Pre-qualifying Requirement
Annexure- PQR

Pre-qualifying Requirement (Technical) for 400kV GIS

(i.) The GIS must be offered from Indian manufacturer, who meets the requirement mentioned at Route-1/ ~~Route-2~~/ Route-3 below.

&

(ii.) Bidder must meet the any of the following qualification Route-1/ ~~Route-2~~/ Route-3,

Route-I:

(5.13.1) The Bidder/ ~~Sub vendor~~ should have designed, manufactured, erected/ supervised erection, tested/ supervised testing and commissioned/ supervised commissioning of one (1) Gas Insulated Switchgear (GIS) equipment(s) installation having at least six (6) bays of 400kV or above voltage class with short circuit current of not less than 40 kA for 1 second, which should have been in successful operation(#) for minimum two (2) years as on the originally scheduled last date of technical bid submission of this tender.

~~**Route-II:**~~

~~(5.13.2) (a) The Bidder/ Sub vendor should have designed, constructed/ erected, tested and commissioned one (1) Air Insulated Substation/ Switchyard of 400 kV or above voltage class having at least six (6) bays which should have been in successful operation for a minimum period of two (2) years.~~

~~&~~

~~(5.13.2) (b) The Bidder/ Sub vendor associates with a GIS manufacturer for sourcing of GIS equipments who meets the requirement indicated at 5.13.1 above. The associate will also be fully responsible for the performance of the GIS portion of the contract.~~

~~In such an event the Bidder shall arrange a Letter of Technical Support to this effect from its Associate as per the format enclosed in the bidding document. This Letter of Technical Support should be submitted prior to the placement of order on approved vendor.~~

Route-III:

(5.13.3) The Bidder/~~Sub vendor~~ should have established manufacturing facilities for GIS equipment in India based on technological support of **an associate** (who meets the requirement at (5.13.1) above) and Bidder/~~Sub vendor~~ should have designed, manufactured, and supplied one (1) Gas Insulated Switchgear (GIS) equipment(s) installation having at least six (6) bays of 400kV or above voltage class. The **associate** will be fully responsible for the performance of the GIS portion of the contract.

In such an event the Bidder shall arrange a Letter of Technical Support to this effect from its **Associate** as per the format enclosed in the bidding document. This Letter of Technical Support should be submitted prior to the placement of order on approved vendor.

Note: -

1) For the purpose of qualifying requirement, one no. of bay shall be considered as a comprising of at least one circuit breaker, two disconnectors and single phase current transformers.
2) (#) Satisfactory operation means certificate issued by the Employer certifying the operation without any adverse remark.

8/5/24 05/05/24. 5.05.24.

EPC PACKAGE FOR 2 X 660 MW
SUPER CRITICAL THERMAL POWER PROJECT,
HTPS, KORBA WEST

(Experience Details - Applicable to all the Bidders)

ATTACHMENT 3K- DOCUMENT(SWITCHYARD*) :*

Sub: Sub-Qualifying Requirements for 400KV GIS Switchyard : (Route-I)

In order to satisfy the requirement of as indicated in Technical Specification, Clause No. 5.13.I of Annexure-PQR We/ Sub vendor hereby confirm that M/s..... ..... is the Bidder / Sub vendor have designed, manufactured, erected/ supervised erection, tested/ supervised testing and commissioned/ supervised commissioning of one (1) Gas Insulated Switchgear (GIS) equipment(s) installation having at least six (6) bays of 400kV or above voltage class with short circuit current of not less than 40 kA for 1 sec as per stipulated requirements mentioned under Clause no. 5.13.1 Annexure-PQR of Bidding documents. The details of above are as under:

Sl. No.	Item Description	Details
1.	Name and Address of Bidder /sub vendor and Name of contact person with email ID, Telephone & Fax Nos.	
2.	Client Name and its Address, including Tel. No. and Fax no.	
3	Name of the plant / project & its location for which the Bidder / Subvendor have designed, constructed / erected, tested and commissioned one (1) Gas insulated Switchgear (GIS) Substation installation having at least six (6) bays of 400kV or above voltage class with short circuit current of not less than 40 kA for 1 sec .	
4.	Name and designation of the responsible person in Clients organisation.	
5	Name & locatin of the substation / switchyard	
6.	i)Contract No. & Date	
	ii)Brief scope of work	
	iii) Value of Order	
07	Scope of work for the aforesaid contract includes the following for Bidder /sub vendor	

Signature of authorized signatory.....

	(i) Manufactured	Yes/No
	(ii) Supplied	Yes/No
	iii)Type test	Yes/No
	iv)Constrction / Erection	Yes/No
	v)Testing	Yes/No
	vi)Commissioning	Yes/No
08	Details of 400kV or above Bays:	
	i)Voltage Level (in KV)	
	ii) No of Bays	
	iii) Short Circuit current rating (in kA for 1 Sec.)	
	iv)Whether GIS insulated Substation/Switchyard or not	Yes/No
09	Date of Commissioning	
10	Date of commencement of successful Operation & No of years of service	
112	Whether one (1) GIS insulated substation of 400kV or above voltage class having at least Six(6) bays which should have been in successful operation for a minimum period of two(2) years prior to the date of Tech-commercial bid opening .	Yes / No
11.	Client(s) certificate(s) enclosed in support of stated experience above at Annexure.....to this Attachment-3K.(Use separate sheet for each experience/Contract)	YES* / NO*

Note :

Signature of authorized signatory.....

1. For the purpose of qualifying requirement, one no. of bay shall be considered as a bay comprising of at least one circuit breaker, two disconnectors and three single phase current transformer.
2. Bidder May gove details of more than one installation for Employer's reference, if he so desires.

*Bidder to strike-off whichever is not applicable.

Date :

Place :

(Signature).....

(Printed Name).....

(Designation).....

(Common Seal).....

Route-II:

In order to satisfy the requirement of as indicated in Technical Specification, Clause No. 5.13.2(a) of Sub-Section-IA, Part-A, Section-VI, We/ Sub vendor hereby confirm that M/s..... ..... is the Bidder / Sub vendor have designed, manufactured, erected/ supervised erection, tested/ supervised testing and commissioned/ supervised commissioning one (1) Air Insulated Substation/ Switchyard of 400 kV or above voltage class having at least six (6) bays which should have been in successful operation for a minimum period of two(2) years as per stipulated requirements mentioned under Clause no. 5.13.2(a) of Sub-Section-IA, Part-A, Section-VI of Bidding documents. The details of above are as under:

Sl. No.	Item Description	Details
1.	Name and Address of Bidder /sub vendor and Name of contact person with email ID, Telephone & Fax Nos.	
2.	Client Name and its Address, including Tel.	

Signature of authorized signatory.....

	No. and Fax no.	
3	Name of the plant / project & its location for which the Bidder / Subvendor have designed, constructed / erected, tested and commissioned one (1) Air insulated substation of 400kV or above voltage class having at least Six (6) bays.	
4.	Name and designation of the responsible person in Clients organisation.	
5	Name & locatin of the substation / switchyard	
6.	i)Contract No. & Date	
	ii)Brief scope of work	
	iii) Value of Order	
07	Scope of work for the aforesaid contract includes the following for Bidder /sub vendor	
	(i) Manufactured	Yes/No
	(ii) Supplied	Yes/No
	iii)Type test	Yes/No
	iv)Constrction / Erection	Yes/No
	v)Testing	Yes/No
	vi)Commissioning	Yes/No
08	Details of 400kV or above Bays:	
	i)Voltage Level (in KV)	
	ii) No of Bays	
	iii) Short Circuit current rating (in kA for 1 Sec.)	
	iv)Whether Air insulated Substation/Switchyard or not	Yes/No
09	Date of Commissioning	

10	Date of commencement of successful Operation & No of years of service	
112	Whether one (1) Air insulated substation of 400kV or above voltage class having at least Six(6) bays which should have been in successful operation for a minimum period of two(2) years prior to the date of Tech-commercial bid opening .	Yes / No
11.	Client(s) certificate(s) enclosed in support of stated experience above at Annexure.....to this Attachment-3K.(Use separate sheet for each experience/Contract)	YES* / NO*

Note :

i) For the purpose of qualifying requirement, one no. of bay shall be considered as a bay comprising of at least one circuit breaker, two disconnectors and three single phase current transformer.
ii) Bidder May gove details of more than one installation for Employer's reference, if he so desires.

