - (b) Three Nos. 1-phase, 2000A, 6-core, multi ratio, current transformers duly distributed on both side of circuit breaker as per single line diagram.

- (c) One No. 3-phase, 2000A, single pole, group operated isolator switch complete with manual and motor driven operating mechanisms.
 - (d) One No. 3-phases, single pole, group operated safety grounding switches complete with manual and motor driven operating mechanisms.
 - (e) Three nos. 1-phase, 2000A, SF6 ducts inside GIS Hall (up to the outer edge of the wall of GIS Hall).
 - (f) Gas monitoring devices, barriers, pressure switches, UHF sensors etc. as required.
 - (g) Local Bay Control cubicle.
- (G) 420kV, 50kA for 1 second, SF6 gas-insulated metal enclosed Tie bay module each set comprising of :-
- (a) One No. 3-phase, 3000A, SF6 gas insulated circuit breaker with/without Controlled Switching device & with/without PIR (as per Bid Price Schedule) complete with operating mechanism.
 - (b) Three Nos. 1-phase, 3000A, 6-core, multi ratio, current transformers duly distributed on both side of circuit breaker as per single line diagram.
 - (c) Two Nos. 3-phase, 3000A, single pole, group operated isolator switches, complete with manual and motor driven operating mechanisms.
 - (d) Two Nos. 3-phase, single pole, group operated safety grounding switches, complete with manual and motor driven operating mechanisms.
 - (e) Gas monitoring devices, barriers, pressure switches, UHF sensors etc. as required.
 - (f) Local Bay Control Cubicle.
- (H) 420kV, 50kA for 1 second, SF6 gas-insulated metal enclosed Tie bay module each set comprising of :-
- (g) One No. 3-phase, 2000A, SF6 gas insulated circuit breaker with/without Controlled Switching device & with/without PIR (as per Bid Price Schedule) complete with operating mechanism.

- (h) Three Nos. 1-phase, 2000A, 6-core, multi ratio, current transformers duly distributed on both side of circuit breaker as per single line diagram.
 - (i) Two Nos. 3-phase, 2000A, single pole, group operated isolator switches, complete with manual and motor driven operating mechanisms.
 - (j) Two Nos. 3-phase, single pole, group operated safety grounding switches, complete with manual and motor driven operating mechanisms.
 - (k) Gas monitoring devices, barriers, pressure switches, UHF sensors etc. as required.
 - (l) Local Bay Control Cubicle.
- (I) The payment of 420kV GIB (SF6 Gas insulated bus ducts) of Line/Transformer/Reactor feeder modules including support structure (along with Gas monitoring devices, barriers, pressure switches, UHF based Partial Discharge measurement Sensors etc. as required) from outside (i.e. wall surface) of the GIS building to center line of SF6/Air Bushing shall be paid as per running meters in line with provision of Bid Price schedule. SF6/ Air bushings along with terminal connectors & support structure for outdoor connections to connect GIB with outdoor AIS equipments (i.e. overhead line, Transformer & Reactor) is also included in the present scope. SF6 gas Bus-duct inside the GIS hall shall be integral part of the respective bay module and it will not be paid separately.

Multi-Tier GIS Bus ducts shall be used, as per requirements to be determined during detailed engineering, considering site constraints and layout arrangement. All present and future line bays shall be properly accommodated within available switchyard area with provision for personnel and equipments movements and maintenance.

- II) 1x315MVA, 400/220/33kV, 3-Phase Auto Transformer including all materials/fittings/accessories, Digital RTCC panel, On-line Multi-gas Analyzer, On-line Insulating Oil Drying System, Common MB/Individual MB, Cables including special cable (if any) etc.
- III) 1x80MVAR, 420kV, 3-Phase Bus Reactor including all materials/fittings/accessories, On-line Multi-gas Analyzer, On-line Insulating Oil Drying System, MB, Cables including special cable (if any).
- IV) 2x63MVAR, 420kV, 3-Phase Switchable Line Reactors along with 145kV Neutral Grounding Reactor (impedance value of each NGR is 450 Ohm (approximately); however actual impedance values shall be decided during detailed engineering) and 120kV Surge arresters including all

materials/fittings/accessories, On-line Multi-gas Analyzer, On-line Insulating Oil Drying System, MB, Cables including special cable (if any).