*Bidder to strike-off whichever is not applicable.

Date :

Place :

(Signature).....

(Printed Name).....

(Designation).....

(Common Seal).....

Signature of authorized signatory.....

In order to satisfy the requirement of as indicated in Technical Specification, Clause No. 5.13.2(b) of Sub-Section-IA, Part-A, Section-VI, We/ Sub vendor hereby confirm that M/s..... ..... is the associates with a GIS manufacturer for sourcing of GIS equipments who meets the requirement indicated at 5.13.1 above. The associate will also be fully responsible for the performance of the GIS portion of the contract.

In such an event the Bidder shall arrange a Letter of Technical Support to this effect from its Associate as per the format enclosed in the bidding document. This Letter of Technical Support should be submitted prior to the placement of order on approved vendor.

Sl. No.	**Item Description**	**Details**
1.	Name and Address of associate and Name of contact person with email ID, Telephone & Fax Nos.	
2.	Client Name and its Address, including Tel. No. and Fax no.	
3	Name of the plant / project & its location for which the Bidder / Subvendor have designed, constructed / erected, tested and commissioned one (1) GIS insulated substation of 400kV or above voltage class having at least Six (6) bays. with short circuit current of not less than 40 kA for 1 sec .	
4.	Name and designation of the responsible person in Clients organisation.	
5	Name & locatin of the substation / switchyard	
6.	i)Contract No. & Date	
	ii)Brief scope of work	
	iii) Value of Order	
07	Scope of work for the aforesaid contract includes the following for Bidder /sub vendor	
	(i) Manufactured	Yes/No
	(ii) Supplied	Yes/No
	iii)Type test	Yes/No
	iv)Constrction / Erection	Yes/No
	v)Testing	Yes/No

Signature of authorized signatory.....

	vi)Commissioning	Yes/No
08	Details of 400kV or above Bays:	
	i)Voltage Level (in KV)	
	ii) No of Bays	
	iii) Short Circuit current rating (in kA for 1 Sec.)	
	iii)Whether GIS insulated Substation/Switchyard or not	Yes/No
09	Date of Commissioning	
10	Date of commencement of successful Operation & No of years of service	
11	Whether one (1) GIS insulated substation of 400kV or above voltage class having at least Six(6) bays which should have been in successful operation for a minimum period of two(2) years prior to the date of Tech-commercial bid opening .	Yes / No
12.	Client(s) certificate(s) enclosed in support of stated experience above at Annexure.....to this Attachment-3K.(Use separate sheet for each experience/Contract)	YES* / NO*

Note :

i)For the purpose of qualifying requirement, one no. of bay shall be considered as a bay comprising of at least one circuit breaker, two disconnectors and three single phase current transformer.

ii)Bidder May gove details of more than one installation for Employer's reference, if he so desires.

*Bidder to strike-off whichever is not applicable.

Signature of authorized signatory.....

Date :

Place :

(Signature).....

(Printed Name).....

(Designation).....

(Common Seal).....

Signature of authorized signatory.....

ROUTE-III:

We have established manufacturing facilities for GIS Equipment in India based on technological support of an associate M/s …….. Who meet the requirements specified in clause no. 5.13.1 of Annexure-PQR of Bidding Documents and in support of same we give the following details:

We the Bidder/Sub vendor have established manufacturing facilities for GIS equipment in India based on technological support of an associate (who meets the requirement at 5.13.1 above) and Bidder/Sub vendor should have designed, manufactured, and supplied one (1) Gas Insulated Switchgear (GIS) equipment(s) installation having at least six (6) bays of 400kV or above voltage class. The associate will be fully responsible for the performance of the GIS portion of the contract.

In such an event the Bidder shall arrange a Letter of Technical Support to this effect from its Associate as per the format enclosed in the bidding document. This Letter of Technical Support should be submitted prior to the placement of order on approved vendor as per stipulated requirements mentioned under Clause no. 5.13.3 of Annexure-PQR of Bidding documents. The details of above are as under:

For Bidder/sub-vendor's having GIS Manufacturing facility in India:

Sl. No.	Item Description	Details
1	Name & Location of the GIS manufacturing facilities	
2.	Name of contact person with email ID, Telephone & Fax Nos of GIS manufacturing facility.	
3	Name and address of the associate providing technological support with Telephone, Fax and email etc	
4	Whether manufacturing facility for GIS available in India based on technological support of Associate.	Yes*/ No*
5	Name of the plant / project & its location for which the Bidder / Subvendor have designed, constructed / erected, tested and commissioned one (1) GIS insulated substation of 400kV or above voltage class having at least Six (6) bays. with short circuit current of not less than 40 kA for 1 sec .	

Signature of authorized signatory.....

4.	Name and designation of the responsible person in Clients organisation.	
5	Name & locatin of the substation / switchyard	
6.	i)Contract No. & Date	
	ii)Brief scope of work	
	iii) Value of Order	
07	Scope of work for the aforesaid contract includes the following for Bidder /sub vendor	
	(i) Manufactured	Yes/No
	(ii) Supplied	Yes/No
	iii)Type test	Yes/No
	iv)Constrction / Erection	Yes/No
	v)Testing	Yes/No
	vi)Commissioning	Yes/No
08	Details of 400kV or above Bays:	
	i)Voltage Level (in KV)	
	ii) No of Bays	
	iii) Short Circuit current rating (in kA for 1 Sec.)	
	iii)Whether GIS insulated Substation/Switchyard or not	Yes/No
09	Date of Commissioning	
10	Date of commencement of successful Operation & No of years of service	
11	Whether one (1) GIS insulated substation of 400kV or above voltage class having at least Six(6) bays which should have been	Yes / No

	in successful operation for a minimum period of two(2) years prior to the date of Tech-commercial bid opening .	
12.	Client(s) certificate(s) enclosed in support of stated experience above at Annexure.....to this Attachment-3K.(Use separate sheet for each experience/Contract)	YES* / NO*

Note :

i)For the purpose of qualifying requirement, one no. of bay shall be considered as a bay comprising of at least one circuit breaker, two disconnectors and three single phase current transformer.

ii)Bidder May gove details of more than one installation for Employer's reference, if he so desires.

*Bidder to strike-off whichever is not applicable.

Date :

Place :

(Signature).....

(Printed Name).....

(Designation).....

(Common Seal).....

Signature of authorized signatory.....

SUPPORT FOR SATISFACTORY PERFORMANCE OF 400kV GIS FOR KORBA WEST STPP(2X660MW)

TO:

[EMPLOYER'S NAME & ADDRESS]

Sub: Letter of Support submitted From …….(name of the Associate) undertaking the responsibility for satisfactory performance of 400kV GIS.

Dear Sirs,

1. In accordance with the Award of the Contract by ……. (Name of the Contractor) to M/s. ……. (Name of the sub-vendor), we, the aforesaid Associate, (M/s …….) shall be fully responsible for the satisfactory performance of the 400kV GIS.