- V) 400kV outdoor equipments i.e. Surge Arresters, Capacitive Voltage Transformers, Line traps, Bus Post Insulators.
- VI) 220kV outdoor equipments i.e. Circuit Breakers, Current Transformers, Surge Arresters, Isolators, Bus Post Insulators.
- VII) 132kV outdoor equipments i.e. Surge Arrester, 1-Phase Circuit Breaker (for Line Reactor NGR bypass scheme), Bus Post Insulators.
- VIII) 220kV, 1600 Sqmm, XLPE underground Cu Cable for inter-connection of 220kV side of 400/220/33kV ICT#4 and 220kV ICT bay at Dhalkebar(NEA) substation:

The scope of works covers survey, planning design, Engineering, Manufacturing, supply, Transportation, Insurance, Delivery at site, Unloading, Handling, Storage, installation (including civil works), Termination, testing, Demonstration for acceptance, commissioning and Documentation of underground 220kV single core 1600 sq mm XLPE Copper cable & Underground Armoured Fiber Optic Cables (12 fiber) complete with all associated materials and accessories for the route shown in tender drawing with a total route length of approximately 170 mtr. The 220kV cables are required for inter-connection of 220kV side of 400/220/33kV ICT#4 and 220kV ICT bay. Necessary Earth Continuity Cable shall also be provided under present scope. The Power cable links shall transfer power at 220kV through single circuit in flat formation with 1Cx1600 sq mm size copper conductor in each phase. One spare power cable of 1Cx1600 sq mm copper conductor is also required to be provided for the above single circuit link. Two nos. underground Fibre Optic (FO) cables each of 12 cores shall be provided for overall current differential protection of ICT & 220kV Cable combination.

- IX) Augmentation of sub-station automation system based on IEC 61850 including hardware and software for remote control station along with associated equipments for following bays (bay as defined in Technical Specification, Section - Substation Automation):

S.No.	Description	No of Bays for Automation
1.	400KV Main Bays	6 Nos.
2.	400kV Tie bays	3 Nos.
3.	400kV Switchable Line Reactor Bays	2 Nos.
4.	220kV Bay	1 No.

Further, the existing 400kV Dhalkebar(GIS) substation is equipped with substation Automation system based on IEC 61850 of ABB make Micro Scada and existing 220/132kV Dhalkebar(AIS) is equipped with substation Automation system based on IEC 61850 of NR Electric Co. Ltd., China make

In the present scope, bidder shall include BCUs required for 400kV & 220kV bays including all necessary hardware and software to integrate with the existing Substation Automation Systems including up-dation of system database, displays, and development of additional displays and reports as per requirement. The existing SAS Architecture drawing for 400kV and 220kV Systems of Dhalkebar substation is enclosed at **Annexure-VIII**.

- X) Control switching devices for the 400kV main, tie & switchable Line Reactor circuit breakers as per BPS and Single Line diagram enclosed at **Annexure-I**.
- XI) Control & Protection System:
 - 1) Complete relay and protection system as per section – Control and Relay panels for the present scope.
 - 2) One no. relay panel housing two nos. numerical overall differential relays (as already mentioned at Clause 4.1(VIII) above) shall be provided at each end (i.e. at 400kV side & 220kV side) to achieve duplicated overall current differential protection of the combination of 400/220/33kV ICT and 220kV XLPE Cable. All associated auxiliary relays, Trip relays, cabling etc shall be in the scope of the contractor.
 - 3) Complete Bus Bar Protection for 400kV Bus sections (under present scope) with one & half Breaker GIS Switching Scheme.
 - 4) Integration of 400kV Bus sectionalizer bays with existing 400kV Busbar protection of ABB make REB670 (centralized numerical Low Impedance type).
 - 5) Augmentation of existing 220kV busbar protection scheme: Existing 220kV Busbar protection scheme at Dhalkebar(NEA) substation is PCS-915 of NR Electric Co. Ltd. make which is centralized numerical Low impedance type. Analogue & digital cards required for the ICT bay under present scope is already existing. Necessary trip relays and wiring/cabling shall be provided under present scope. Integration of the ICT bay with the existing 220kV busbar protection scheme shall also in the scope of the Contractor
- XII) Fire Protection System for all Buildings and Transformers/Reactors as per technical specification. HVW spray system is envisaged for 315MVA, 400/220/33kV, 3-Phase Auto Transformer, 1x80MVAR, 3-Phase Bus Reactors and 2x63MVAR, 3-Phase Line Reactors. Portable Fire Extinguishers as per BPS shall also be provided.
- XIII) Lattice or pipe structures (galvanized): Standard 400kV & 220kV Towers & Beams and 400kV, 220kV & 132kV outdoor equipment support structures, LM structures shall be provided as per standard drawings enclosed with the tender and all GIS support structures shall be as per GIS manufacturer's design. BOM of all structures (including standard structures) like towers, beams, equipment support structures etc. shall be in the scope of the Contractor. However, nonstandard structure for towers, beams & equipments

which is not enclosed with tender shall be designed by the contractor and submitted to Employer for approval.

- XIV) Bus post Insulators, insulator strings and hardware, clamps & connectors including terminal connectors, spacers, Aluminum tube, conductor, Earth wire, Bus bar and earthing materials, Auxiliary earth mat, Bay marshalling box, cable supporting angles/channels, Cable trays and covers, Junction box, buried cable trenches for lighting, PVC pipes for cabling of equipment etc. as per requirement.
- XV) Air Conditioning System for Panel room of approximately 15Mx10M size.
- XVI) Air conditioning & Illumination of one no. Switchyard Panel Room in 220kV switchyard.
- XVII) Extension of existing Ventilation system for GIS hall.
- XVIII) LT switchgear (AC/DC Distribution boards).

Extension of existing LT A.C. system

Supply & installation of 2 nos. ACDB extension boards each comprising of the following AC feeders in present scope:

- i) 400A, 4 pole MCCB Incomer module
- ii) 63A, 4 pole MCCB module (Type E) - 10 nos.
- iii) 32A, 4 pole MCCB module (Type E) – 10 nos.

Extension of existing 220V DC system

Supply & installation of 2 nos. DCDB extension boards each comprising of the following DC feeders in present scope:

- i) 100A, 2 pole MCCB Incomer module
- ii) 32 A double pole MCB Module – 12 nos.

- XIX) 250KVA Silent type outdoor DG Set with acoustic enclosure.
- XX) 1.1kV grade Power & Control cables along with complete accessories, including Cable for oil filtration units.
- XXI) Indoor & outdoor lighting and illumination of the switchyard including DG set area, street lighting, GIS Buildings & Panel Room.
- XXII) Extension of existing Earth mat inside the GIS building and outdoor yard. Earthing of all indoor & outdoor equipments including Transformers & Reactors. Measurement of earth resistivity is in the scope of Contractor. Existing Earthmat layout drawing of Dhalkebar(NEA) substation is enclosed with the tender drawing as per **Annexure-I**.
- XXIII) Extension of existing EOT Cranes for GIS Hall.
- XXIV) Digital protection Coupler (suitable for interfacing with E1 port of SDH equipment) and associated power & control cables, fibre cables & accessories as required for both end of the following lines:-

Dhalkebar - Arun-3 400kV D/C Line
Dhalkebar – Muzaffarpur 400kV D/C Line

All the 400kV Lines terminating at Dhalkebar GIS are equipped with OPGW cables and hence Digital Protection coupler along with conventional analogue protection coupler over PLCC is considered under present scope.

Each DPC shall be equipped with all accessories, cabling etc required to interface with SDH/MUX telecommunication terminal equipment located in the respective panel room at each substation end. All these equipment including required converters, cables etc. required for its commissioning is in present scope of contract. The specification of Digital Protection coupler is attached as **Annexure-II.**

- XXV) Analogue PLCC equipment (excluding Wave Trap) for 400kV System
- a) PLCC equipments for both end of Dhalkebar - Arun-3 400kV D/C Line
 - b) PLCC equipments for both end of Dhalkebar - Muzaffarpur 400kV D/C Line.
- XXVI) Augmentation of existing Visual Monitoring System for watch and ward of present scope. Details of the existing Visual Monitoring System is enclosed at **Annexure-III.**
- XXVII) Direct Stroke Lightning protection for the switchyard extension under present scope.
- XXVIII) Any other equipment/material required for completing the specified scope, shall be included in the scope of supply and the offer should be complete & comprehensive.
- XXIX) FOTS based Telecommunication system:
The broad Scope of the procurement of FO based Communication Equipment shall include planning, designing, engineering, supply, transportation, insurance, delivery at site, unloading handling, storage, installation, termination, testing, training and demonstration for acceptance, commissioning and documentation for :
- a) SDH Equipment along with suitable interfaces and line cards.
 - b) All cabling, wiring, Digital Distribution frame patch facilities and interconnection to the supplied equipment at the defined interfaces,
 - c) System integration of all supplied subsystem.
 - d) Integration with the existing communication system based on SDH and PDH of employer.
 - e) Integration of supplied subsystem with SCADA system, PLCC equipment, PABX of NCC, VOIP (SIP compliant for voice).

XXX) Design, engineering, manufacture, testing and supply including transportation, insurance & storage at site of mandatory spares as per Bid Price Schedule enclosed with the bidding documents.

XXXI) **Civil works** - The work shall include but not limited to the following:-

- (i) Soil Investigation report for the existing 400/220kV Switchyard is enclosed at **Annexure-X**, which shall be referred for Bay extension works under present scope.
- (ii) Earth Resistivity Test (ERT) shall be conducted under present scope of works as per technical specification.
- (iii) Contouring & site leveling. The filling of about 0.6 meter depth is envisaged in the area under present scope of work inside substation to achieve finished ground level. The finished ground level shall be finalized during detailed engineering.
- (iv) **Design, Engineering and civil work (as per Contractor supplied drawings) for :-**

- (a) GIS Buildings: Extension of existing 420kV GIS hall for the portion as shown in the GA drawing diameters (including adequate space for maintenance bays). The extended GIS hall shall be pre-engineered building matching with the existing PEB type GIS Hall. The GIS building shall be suitable for further expansion in one direction to accommodate the future 400kV GIS bays. The scope shall include the following:

All civil works excluding excavation, PCC, RCC and reinforcement steel to complete GIS building, equipment foundations and internal cable trenches of GIS hall shall be deemed to be included in the item for GIS Hall as per BPS. However, Excavation, PCC, RCC and reinforcement steel required shall be measured & paid separately as per respective items of BPS. The existing PEB type GIS hall drawings are enclosed at **Annexure-IX**.