2. Further, the manner of achieving the objective set forth in point 1 above shall be as follows For ……. (Equipment name):

   (a) We the Associate shall be fully responsible for design, engineering, manufacture, assembly, testing and inspection at manufacturer's works before despatch, packing, insurance, supply, transportation, delivery to project site, handling, storage and preservation at site store, transportation to place of installations, complete work of site assembly, erection, testing at site and commissioning of 400 KV GIS Equipment and putting into satisfactory operation.

   (b) Further, we shall depute our technical experts from time to time to the Contractor's/*Sub-Vendor's works/Employer's project site as and when necessary to facilitate the successful performance of the 400 KV GIS.

   (c) Further, We shall ensure proper design, manufacture, supply, installation, testing and commissioning for the successful performance of the 400 KV GIS Equipment covered under the said Contract in accordance with stipulations of Bidding Documents and if necessary the we shall advise the Contractor/*Sub-Vendor suitable modifications of design and implement necessary corrective measures to discharge the obligations under the contract.

   (d) We shall participate in Technical Co-ordination meetings (TCMs) from time to time, as and when required by Employer.

   (e) We shall promptly carry out all the corrective measures and shall promptly provide corrected design and shall undertake replacements, rectifications or modifications to the equipment as

and when required by Employer in case the equipment fails to demonstrate successful performance as per contract at site.

3. We, the Associate do hereby undertake and confirm that this Letter of Support shall be valid till 90(ninety) days after the end of the defect liability period of the contract.

Signature of the Authorised Representative:……..…

For M/s ……

(Associate)

Name ……..…..

Designation ……

Date:……

Common Seal of the Company

***: Strike off whichever is not applicable.**

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NOIDA

DOCUMENT NO.	**TB-PBTU-CSPGCL-GIS**	**Rev 00**	**Prepared**	**Checked**	**Approved**
TYPE OF DOC.	**TECHNICAL SPECIFICATION**	**NAME**	**BY**	**DKS**	**VK**
TITLE **400kV Gas Insulated Switchgear with its accessories**		**SIGN**	-sd-	-sd-	-sd-
		DATE	10.05.2024	10.05.2024	10.05.2024
		GROUP	**TBEM**		
		WO No.			

CUSTOMER	**Chhattisgarh State Power Generation Company Limited (CSPGCL),**
PROJECT	Pre Bid Tie up for, EPC Package for Design, Engineering, Manufacturing, Supply, Erection, Testing And Commissioning of 400kV GIS Switchyard of 2 X 660 Mw Super Critical Thermal Power Project, HTPS, CSPGCL Korba West

Contents

Remarks:
Bidder to note that data and details of Guaranteed Technical Particulars shall not be reviewed during Technical Evaluation/ Review, hence compliance of Guaranteed Technical Particulars in line with Technical Specification has to be ensured by the bidder.

Rev. No.	Date	Altered	Checked	Approved	
Distribution				To	
				Copies	

SECTION 1: CHECKLIST FOR TECHNICAL EVALUATION

Along with the technical offer/ bids, the bidder should submit this checklist confirming the inclusion of the enclosures as listed below,

Sl. No.	Documents to be enclosed	Bidder to confirm (Please tick "Confirmed")
1.	Supporting documents for compliance of Technical Qualifying Requirement.	Confirmed
2.	Unpriced BOQ duly mentioning "Quoted" for all the items, signed and sealed.	Confirmed
3.	Annexure-A & B duly filled, signed and sealed.	Confirmed

Note: Any bidder not meeting the above requirement is liable for non-evaluation.
The above checklist is reviewed and verified for,

NIT Reference No.:

Name of Bidder:

Name of Project:

Date: Bidder's Stamp & Signature

CONTENTS

1. SCOPE

This technical specification covers the requirements of (1) design, type testing, engineering, fabrication, manufacturing, shop assembly, inspection including and testing at manufacturer's works, proper packing, supply and delivery to project site, (2.) supervision of material reconciliation, installation/ erection, (3.) execution of site testing & commissioning along with necessary kits, tools & equipment, putting GIS with LCC & its Accessories into successful operation complete with all materials, support structures, anchoring bolts, chemical anchor, accessories, commissioning spares & maintenance spares, special spanners, special tools & tackles, any specific required ancillary services, SF6 gas for first filling & spare etc. including design studies, training of Customer/ BHEL personnel for offered GIS & its Accessories complete in all respects for efficient & trouble-free operation mentioned under this specification.

The complete technical specification comprises of following sections:

Section-1	:	Standard & Project Specific Technical Specification & Bill of Quantities
Section-2	:	Equipment Specification under scope of Supplies
Section-3	:	Project Details & General Technical Requirements (For All Equipment under the Project)
Section-4	:	Annexures Annexure A- Compliance Certificate Annexure B- Schedule of Technical Deviations

The following order of priority shall be followed. In case of conflict between requirements specified in various documents, the more stringent one shall be followed. BHEL/Customer concurrence shall, however, be obtained before taking a final decision in such matters.

1. Statutory Regulations
2. Section-1 (Standard Specification for GIS)
3. Section-1 (Project Specific Specification for GIS)
4. Section-2
5. Section-3

Bidder shall furnish list of conflicts/ ambiguities/ deviations, if any, along with their technical offer and also furnish the basis that is considered for submitting technical offer. BHEL will address the bidder's listed conflicts prior to award. In case of ambiguity, bidder shall inform BHEL of their interpretation. In case bidder fails to convey the same prior to award, BHEL decision on interpretation shall be considered final if need arises during the execution. No additional cost or extra time on account of conflicts/ ambiguities/ deviations shall be admissible.

In general, no deviation from the requirements specified in various clauses of this specification shall be allowed and hence, a certificate to this effect shall have to be furnished along with the offer (Annexure-A), however bidder shall furnish list of conflicts/ ambiguities/ deviations (Annexure-B), if any. Any deviation not specifically brought out in Annexure-B (Schedule of Technical Deviations) **shall not be admissible** for any time and commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications

irrespective of any such deviation indicated / taken elsewhere in the submitted offer and hence, any conflicts/ ambiguities/ deviations mentioned elsewhere in technical offer shall not be reviewed.

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the notice inviting tender/ enquiry.

2. PROJECT SPECIFIC TECHNICAL REQUIREMENTS

Project specific technical requirements shall be as per Section-1 (Part-B) of technical specification.

3. GENERAL TECHNICAL REQUIREMENTS

The other general requirements for GIS with LCC & its Accessories shall be as follows,

1. The positioning of the circuit breaker in the GIS shall be such that it shall be possible to access the circuit breaker of any feeder from the front side for routine inspection, maintenance and repair without interfering with the operation of the adjacent feeders.
2. The physical layout shall ensure free movement of the SF6 Gas Cart and easy access to all components of the GIS for operation and maintenance purposes.
3. The service activities shall include consumables/ commissioning spares required during commencement of GIS installation, testing and commissioning in all respect.
4. Bidder shall offer their latest type tested model to accommodate the specified & allocated space as per attached layout drawing of GIS.
5. Bidder shall conduct insulation co-ordination studies including VFTO report in line with IEC for establishing surge arrester rating, quantity and any other requirement for successful operation of GIS, however, additional supply of surge arrester in line with above required shall be paid as per Bill of Quantity, as applicable.
6. Bidder shall check and ensure adequacy of system protection for successful operation of GIS. After checking of system by bidder, GIS shall be installed and if any failure, malfunction of any part occurs after/ during commissioning, same shall be replaced immediately without any extra cost.
7. In case, Controlled Switching Device is specifically required as per BOQ/ Technical specification, same shall have display facility at the front for the display of settings and measured values. In case, CSD does not have complete display facility for settings and measured values, bidder to supply one number laptop PC with pre-installed, licensed software for each site. Special cable required for integration is deemed inclusive in bidder's scope.
8. The quantity of SF6 gas for GIs shall include quantity for initial installation of complete GIS System, including wastage during installation, testing and successful commissioning. Hence, Supply of additional quantity to cater the losses during installation, testing & commissioning shall be deemed to include in bidder's scope.
9. The offered GIS with LCC & its Accessories shall be complete in all respect in compliance to technical specification and relevant IS/ IEC/ IEEE standards as applicable. Any other equipment/ material required to complete the specified GIS scope of work are inclusive of bidder's scope of supply & services.
10. All essential and desirable accessories are deemed inclusive of offer i.e. and not limited to Gas Monitoring Devices, Pressure Switches, PD sensors, Pressure relief device, insulator, expansion joint/ flexible, bellows/ compensators like lateral mounting units, Axial compensators, Parallel compensators, tolerance compensators and vibration compensators etc. complete in all respect.
11. Length & route of GIB is purely indicative and same shall be finalized during detailed engineering stage.
12. BHEL reserve rights to amend Bay sequence during contract stage, no separate claim

shall be admissible in this regard.