- (b) Due to space constraint in existing 400kV Panel Room located inside the control room building, a separate Panel Room (approximately 15Mx10M size) shall be constructed. 400kV Panel Room building shall be designed as per Technical specification. All civil works excluding excavation, PCC, RCC and reinforcement steel to complete Panel Room building, equipment foundations and internal cable trenches of control room building shall

be deemed to be included in the item for Panel room building as per BPS. However, Excavation, PCC, RCC and reinforcement steel required shall be measured & paid separately as per respective items of BPS.

- (c) Extension of EOT Crane in 400kV GIS Hall.
 - (d) All civil works including foundations associated with erection of SF6 gas insulated metal enclosed switchgear along with its SF6 ducts inside the building.
 - (e) Foundation for Bus duct supporting structures (outside GIS Hall), GIS (SF6/Air) bushing, lighting poles, panels and control cubicles of equipments wherever required. Foundation loads for GIS bus duct supports (Vertical, shear and moment) shall be provided with detailed calculation.
 - (f) Cable trenches (cross sectional details & layout) inside GIS hall, Panel room.
 - (g) Drainage Layout in the substation (Cross sectional details of drains shall be provided by the Employer).
 - (h) Foundations of non-standard Towers and Equipment support structures.
 - (i) Foundation for Bay marshalling box, panels and control cubicles of equipments (wherever required).
 - (j) Dismantling of existing Boundary wall.
 - (k) Any other item required for completion of scope of works
- (v) Civil Works as per Drawing /Specifications provided by the Employer:**
- (a) Foundation of owner supplied 01 no. 400/220/33kV, 315MVA Auto Transformer, 01 no. 420kV, 80MVAR Bus Reactor & 02 nos. 420kV, 63MVAR Line Reactors along with jacking pads and pylon supports, rail cum road and fire resistant wall(s).
 - (b) Construction of one switchyard panel room (SPR).
 - (c) Foundation of 250kVA DG set etc.
 - (d) Foundations for standard 400kV & 220kV Towers.

- (e) Foundations for standard supporting structures for 400kV, 220kV & 132kV Equipments.
- (f) Foundation for LM structures.
- (g) All roads as shown in GA drawing including culverts. All roads shall be as per section details provided by owner.
- (h) Cable trenches along with covers and sump pits outside control room and GIS hall. Section details shall be as per owner-supplied drawings however the cable trench layout shall be prepared by the contractor.
- (i) Switchyard Fencing along with Gate for substation.
- (j) Removal & re- spreading of existing Gravel (wherever available) after doing PCC and anti-weed treatment is also in the present scope. Any shortfall in gravel (if any) for achieving required thickness of gravel shall also be in contractor's scope for which no extra payment shall be made and deemed to be included in the quoted cost of item.

In the area under present scope where stone spreading does not exist, the same shall be provided along with anti-weed treatment and PCC. However, the layout drawings for the same shall be developed and submitted by contractor for necessary approval.
- (k) Boundary wall along property line with Main Gate & Security Room with septic tank & soak pit.

However the layout of (g), (h), (i), (j) & (k) shall be prepared by the contractor & submitted to the employer for approval

4.2 The bidders are advised to visit the substation sites and acquaint themselves with the topography, infrastructure and also the design philosophy. Before proceeding with the construction work of the new Sub-stations and existing substations, the Contractor shall fully familiarize himself with the site conditions and General arrangements & scheme etc. Though the consultant/Employer shall endeavor to provide the information, it shall not be binding for the consultant/Employer to provide the same. 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 shall be supplied by the Contractor. The cement and steel shall also be supplied by the Contractor.

The complete design (**unless specified otherwise in specification elsewhere**) and detailed engineering shall be done by the Contractor based on conceptual tender drawings.

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

4.4 Design of substation and its associated electrical & mechanical auxiliaries systems includes preparation of single line diagrams and electrical layouts including layout arrangement for transformers, foundation layout, cable trench layout, earthmat layout, erection key diagrams, electrical and physical clearance diagrams, design calculations for earthing and lightning protection system (including Direct Stroke Lighting Protection), control and protection schematics, wiring and termination schedules, civil designs and drawings, design of fire fighting system and air conditioning system, indoor/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.

4.5 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.

4.6 The technical specification for various equipments and works for different voltage levels have been standardized. Items, which are not applicable for the scope of this package as per schedule of quantities described in BPS, the technical specification for such items should not be referred to.

5.0 SPECIFIC EXCLUSIONS

- i) Soil Investigation (except Soil resistivity test).
- ii) Bore well along with pumps for permanent water supply.
- iii) Employer's site office and stores.

6.0 PHYSICAL AND OTHER PARAMETERS

6.1 Location of the Substations –

Dhalkebar(NEA) substation is in the South-Eastern part of Nepal.