13. Any Item not quoted mentioned "Not Applicable" in Bill of Quantity and found applicable as per technical specification and system requirement shall be supplied without any commercial implication to BHEL/ Customer.
14. Gas Insulated Bus Bars running across the length of the switchgear/ main bay to tie bay to interconnect each of the bay modules (as per layout) along with necessary interfaces (as applicable under the technical requirement) is deemed to be inclusive in the scope of bidder, however, it shall be payable/ not payable as per Bill of Quantity.
15. Special Tools &, tackles, Testing & Maintenance Equipment/ Instruments shall be supplied and demonstrated at site as per requirement of Bill of Quantity, however same shall not be used for erection/ installation, testing and commissioning of GIS, hence bidder to bring Special Tools &, tackles, Testing & Maintenance Equipment/ Instruments at site for during erection/ installation, testing & commissioning on returnable basis.
16. Final documentation shall be submitted in hard copy (six copies) as well as soft (Three CDs/DVDs/ Pen Drives).
17. Bidder to submit all supporting documents in English. If document submitted by bidder is other than English language, self-attested English translated document should also be submitted.
18. Total contract value may vary up to ±30% at contract stage.

4. METHODOLOGY FOR MEASUREMENT OF GIB DUCT

1. Length measurement of Gas Insulated Bus (GIB) duct shall be considered from the end of last GIS Bay equipment (VT, LA etc.) to end termination point (SF6 to air bushing / SF6 to oil bushing/ Cable connection module etc.).
2. Any change in bay pitch (distance between bays): In a case where shifting of GIS bays shall be called by BHEL (during contract stage) due to layout requirement/ cost optimization/ revision/ change in civil architectural requirement or due to expansion joint requirement in the GIS building, Bidder to incorporate the same with full compliance of technical requirement. Payment for additional length of main bus bar shall be payable against Bill of Quantity item under head "Gas Insulated Bus Duct", subject to condition that such shifting is not attributed to bidder.

5. SUPPORT STRUCTURE & HARDWARE (INCLUDING STRUCTURE STEEL)

1. Structural Steel, Support Structure & Hardwares (required for installation of complete GIS system with LCC & its Accessories etc.) are deemed to be inclusive in bidder's scope of supply, whether, same may/ may not be indicated with break-up in Bill of Quantity.
2. All steel structure members shall be hot-dip galvanized after fabrication (excluding floor embedded items for which OEM standard practice & recommendation shall be followed). All field assembly joints shall be bolted. Field welding shall generally not be acceptable. Noncorrosive metal or plated steel shall be used for bolts and nuts throughout the work, however for complete details, please refer Section-2.
3. Lattice/ pipe structure materials for support of GIS, Bus Ducts, SF6 to oil bushing/ SF6 to cable connection, SF6 to air bushing/ connection including anchor fastener, bolts, foundation bolts, base plate / channel / metallic / structural member for placement of GIS system, all floor and wall embedded Items, wall crossing arrangements, rails and/ or other items structural items as required. Bidder shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts, Anchor Fasteners, foundation bolts, nuts and washers, equipment fixing hardware shall be provided to fasten the switchgear base frames to the foundation channels as applicable
4. The GIS Equipment shall be complete with all necessary supports, ladders, galleries, staircases, catwalks, movable platforms or walkways (for accessing the equipment above

two meters for maintenance and operation), mechanism cabinets, internal cable raceways etc. for each bay and it shall be of modular construction and extendable design.

5. Structural steel for complete GIS system with LCC & its Accessories is deemed to be inclusive in bidder's scope of supply.

6. INTERNAL CABLING

1. Power, control & instrumentation cables for Cabling (1.) within GIS, (2.) GIS to LCC, (3.) LCC to LCC (excluding incoming power cable) shall be deemed inclusive in bidder's scope. The details for same may/ may not be indicated with Bill of Quantity. However, bidder to ensure completeness for GIS system with LCC & its Accessories
2. In addition to above, cables required for other accessories including Gas monitoring system, PD monitoring system etc. shall also be included in bidder's scope.
3. The other materials including cable lugs, glands, shrouds, ferrules, ties etc. required for completeness of cabling work is included in bidder's scope.
4. Bidder shall provide complete cable schedule along with termination during detailed engineering stage for carrying out the activities at site.
5. Bidder shall ensure that termination blocks in the panels both for incoming feeder cables shall be suitable for termination of requisite cable.

7. EARTHING MATERIALS FOR GIS

Bidder to submit detailed calculations and layout drawings for earthing system during detailed engineering stage based on technical specification, bidder's design philosophy, IS/ IEC/ IEEE requirement as applicable. Bidder to provide the bill of quantity of earthing materials requirement for entire GIS system with LCC & its Accessories. However, following may please be noted in this regard,

1. Supply of 40 mm MS ROD, 75X12 mm GI Flat, 50X06 mm GI Flat is **not in bidder's scope** of supply. These materials shall be supplied by BHEL as a free issue item and shall be used in line with approved earthing philosophy and technical requirement. However, any other earthing materials (Cu Flat/ braid, Al Flat/ Braid, Lug, hardware etc.), other than mentioned above, shall be in bidder's scope of supply.
2. Installation/ erection/ laying of earthing system for GIS shall be done by BHEL/ its contractor, however, supervision shall be provided by bidder as per approved design philosophy.
3. Special requirement for earthing (as mentioned in Section-2) shall be duly taken care while designing the earthing system for GIS and its associated system.

8. DRAWINGS / DOCUMENTS FOR MANUFACTURING CLEARANCE

The drawings/ documents, as follows shall be used for providing technical clearance for manufacturing of GIS and furthermore, it shall be used for delay analysis, if any, from bidder. The first drawing submission will be counted from the date of submission of reasonably correct drawings.