6.2 Meteorological data

S.No.	Description	Dhalkebar(NEA)
i).	a) Max. ambient air temperature (°C)	37.4
ii)	Minimum ambient air temperature (°C)	7.4
iii)	Altitude (above M.S.L.) (mtrs)	137
iv)	Relative humidity - Maximum	86.28%
v)	Relative humidity - Minimum	33.06%
vi)	Amount of snow fall (mm)	0
vii)	Wind speed	47m/s
viii)	Seismic requirement (the Frequency range for the earthquake spectra shall be as per IEC-62271-300 for Circuit Breaker)	0.5g (Horizontal peak acceleration value).
ix)	Pollution Level	Light
x)	Rainfall (mm/year)	1000

However, for design purposes, ambient temperature should be considered as 50 degree centigrade and Relative humidity 100% for both the substations. Further, altitude (from MSL) to be considered less than 1000 Meter for both the substations.

6.3 The fault level of all equipment to be supplied under present scope shall be as indicated below:

S.NO.	Voltage Level	Dhalkebar(NEA)
1	400kV	50 kA for 1 sec
2	220kV	40kA for 1 Sec

7.0 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 bill of quantity has been indicated in BPS (Bid price Schedules) shall be payable on unit rate basis/quoted rate basis. During actual execution, any variation in such quantities shall be payable as per relevant clauses incorporated in Letter of award.

Wherever the quantities of items/works are not indicated, 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. For module identification, Bidder may refer typical drawings enclosed with the specifications. 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.

Break up of detailed bill of quantities of the mandatory spares is given in the bid price Schedules.

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 Owner.

8.0 BASIC REFERENCE DRAWINGS

8.1 The switching scheme to be adopted at 400kV & 220kV levels shall be as below.

Name of Substation	Switching scheme to be adopted	
	400kV System	220kV System
400(GIS)/220(AIS)kV Dhalkebar(NEA)	One & half Breaker for GIS Switchgear	Double Main & Transfer AIS

Single line diagram and general arrangements are enclosed with the bid documents for reference, which shall be further engineered by the bidder.

8.2 The reference drawings, which form a part of the specifications, are given at **Annexure - I**. The bidder shall maintain the overall dimensions of the

substation, phase to earth clearance, phase to phase clearance and sectional clearances.

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 Owner.

9.0 ORDER OF PRECEDENCE OF DIFFERENT PARTS OF TECHNICAL SPECIFICATION

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

1	Section : Project	Rev. 00
2	Section : General technical Requirement	Rev. 14
3	Section : GIS	Rev. 5A
4	Section : Transformer upto 400kV Class	Rev. 11
5	Section : Shunt Reactor upto 400kV	Rev. 10
6	Section : Switchgear –Circuit Breaker	Rev.11
7	Section : Switchgear –Instrument Transformer	Rev.11
8	Section : Switchgear –Isolator	Rev.11B
9	Section : Switchgear –SA	Rev.11
10	Section : LT Switchgear	Rev. 05
11	Section : Lighting System	Rev. 07
12	Section : LT Transformer	Rev. 05
13	Section : Fire Protection System	Rev. 06
14	Section : Power & Control Cable	Rev. 06
15	Air Conditioning System	Rev. 04
16	Section : DG Set	Rev. 05

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17	Section :Switchyard Erection	Rev. 10
18	Section :Structure	Rev. 06
19	Section :Civil Works	Rev. 11A
20	Section :Control & Relay Panel	Rev. 09
21	Section : PLCC	Rev. 05
22	Section : Sub-station Automation System	Rev. 04
23	EHV XLPE Power Cable	Rev. 00
24	Telecommunication System	Rev. 01

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

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

10. SPARES

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 Owner 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.

11. SPECIFIC REQUIREMENT

- a) The Bidders are advised to visit Sub-stations site and acquaint themselves with the topography, infrastructure, etc.
- b) **Protection of 315MVA 3-Phase 400/220/33kV Auto-transformer:** Duplicate overall transformer differential protection scheme (based on numerical line differential protection) shall be provided for protection of the combination of 400/220/33kV ICT and the 220kV underground XLPE

cables (required for Inter-connection of 220kV side of the ICTs with existing 220kV switchyard). Optical Fibre cable required to achieve the overall transformer differential protection shall be provided under present scope of works. Two sets of Numerical overall transformer differential protection (each set consists of one no. numerical current differential relay at each end of the combination of ICT & associated 220kV XLPE power cable) shall be provided instead of conventional transformer differential relay as mentioned in Section-Control & Relay Panels. One no. Protection Panel incorporating two nos. numerical current differential relays & necessary trip/auxiliary relays required for overall differential protection for the ICT and associated interconnecting 220kV XLPE power cables shall be provided and to be located inside Switchyard Panel Room to be constructed under present scope at 220kV switchyard. Necessary arrangement for connection of fibre optic approach cable to the overall differential relays at both end of the combination of ICT & 220kV XLPE cable is included under present scope. Two separate optical fibre cable shall be provided for the above said duplicate numerical overall differential protection.

- c) The Metallic sheath of 220kV XLPE Cable shall be of corrugated Aluminium.
- d) The bidder shall be responsible for safety of human and equipment during the working. It will be the responsibility of the Contractor to co-ordinate and obtain Electrical Inspector's clearance before commissioning. Any additional items, modification due to observation of such statutory authorities shall be provided by the Contractor at no extra cost to the Owner.