Sl. No.	Overall Drawings approval required in Cat I /Cat II
	Lot1
1	GIS- Gas Schematics with Single Line Diagram (Including CT VT Parameters)
2	GIS- Guaranteed Technical Particulars (Including all GIS equipment)
3	GIS- Layout, Plan & Section Drawing
4	GIS- Interfacing Drawings for Cable Connection Module / SF6 to Air Bushing /

	SF6 to Oil Module (as applicable) with its Guaranteed Technical Particulars
5	GIS- Type Test Reports (Including all GIS equipment)
6	GIS- Quality Assurance Plan & Inspection Test Schedule
	Lot 2
7	GIS- Secondary Engineering Base Design & Control Schematics for GIS and Local Control Cabinet
8	GIS- Maintenance Equipment Catalogue with Guaranteed Technical Particulars, test reports
9	GIS- Civil Design Specification with Foundation Loading Diagram (Including interfacing details)
10	GIS – Support Structure, Platform, Wall & Floor Inserts & Hardware drawing & BOM
11	GIS- Earthing Layout with Design
12	GIS- Quantification for main Items, Spares, Consumables
13	Design Calculations for GIS including insulation co-ordination studies with VFTO report, earthing design calculations etc.
	Miscellaneous Drawing
15	GIS- 3D OGA Drawing compatible with Autocad & Primtech for GIS System (3D-Model with complete editable data base)
16	Manuals on unloading, safe storage, transportation, installation, testing, commissioning, routine check, preventive maintenance

9. TYPE TESTING

Bidder to comply the requirement of Type Tests as mentioned Section-2. All equipment being supplied shall in general conform to type tests as per technical specification and shall be subject to type, routine & acceptance tests in accordance with requirements stipulated in Section-2.

10. QUALITY PLAN

The successful bidder shall submit Quality Assurance Plan (including manufacturing Quality Plan, Factory Acceptance Test etc.) for major components such as breakers, disconnecting switches, lightning arrestors, earth switches, etc. with in-process inspection methods, tests, records, etc. for BHEL/ Customer approval. Customer hold points shall also be included in the plan, which shall be mutually agreed by the BHEL/ Customer and Bidder and approved. In case bidder has reference Quality Assurance Plan agreed with BHEL/ Customer, same shall be submitted for specific project to BHEL/ Customer approval. There shall be no commercial implication to BHEL/ Customer on account of Quality Plan approval.

Superior quality control system shall be adopted to assure high product quality. Raw

materials of the best commercial grade quality and high reliability shall be used in the manufacture of GIS. High reliability of materials shall be ensured so as to keep maintenance work to a minimum. All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan. The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification. Charges for all these tests for all the equipment & components shall be deemed to be included in bidder's scope.

GIS and its associated materials shall be subject to inspection by BHEL/ Customer or authorized representative at bidder/ manufacturers' works. Hence, Bidder shall furnish all necessary information concerning the supply to BHEL/ Customer. During fabrication, the equipment shall be subject to inspection by BHEL/ Customer or by an agency authorized by BHEL/ Customer to assess the progress of work as well as to ascertain that only quality raw material is used.

11. SITE SERVICES

Site service activities shall be carried out at in stages as per requirement or front availability at site, and hence multiple visits for completion of work are envisaged as per site requirements hence any claim in this regards shall be admissible as per Bill of Quantity.
Further, bidder shall carry out following supervision activities at site,

1. Supervision of complete installation / erection of GIS with LCC & its Accessories
2. Verification of materials for proper storage along with storage instructions/ training to site persons for long storage.
3. Support and assistance for reconciliation of surplus materials and handing over of spares to customer
4. Final documentation including AS BUILT documents

12. TESTING & COMMISSIONING

1. The GIS System shall be subjected to the site tests as per technical specifications, IEC-62271-203. Bidder to submit site acceptance testing (SAT) procedures and get the same approved from BHEL / Customer before commencement of testing at site.
2. Carrying out successful HV/ Power Frequency Testing of GIS as per IEC shall be in scope of bidder, which includes HV test kit with operator, accessories & tools required for completion of HV testing. In case, HV testing could not be completed in one go, same shall be payable/ not payable as per details mentioned in Bill of Quantity.
3. BHEL shall provide extend support and assistance at site for smooth conduction of HV Testing including unloading, assembling of HV test kit, dismantling, packing & loading back for transportation.
4. Complete Field testing and commissioning of GIS system with LCC & its Accessories are under the scope of Bidder.
5. Start-up & Commissioning spares are included in bidder's scope of supply and shall be included in the base price. Adequate stock of start-up & commissioning spares shall be made available at the site such that commissioning of the equipment/ systems, performance testing and handing over the equipment/ systems to customer can be carried out without any hindrance or delays.
6. Bidder shall ensure the availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply. Bidder shall give a notice of at least one year to the Customer & BHEL (both) before phasing out the products/spares to enable the owner for placement of order for spares and services.

13. ARRANGEMENT OF GENERAL/ SPECIAL TOOLS & TACKLES, TESTING INSTRUMENTS

1. Special tools & tackles for installation/ erection including SF6 gas cart/ plant shall be arranged by bidder and list for same shall be provided by during contract stage only. However, same shall be bought at site on **returnable** basis only. In addition to above, all testing instruments including HV Test Kit etc. required for successful installation, testing, commissioning of GIS shall also to be arranged by bidder on returnable basis and hence, cost of the same shall be deemed inclusive in the offer.
2. General tools & tackles shall be arranged by BHEL, however, details & list of such requirement including general tools-tackles, spanners, gauges, slings, other lifting devices, crane, welding machines, drills, general instruments etc. general in nature required for installation of GIS shall be provided bidder during contract stage only. In case bidder fails to convey the same along with technical bid, BHEL decision on interpretation of general tools tackle shall be considered final and any tools & tackles required, at later stage, shall be brought at site by bidder without any claim.
3. The bidder is clarified that no mandatory spares shall generally be used during the commissioning of the equipment.

14. PACKING AND DISPATCH

1. The equipment shall be carefully packed for transport by sea, rail and road in such a manner that it is protected against the climatic conditions and for any damage during transportation, transit and storage. Packing of the equipment shall be suitable for long storage (minimum 1 year).
2. The GIS transport units shall be shipped in the largest factory assembled units within transport and loading limitations and considering handling facilities on site to reduce the erection and installation work on site to a minimum. Where possible all items of equipment or factory assembled units shall be boxed in substantial crates or containers to facilitate handling in a safe and secure manner.
3. Each individual piece to be shipped, whether crate, container or large unit, shall be marked special notations such as ‘Fragile’, ‘This side up’, ‘Centre of gravity’, ‘Weight’, ’Owner's particulars’, ’PO no.’ etc., and other details as per purchase order & technical specification.
4. The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains and high ambient temperature.
5. Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. This applies particularly to the equipment of which each gas section shall be sealed and pressurized prior to shipping. Dry nitrogen/air or dry SF6 gas (in full compliance to technical requirement) shall be used and the pressure shall be such as to ensure that, allowing for reasonable leakage, it will always be greater than the atmospheric pressure for all variations in ambient temperature and the atmospheric pressure encountered during shipment to site and calculating the pressure to which the sections shall be filled to ensure positive pressure at all times during shipment.
6. All blanking plates, caps, seals, etc., necessary for sealing the gas sections during shipment to site shall be provided. Any seals, gaskets, `0' rings, etc. that will be used as part of the arrangement for sealing off gas sections for shipment of site, shall not be used in the final installation of the equipment at site. Vendor to provide quantity of components accordingly considering permanent installation and commissioning.

15. SPECIFIC- EXCLUSIONS (NOT IN BIDDER’S SCOPE)

Bidder to note the following exclusions, which are not in their scope of supply & services,

1. Installation / Erection of GIS with LCC & its Accessories except supervision work.

2. Cable laying & terminations, however supervision work & termination of special cables shall be in bidder's scope.
3. Open & Closed stores at site. (Bidder to provide space requirement in during contract stage only)
4. Local transportation/ conveyance for bidder's engineers shall be arranged by BHEL between local stay and site.
5. Office assistance shall be provided BHEL including sitting facility etc.
6. Receipt & unloading of material at site except verification of materials received at site
7. Terminal connector for SF6 to Air Bushing to conductor or any other interfacing equipment.
8. Watch & Ward of GIS material at BHEL Store
9. Civil Works i.e. GIS related civil works.
10. EOT crane, Air Conditioning & Ventilation System, Illumination System & Fire detection & alarm system, however complete input shall be provided for EOT and other system
11. Control Relay & Protection Panels, Numerical Relays, Bus Bar Protection Panel, SAS & ECS system, ACDB, DCDB, Battery & Charger
12. Earthing material i.e. 40 mm MS Rod, 50X6 GI Flat & 75X12 GI Flat for earthing
13. Outdoor AIS Equipments
14. Power & Control cable beyond LCC
15. BHEL/ Customer/ Third party inspector travel, lodging & boarding charges during testing / inspection.