The Contractor shall arrange all T&P (such as necessary supports, cranes, ladders, platforms etc.) for erection, testing & commissioning of the system at his own cost. Further, all consumables, wastage and damages shall be to the account of contractor.

- e) Two sets of 3½C x 300 Sq. mm XLPE power cable for oil filtration units of Transformers & Reactors shall be provided along with 250Amps, TPN MCCB receptacles. The cable shall be terminated at 250A MCCB receptacles at two separate locations near Transformers & Reactors in the yard.
- f) Erection, testing and commissioning of GIS, Transformers, Reactors, Substation automation system, Control and protection Panels, PLCC & SDH system including Digital Protection Coupler shall be done by the contractors under the supervision of respective equipment manufacturers. Charges for the above supervision shall be included by

Technical Specification, Section – Project
Substation Package-SS01 for extension of 400(GIS)/220(AIS)kV Dhalkebar(NEA) Substation under Transmission system associated with Arun-3 HEP of SJVN Arun-3 Power Development Company Pvt. Ltd. (SAPDC) Rev 00

the bidder in the erection charges for the respective equipment in the BPS.

- g) The duct connections should be such that it is possible to remove transformer for repair and maintenance conveniently.
- h) The Contractor shall impart the necessary training to the Employer's Personnel as per following details:-

The contractor shall organize and conduct complete and thorough training program (to be conducted in English language) providing necessary training material at no extra cost to the Employer. However, the traveling and living expenses of Employer's personnel, if any, shall be borne by Employer. The training shall be carried out at the place of manufacture or as the case may require and as agreed by Employer so as to ensure the complete adequacy of the program and imparting of detailed knowledge of system/equipment design engineering and operation and maintenance aspects.

The duration of the training shall be as follows.

- Design, operation and maintenance of the GIS installations including procedures for fault attending at manufacturers'/suppliers' works for 6 (Six) personnel of Employer for 5 days.
- The contractor shall also provide training in the area of testing, commissioning and maintenance for 10 personnel for 5 days at Dhalkebar substation.
- Design, operation, maintenance and commissioning aspect for 6 (Six) persons at manufacturer's / supplier's works as per following
 - i) Protection and Automation 3 days
 - ii) Circuit Breaker 2 days
 - iii) Telecommunication Equipment (SDH, MUX & NMS (Craft Terminal) 2 Days
 - iv) Digital Protection Coupler & PLCC 2 days
 - v) Transformers 3 days
 - vi) Reactors 2 days
- i) The lighting fixtures for switchyard lighting shall be mounted on LMs wherever LMs are provided. Where LMs are not available, the fixtures may be mounted on Gantry structures or on lighting poles to be provided by the contractor.
- j) **Technical Experience of Contractor/Sub-contractor for execution of AIS Substation work:**

Contractor/Sub-contractor must have erected, tested and commissioned as a prime contractor* under a single contract, at least two (2) nos. AIS^ Circuit Breaker equipped bays of 220kV or above voltage level in one (1) substation or switchyard during last seven (7) years and these bays must be in satisfactory operation# as on the originally scheduled date of bid opening.

Note-1 (*): In case of works executed under a contract that had been awarded on a Joint Venture, the experience of individual Joint Venture partner shall be considered limited to the scope of that partner under the said contract.

Note-2 (#): Satisfactory operation means certificate issued by the Employer certifying the operation without any adverse remark.

Note-3 (^): AIS means Air Insulated Substation.

Note-4: In case Contractor/Sub-contractor is a holding company, the technical experience referred above shall be of that holding company only (i.e. excluding its subsidiary/group companies). In case Contractor/Sub-contractor is a subsidiary of a holding company, the technical experience referred above shall be of that subsidiary company only (i.e. excluding its holding company).

k) **The relevant clauses of Section-Transformer Upto 400kV Class, Rev. 11 shall be superseded by the following:**

1. Tan δ value of RIP (Resin Impregnated Polymer) condenser bushing shall be 0.005 (max.) in the temperature range of 20°C to 90°C. The measured Tan δ value at site should not exceed by 0.001 w.r.t. factory results (measured at approx. similar temperature conditions) during warrantee period.
2. The following accessories shall be provided with Transformer in addition to the requirement of the technical specification Section – Transformer (Up to 400kV Class) (Rev11):
 - a. Condition Controlled Maintenance Free Type Breather as per **Annexure-XIII**.
 - b. Conservator protection Relay/ Air bag rupture Relay
3. Size of valves for UHF sensor shall be minimum 50NB.
4. SFRA test at factory and site shall be carried out both in oil filled condition and without oil filled condition.