Rev. No.	Date	Initiated by	Reviewed by	Approved by	Updates
04B	03.05.2024	By	DKS	VK	Revised for non POWERGRID projects

Contents

This technical specification is required for Pre-bid tie-up for participation in the following tender:

Name of the Customer	Chhattisgarh State Power Generation Company Limited (CSPGCL)
Name of Main Contractor	Bharat Heavy Electricals Limited
Name of the Project/ Tender	Pre Bid Tie up for, EPC Package for Design, Engineering, Manufacturing, Supply, Erection, Testing And Commissioning of 400kV GIS Switchyard of 2 X 660 Mw Super Critical Thermal Power Project, HTPS, CSPGCL Korba West
Location	Korba West

400kV Gas Insulated Switchgear:

Bay details:

The SF6 gas insulated switchgear (50 Hz) shall be of the indoor metal-enclosed type. 400kV 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 necessary base plate, Anchor Fastener for foundation bolts. In addition, all necessary stairs, platforms, supports, fixed ladders, portable scissor lift and walkways etc. as required for operation & maintenance work shall also be provided.

SF6 gas insulated metal enclosed bus bars, Circuit Breakers, Isolators, safety ground switches, High speed fault making ground switches, Current transformers, Surge arresters, GIS ducts, Local Bay control cabinets, On line Partial discharge Monitoring system for GIS switchgear, GIS Busducts, SF6 gas monitoring equipments, Bus VTs, etc.

Bay details are as shown in the Single Line diagram associated with CSPGCL Unit-6 and Unit-7 Stage-IV Units (2X660MW).

a) 400kV GIS modules/ Equipment as per Bill of Quantity (BOQ) and description given in section-2
b) Controlled Switching devices as per Bill of Quantity (BOQ).

c) Testing and Maintenance equipment as per Bill of Quantity (BOQ).
d) Any other equipment/material required to complete the specified GIS scope of work.

1. BILL OF QUANTITIES:

Please refer the followings

Section1_Annexure- BOQ_CSPGCL, Korba

a) During tender stage No of bays of GIS may vary. No of bays of GIS shall be finalized after receipt of Notification of award (NOA) from Customer/ BHEL.
b) Overall contract value may vary ±30%.

2. SPECIFIC TECHNICAL PARAMETERS

Please refer the following documents for project specific technical requirement,

- General Specification for 400kV GIS

Detailed technical requirement of GIS shall be as per SECTION-2.

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.

Any clarification(s) for GIS published by M/s Customer/ BHEL with reference to subject project will also valid for this specification.

3. OTHER TECHNICAL REQUIREMENTS

- SF6 GAS REQUIRED FOR PLACING GIS INTO SUCCESSFUL OPERATION - Complete in all respect in compliance to technical specification and requirements.
- STRUCTURE MATERIAL INCLUDING FOUNDATION BOLTS, EMBEDDED ITEMS, RAILS AND/ OR OTHER MATERIALS ETC - Complete in all respect in compliance to technical specification and requirements. In the event of changes in present scope, payment shall be made on pro-rata basis of number of circuit breaker bays only.

4. SPECIFIC TECHNICAL REQUIREMENTS FOR CSD

Complete interfacing with GIS and CSD shall be in bidder's scope. Any additional item like transducer, contact multiplication relay, switches, special/ screened cables, modification hardwired, modification in schematics for interfacing and for complying to the TS requirement shall be in bidder's scope.

All wiring necessary for interface of GIS/ CRP with bidder supplied CSD is deemed to be included in the scope of bidder. Cables, lugs, ties etc. required for connection of CSD in existing relay panel is deemed to be included in bidder's scope.

The CSD should have display facility at the front for the display of settings and measured values. In case where CSD does not have complete display facility for settings and measured values, bidder to supply one number laptop PC with pre-installed, licensed software for each site. Cost of the same shall be deemed included in offer.

Special cables (i.e., screened/ FO cable) other than 1.1kV LT Power & Control Cables required for CB / CSD / Relay Panel interfacing shall be in bidder's scope only.

5. TECHNICAL QUALIFYING REQUIREMENTS:

Please refer **Annexure-PQR** for qualification criteria. Bidder to submit complete supporting documents complying technical qualifying requirement along with the technical bid

6. TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

All GIS equipment being supplied shall conform to type tests as per technical specification and shall be subject to routine & acceptance tests in accordance with requirements stipulated under respective sections.

For the complete details of type test requirements, please refer Section-2 and Section-3 of technical specification.

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ANNEXURE: BOQ_400kV GIS_SERVICE_CSPGCL KORBA
REV No: 00
DATE: 05.05.2024

Sl. No.	Item Description	Unit	Qty.	Remarks
1.0	**SUPPLY- GIS: 400KV, 63KA FOR 1S, GAS INSULATED SWITCHGEAR (GIS) AS PER TS (Two bus with One & Half Breaker Scheme)**			
1.01	GIS SUPPLY: 400KV, 3150A, 63 kA, SF6 GIS BUS BAR MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS	SET	2	
1.02	GIS SUPPLY: 400KV, 63 kA, SF6 BUS PT BAY MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS	SET	2	400kV PT BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Disconnector with Double Maintenance Grounding Switch, complete with operating mechanism. (b) 3 NO- 1 phase multi winding Voltage Transformer In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable shall be included, however, Controlled Switching Device (CSD), Surge Arrester with counter, Online PD Monitoring System, Local Control Cubicle and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 400kV GIS)- Technical Specification.
1.03	GIS BAY SUPPLY: 400kV, 3150A, 63 kA, SF6 GIS GT FEEDER BAY MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS	SET	2	400kV GIS BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Circuit Breaker compatible for Controlled Switching Facility, complete with operating mechanism (b) 3 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. (c) 3 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism. (d) 6 NO- 1 phase multi ratio Current Transformer (f) 3 NO- 1 phase multi ratio Current Transformer for metering purpose In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Surge Arrester with counter, Online PD Monitoring System, Local Control Cubicle and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 400kV GIS)- Technical Specification.
1.04	GIS BAY SUPPLY: 400kV, 3150A, 63 kA, SF6 GIS ST FEEDER BAY MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS	SET	2	400kV GIS BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Circuit Breaker compatible for Controlled Switching Facility, complete with operating mechanism. (b) 3 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. (c) 3 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism. (d) 6 NO- 1 phase multi ratio Current Transformer (e) 3 NO- 1 phase multi ratio Current Transformer for metering purpose In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Surge Arrester with counter, Online PD Monitoring System, Local Control Cubicle and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 400kV GIS)- Technical Specification.
1.05	GIS BAY SUPPLY: 400kV, 3150A, 63 kA, SF6 GIS LINE FEEDER BAY MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS	SET	2	400kV GIS BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Circuit Breaker compatible for Controlled Switching Facility, complete with operating mechanism. (b) 3 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. (c) 2 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism. (d) 1 SET- 1 NO x3 phase Fast Acting Earthing Switch, complete with operating mechanism. (e) 6 NO- 1 phase multi ratio Current Transformer (f) 3 NO- 1 phase multi ratio Current Transformer for metering purpose In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Surge Arrester with counter, Online PD Monitoring System, Local Control Cubicle and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 400kV GIS)- Technical Specification.
1.06	GIS BAY SUPPLY: 400kV, 3150A, 63 kA, SF6 GIS LINE FEEDER BAY MODULE FOR INTERCONNECTION WITH EXISTING SWITCHYARD (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS	SET	1	400kV GIS BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Circuit Breaker compatible for Controlled Switching Facility, complete with operating mechanism. (b) 3 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. (c) 2 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism. (d) 1 SET- 1 NO x3 phase Fast Acting Earthing Switch, complete with operating mechanism. (e) 6 NO- 1 phase multi ratio Current Transformer (f) 3 NO- 1 phase multi ratio Current Transformer for metering purpose In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Surge Arrester with counter, Online PD Monitoring System, Local Control Cubicle and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 400kV GIS)- Technical Specification.
1.07	GIS BAY SUPPLY: 400kV, 3150A, 63 kA, SF6 GIS TIE FEEDER BAY MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS	SET	4	400kV GIS BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Circuit Breaker compatible for Controlled Switching Facility, complete with operating mechanism. (b) 2 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. (c) 4 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism. (d) 6 NO- 1 phase multi ratio Current Transformer In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Surge Arrester with counter, Online PD Monitoring System, Local Control Cubicle and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 400kV GIS)- Technical Specification.

Sl. No.	Item Description	Unit	Qty.	Remarks
1.08	GIS BAY SUPPLY: 400kV, 3150A, 63 kA, SF6 GIS BUS REACTOR FEEDER BAY MODULE (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS) AS PER TS	SET	1	400kV GIS BAY MODULE shall include following but not limited to, (a) 1 SET- 1 NO x3 phase Circuit Breaker compatible for Controlled Switching Facility, complete with operating mechanism. (b) 3 SET- 1 NO x3 phase Disconnector, complete with operating mechanism. (c) 2 SET- 1 NO x3 phase Maintenance Grounding Switch, complete with operating mechanism. (d) 1 SET- 1 NO x3 phase Fast Acting Earthing Switch, complete with operating mechanism. (e) 6 NO- 1 phase multi ratio Current Transformer In addition to above, Gas device, UHF sensors, Pressure Switches, Expansion joints/ Flexible connections, Insulators etc. as applicable, however, Controlled Switching Device (CSD), Surge Arrester with counter, Online PD Monitoring System, Local Control Cubicle and End Terminations, if applicable shall be covered separately. GIS shall be complete with all necessary terminal boxes, inspection windows, SF6 gas, grounding connection, pipings for gas monitoring system, trays, support structures with mounting hardwares, walkways, interconnecting cables with glands, ferrules, lugs etc. Please refer section-2 (TS for 400kV GIS)- Technical Specification.
1.09	GIS SUPPLY: 400KV, ONLINE PD MONITORING SYSTEM **(OPMS)** FOR 400KV GIS SYSTEM	Lot	1	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
1.10	GIS SUPPLY: 400KV, CONTROLLED SWITCHING DEVICE **(CSD)** FOR 420KV, 3-PH CIRCUIT BREAKER	SET	6	It is considered for ST & BR BAYS WITH ASSOCIATED TIE BAYS. 1 SET= 1 NO. OF EACH TYPE & RATING Please refer section-2 (TS for 400kV GIS)- Technical Specification.
1.11	SUPPLY- GIS : 400KV, 3150A, 1 PHASE GAS INSULATED BUS DUCT (INCLUDING SF6 GAS, STRUCTURE WITH HARDWARES AND EARTHING MATERIALS)	MTRS	1100	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
1.12	GIS SUPPLY: 400KV, 3150A, 1 PHASE SF6 TO AIR BUSHING (POLYMER) (INCLUDING SF6 GAS, STRUCTURE WITH HARDWARES AND EARTHING MATERIALS)	SET	24	1 SET= 1 NO. OF EACH TYPE & RATING Please refer section-2 (TS for 400kV GIS)- Technical Specification. It is considered for LINE FEEDER BAYS only.
1.13	GIS SUPPLY: 390KV, 20kA, CLASS-4, 1 PHASE SURGE ARRESTER WITH SURGE COUNTER (INCLUDING SF6 GAS, STRUCTURE, HARDWARES & EARTHING MATERIALS)	SET	6	Please refer section-2 (TS for 400kV GIS)- Technical Specification. 1 SET= 1 NO. OF EACH TYPE & RATING It is considered for BUS BAR MODULE only, however, no. of surge arrester, its excat rating and location shall be decided based on insulation coordination/ transient studies.
1.14	GIS SUPPLY: LOCAL CONTROL CUBICLES	SET	12	Please refer section-2 (TS for 400kV GIS)- Technical Specification. It is considered for GIS BAYS only.
2.0	**SUPPLY- GIS: SPECIAL TOOLS AND TESTING & MAINTENANCE INSTRUMENTS AS PER TS**			
2.01	GIS SUPPLY: SF6 GAS FILLING AND EVACUATING EQUIPMENT (PORTABLE)	NO.	1	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
2.02	GIS SUPPLY: SF6 GAS FILTERING, DRYING, STORAGE AND RECYCLING PLANT	NO.	1	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
2.03	GIS SUPPLY: SF6 GAS LEAK DETECTOR	NO.	1	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
2.04	GIS SUPPLY: OPERATIONAL ANALYSER WITH DCRM KIT-	NO.	1	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
2.05	GIS SUPPLY: SELF-POWERED HYDRAULIC AERIAL WORKING PLATFORM WITH ARTICULATED AND FLY BOOM FOR GENERAL PURPOSE MAINTENANCE IN SWITCHYARD AND TRANSFORMER YARD. (SUITABLE FOR 24M WORKING HEIGHT)	NO.	1	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
2.06	GIS SUPPLY: DEW POINT METER	NO.	1	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
2.07	GIS SUPPLY: PORTABLE PD MONITORING SYSTEM FOR GAS INSULATED SWITCHGEAR	NO.	1	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
2.08	GIS SUPPLY: SF6 GAS ANALYZING EQUIPMENT AND INSTRUMENT	NO.	1	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
2.09	GIS SUPPLY: PORTABLE LEAKAGE CURRENT ANALYZER (FOR GAPLESS SURGE ARRESTER)	NO.	1	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
2.10	GIS SUPPLY: HYDRAULIC PORTABLE TYPE LADDER	NO.	1	Please refer section-2 (TS for 400kV GIS)- Technical Specification.
3.0	**SPARES- GIS: 400KV, 63KA FOR 1S, GAS INSULATED SWITCHGEAR (GIS) AS PER TS**			
3.01	GIS SPARES: 400kV GIS- SF6 Gas Pressure Relief Devices of each type along with O-Rings	NO.	3	
3.02	GIS SPARES: 400kV GIS- SF6 Pressure gauge with coupling device cum switch or density monitors and pressure gauge, as applicable (of each type)	LOT	1	1 SET= 5% of total population (Max. 5 nos and min.1 nos)