5. In case of any winding failure during factory testing, manufacturer shall replace complete Transformer winding and insulation. Regarding other components, decision shall be taken based on inspection.
6. For foundation of cooler bank of 400kV, 500 MVA Transformer, fixing of cooler support shall be provided through Anchor Fastener with chemical grouting and no pockets for bolting shall be provided.
7. Regarding cooler pipe supports, Buchholz pipe (if required) and fire-fighting pipe supports, no concrete block shall be made for pipe support as locations of all the blocks are different for different manufacturers. Pre-fabricated metallic support from pit shall be provided for cooler pipe & Pylon support which shall be fixed through Anchor Fastener with chemical grouting. Further cooler pipe & Pylon support shall be encased with concrete to prevent rusting.

l) The relevant clauses of Section-420kV Reactor Upto 400kV, Rev. 10 shall be superseded by the following:

1. Tan δ value of RIP (Resin Impregnated Polymer) condenser bushing shall be 0.005 (max.) in the temperature range of 20 °C to 90 °C. The measured Tan δ value at site should not exceed by 0.001 w.r.t. factory results (measured at approx. similar temperature conditions) during warrantee period.
2. SFRA test at factory and site shall be carried out both in oil filled condition and without oil filled condition.
3. Size of UHF valves shall be minimum 50NB
4. The following accessories shall be provided with Reactor in addition to the requirement of the technical specification Section – Reactor (Up to 400kV Class) (Rev10):
 - a. Condition Controlled Maintenance Free Type Breather as per Annexure-**XIII**.
 - b. Conservator protection Relay/ Air bag rupture Relay
5. In case of any winding failure during factory testing, manufacturer shall replace complete Reactor winding and insulation. Regarding other components, decision shall be taken based on joint inspection.
6. Reactor Manufacturers to ensure that roller mounting pad at the bottom of the tank shall be removed for better contact of reactor bottom plate to plinth. Roller to be mounted directly with tank bottom.

7. For 400kV Reactors, cooler bank shall be tank mounted. 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. Supply of plates is covered under separate package.
 8. Specific area shall not be provided for jacking pad in the foundation as jacking shall be done by laying temporary metal plates size 400 mm x 400 mm x 32 mm (min) thick. One set of metal plates for jacking of reactor shall be provided.
 9. 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.
- m) Augmentation and integration work related to SCADA System
- n) The 400/220kV bays under present scope shall be integrated by the contractor into existing SCADA system of Siemens ‘SINAUT Spectrum’(version 4.3.2) installed at Master Station i.e. Nepal Electricity Authority Load Dispatch Centre (located in Siuchatar, Kathmandu). The integration shall include all hardware and software required at the Control Centre as well as necessary data base, display generation and upgrades for proposed control and monitoring of station and Network Analysis. The manufacturers of the existing SCADA system are:-
- LDC facilities: Siemens Germany
- The existing communication protocol used for SCADA at LDC Kathmandu is IEC 101. For the present scope of work no RTU is envisaged and the Data for SCADA purpose shall be obtained from the Substation Automation System (based on IEC 61850) using Gateway port with communication protocol IEC 101/104 as per requirement being provided at Dhalkebar Substation under present contract.
- o) Contractor may adopt Indian Standard codes in place of BS/International codes for design of civil works, Gantry structures and Equipment Support structures irrespective of what has been mentioned in the Technical specification of Civil Works & Structures.
- p) All RCC shall be of M-25 grade with mixed design conforming to relevant Indian Standard. All Reinforcement steel shall be of FE-500(Minimum) grade conforming to Indian Standard.
- q) The Employer will issue the fabrication drawings of the standard structures to the successful bidder. The bidder shall do the proto

assembly of the structures as per the issued fabricated drawings. Employer may opt to witness such proto assembly. The bidder shall follow the fabrication drawing for preparing the proto assembly and do the minor adjustments if necessary, without affecting the strength of the structure. In case of equipment support structure the attachment of stool and fixing of MOM box etc. shall be taken care by the vendor as per the requirement of the equipment. The bidder however shall not submit the proto corrected drawings and BOM for approval of the employer. The arrangement shall however not absolve the bidder from the responsibility of supply and erection of safe sound and durable structure.

- r) Appendix-V of Section-Fire protection System, Rev.06 shall be deleted.
- s) 400kV Transformers are being provided with Digital RTCC relay, online insulating oil drying system, online Dissolved Gas Analyzer (DGA)-multi gas, online temperature monitoring system (Fibre Optic Sensor) and 420kV Reactors are being provided with online insulating oil drying system, online Dissolved Gas Analyzer (DGA)-multi gas & online temperature monitoring system (Fibre Optic Sensor). These equipments are IEC 61850 compliant and required to be integrated with the existing Substation Automation System (SAS).
- t) 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
- u) 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).”
- v) 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.

- w) Transmission line side insulator String (including Hardware) i.e. tension insulator on the line side of the take-off gantry for 400kV line terminations is under the present scope of specification.
- x) One number portable fire extinguisher (CO2 type) of 4.5 kg shall be provided for each switchyard panel room as per Bid proposal sheet (BPS).
- y) One number Energy meter for the record and revenue purpose is to be provided for each 400kV bays (Tie bays & Reactor bays to be excluded) under present scope and one number Energy meter for the record and revenue purpose is to be provided at 220kV side of ICT#4 under present scope of contract, meeting the requirement as specified at **Annexure – IV**.
- z) Non-CFC refrigerant shall be utilized for Air conditioning system.
- aa) Nuts, Bolts and washers for all non-standard structures shall be payable as per BPS.
- bb) One no. Switchyard Panel Room (SPR) is envisaged for 220kV switchyard to accommodate the panels for 220kV ICT bay. Due to space constraint in the existing Panel room located inside the 400kV control room building (located adjacent to the existing GIS Hall), a separate Panel Room (approximately 15Mx10M size) shall be constructed to accommodate the panels i.e. Bay level units, relay and protection panels, Digital RTCC panels, Digital Protection coupler panels, PLCC panels etc for 400kV system. Tentative location of the 400kV panel room is shown in the GA drawing. Both the 400kV Panel room & 220kV Switchyard Panel Room (SPR) shall be air-conditioned and the supplier shall submit detailed heat load calculation during detailed engineering. Further, the temperature of enclosure /room shall be monitored through substation automation system by providing necessary temperature transducers.
- cc) The Contractor shall be responsible to select and verify the route, mode of transportation and make all necessary arrangement with the appropriate authorities for the transportation of the equipment. The dimension of the equipment shall be such that when packed for transportation, it will comply with the requirements of loading and clearance restrictions for the selected route. It shall be the responsibility of the contractor to coordinate the arrangement for transportation of the transformers & reactors for all the stages from the manufacturer's work to site.

The conditions of roads, capacity of bridges, culverts etc. in the route shall also be assessed by the bidders. The scope of any necessary modification/ extension/ improvement to existing road, bridges, culverts etc. shall be included in the scope of the bidder. The contractor shall carry out the route survey along with the transporter and submit the detail proposal and methodology for transportation of transformers & reactors within three months from the date of award.

- dd) Control voltage for Substation and Telecommunication/PLCC system shall be 220V DC and 48V DC respectively.
- ee) The transmission lines associated with Dhalkebar(NEA) extension substation shall be provided with the following conductors under separate packages. Accordingly, the contractor shall provide clamps & connectors for line side droppers/jumpers to suit the line conductor requirement.

Sl. Nos.	Name of the Transmission Line	Conductor type
1.	400kV Dhalkebar – Arun-3 HEP Double circuit line	Quad Moose ACSR Conductor
2.	400kV Dhalkebar – Muzaffarpur (presently Bathnaha) Double circuit line	Quad Moose ACSR Conductor

- ff) For supply of SF6 Gas, the contractor shall obtain necessary license from the concerned statutory authorities in Nepal. The contractor shall comply with all the legal & statutory requirements as per the local laws for importing, handling & storage of SF6 gas in Nepal. For this purpose NEA shall extend necessary assistance (documentation etc) for obtaining such clearance & licenses, however the complete responsibility for submitting the application and co-ordination with authorities shall be in the scope of contractor.
- gg) In view of the future maintenance requirement, the contractor shall provide the Gas storage capacity equivalent to the Gas used in largest Gas tight GIS Module. Further, the spare Gas shall be supplied in Gas storage cylinders.
- hh) Details of existing RTU based SCADA and its data acquisition is enclosed at **Annexure-VI**.
- ii) Technical specification of Oil Filtration Plant is enclosed at **Annexure-VII**.

- jj) The short description has been used in the bid price schedule. The details of all such short description are given in **Annexure-XIV** of this Section-Project. The bidder shall refer these detailed descriptions for clarity.
- kk) For underground Fiber optic cable, **Annexure-XII** shall be referred.
- ll) In Section-GTR and other Technical specifications, the term “Purchaser” and/or “Employer” may be read as “Owner”.

12. PRECOMMISSIONING, COMMISSIONING, TRIAL-RUN & COMPLETION

As soon as the Facilities covered by these specifications are physically completed in all respects, the Pre commissioning, Commissioning, Trial run and Completion of the Facilities, as mentioned below, shall be attained in accordance with the procedure given in the Conditions of Contract, Vol.-I of the Bidding Documents.

(i) Pre commissioning: As per relevant Chapters

(ii) Commissioning : Charging of the Facilities at rated voltage

Further, wherever appearing in these specifications, the words – ‘commissioning checks’, ‘installation checks’, ‘site tests’, ‘performance guarantee tests for fire protection system’, are to be considered as ‘pre commissioning checks’.

(iii) Trial-run : Operation of the Facilities or any part thereof by the Contractor immediately after the Commissioning for a continuous period of 72 (Seventy two) hours continuously. In case of interruption due to problem / failure in the respective equipment, the contractor shall rectify the problem and after rectification, continuous 72 (Seventy two) hours period start after such rectification.

(iv) Completion : Upon successful completion of Trial-run.

‘Guarantee Test(s)’ and/or ‘Functional Guarantees’ are applicable only for Substation Automation System as specified in Chapter-‘Substation Automation System.’