Sl. No.	Item Description	Unit	Qty.	Remarks
3.03	GIS SPARES: 400kV GIS- Coupling device of each type for pressure gauge cum switch for connecting Gas handling plant	SET	2	
3.04	GIS SPARES: 400kV GIS- Rubber gaskets,"O"Rings and seals for SF6 gas, including Circuit Breaker, Disconnector and other GIS equipment	SET	3	
3.05	GIS SPARES: 400kV GIS- Molecular filter for SF6 gas with filter bags	SET	1	1 SET= 5% of Total weight
3.06	GIS SPARES: 400kV GIS- All type of control valves for SF6 gas of each type	SET	3	
3.07	GIS SPARES: 400kV GIS- SF6 gas cylinder of 50Kgs/ cylinder	LOT	1	LOT 1= 20% of total gas qty
3.08	GIS SPARES: 400kV GIS- Locking device to keep the Dis-connectors and Earthing switches in close or open position in case of removal of the driving mechanism (If applicable)	NO.	3	
3.09	GIS SPARES: 400kV GIS- Spares for Local control cabinet including MCB, fuses, timers, Aux Relays, contactors, push buttons, switches, lamps, annunciation windows etc of each type & rating, terminals of each type (Set)	SET	2	
3.1	GIS SPARES: 400kV GIS- UHF PD sensors of each type, if applicable	LOT	1	LOT 1= 5% of total population (max 5nos and min 1no)
3.11	GIS SPARES: 400kV GIS- Bus Support insulator / gas Barrier of each type along with associated contacts and shields	NO.	5	
3.12	GIS SPARES: 400kV GIS- SF6 to air bushing of each type & rating along with conductor and enclosure for 1 phase enclosure	NO.	1	
3.13	GIS SPARES: 400kV GIS- All types of Corona shield	SET	1	1 SET= 3 No. of each type
3.14	GIS SPARES: 400kV GIS Circuit Breaker- One complete pole (1phase unit) of circuit breaker including CSD/Closing resistor, grading capacitor(as applicable), of each type & rating complete with , interrupter, main circuit , enclosure and marshalling Box with operating Mechanism to enable replacement of any type / rating of CB by spare	SET	1	1 SET= 1 No. of each type & rating
3.15	GIS SPARES: 400kV GIS Circuit Breaker- Tripping coils assembly with resistors as applicable	SET	2	1 SET= 3 No. of each type
3.16	GIS SPARES: 400kV GIS Circuit Breaker- closing coil assembly with resistor as applicable (3nos of each type)	SET	2	1 SET= 3 No. of each type
3.17	GIS SPARES: 400kV GIS Circuit Breaker- Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating(If applicable)	SET	1	
3.18	GIS SPARES: 400kV GIS Circuit Breaker- Aux. switch assembly	SET	1	1 SET= 3 No. of each type
3.19	GIS SPARES: 400kV GIS Circuit Breaker- Operation counter	SET	1	1 SET= 3 No. of each type
3.2	GIS SPARES: 400kV GIS Circuit Breaker- Window scope/ Observing window, if applicable	SET	1	1 SET= 3 Nos. of each type
3.21	GIS SPARES: 400kV GIS Circuit Breaker-Spare of Hydraulic operated mechanism if Applicable: a. Hydraulic operating mechanism with drive Motor of each type- 1 no. b. Ferrules and joints & couplings of each type- 1 Set c. Hydraulic Filter of each type- 1 Sets d. High Pressure Hose of each type- 1 Set e. N2 accumulator of each type- 2 No. f. Pressure Transducers- 1No. g. Valves of each type- 1 Set h. Orings, gaskets and seals- 1 Set i. Pressure gauges with coupling device of each type- 1 Set j. Hydraulic oil- 20% of total used quantity in substation k. Limit switch- 1 no. of each type l. Pipe length (Copper & steel) of each size & type-1set m. Pressure switch of each type-2nos n. Pressure Relief device of each type- 1set	LOT	1	1 LOT= 1 Set for each type of Circuit Breaker
3.22	GIS SPARES: 400kV GIS Circuit Breaker- Complete Spring operating Mechanism including charging mechanism etc of each type & rating if applicable	SET	1	
3.23	GIS SPARES: 400kV GIS Circuit Breaker- Spring charging motor of each type & rating	NO.	2	
3.24	GIS SPARES: 400kV GIS Disconnector- Complete set of 3 nos. of single phase/ one 3- ph isolator of each type, dimension, current & voltage rating including main circuit, enclosure, driving mechanism and support insulator etc. to enable replacement of any type/ rating of isolator by spare	SET	1	
3.25	GIS SPARES: 400kV GIS Disconnector- Complete set of 3 nos. of single phase/ one 3-ph Maintenance earthing switch of each type, dimension, current & voltage rating including main circuit , enclosure , driving mechanism and support insulator etc to enable replacement of any type / rating of isolator by spare	SET	1	

Sl. No.	Item Description	Unit	Qty.	Remarks
3.26	GIS SPARES: 400kV GIS Disconnector- Complete set of 3 nos. of single phase / one 3-ph Fast earthing switch of each type, dimension, current & voltage rating including main circuit, enclosure, driving mechanism and support insulator etc. to enable replacement of any type / rating of isolator by spare	SET	1	
3.27	GIS SPARES: 400kV GIS Disconnector- Copper Contact fingers for isolator male & female contact along with corona shield -for one complete (3 phase) isolator of each type and rating	SET	1	
3.28	GIS SPARES: 400kV GIS Disconnector- Copper Contact fingers for Maintenance earthing switch male & female contact along with corona shield -for one complete (3 phase) isolator of each type and rating	SET	1	
3.29	GIS SPARES: 400kV GIS Disconnector- Copper Contact fingers for Fast earthing switch male & female contact along with corona shield -for one complete (3phase) isolator of each type and rating, If Applicable	SET	1	

Sl. No.	Item Description	Unit	Qty.	Remarks
3.3	GIS SPARES: 400kV GIS Disconnector- Open/ close contactor assembly, timers, key interlock, interlocking coils, relays , push buttons indicating lamps , power contactors, resistors, fuses MCBs & drive control cards etc for one complete MOM box (3-ph gang operated or 1-ph unit) disconnector and (3 ph) earthing switch of each type and rating for one complete (3 ph) disconnector and earthing switch of each type & rating, if applicable a) For Disconnector- 1SET b) For Maintenance Earth switch- 1SET c) For Fast Earthing switch- 1SET	LOT	1	
3.31	GIS SPARES: 400kV GIS Disconnector- Limit switches and Aux. switches for complete 3-phase equipment, a) For Disconnector- 1SET b) For earth switch- 1 SET c) For high-speed earth switch- 1SET	LOT	1	
3.32	GIS SPARES: 400kV GIS Disconnector- Drive Mechanism of each type, a) For isolator- 1SET b) For Maintenance Earth switch- 1SET c) For Fast Earthing switch- 1SET	LOT	1	
3.33	GIS SPARES: 400kV GIS Disconnector- Motor Drive Mechanism of each type, a) For isolator- 1SET b) For Maintenance Earth switch- 1SET c) For Fast Earthing switch- 1SET	LOT	1	
3.34	GIS SPARES: 400kV GIS Current Transformer- Complete CT, of each type and with enclosure to enable replacement of any type/ rating of CT as spare	SET	1	1 SET= 1 NO. of each type/ rating
3.35	GIS SPARES: 400kV GIS Voltage Transformer- Complete VT of each type and with enclosure to enable replacement of any type / rating of VT as spare	SET	1	1 SET= 1 NO. of each type/ rating
3.36	GIS SPARES: 400kV GIS Surge Arrestor- Complete Surge Arrestors of each type and with enclosure with surge monitor counter to enable replacement of any type/ rating of VT as spare	SET	1	1 SET= 1 NO. of each type/ rating
3.37	GIS SPARES: 400kV GIS Surge Arrestor- Surge Monitor and counter of each type/ rating	SET	1	1 SET= 1 NO. of each type/ rating
4.0	**SPARES- GIS: REFERENCE UNIT PRICE FOR ADDITION / DELETION OF SUPPLY ITEMS** (Unit Prices of Individual Equipment included here or in manadatory spares are required for any Addition/Deletion of Equipment and replacement of damaged items. Bidder to ensure that the unit prices have a logical relationship with prices of assemblies in main items. Quoting for unit prices is mandatory and shall be considered for evaluation).			
4.01	SUPPLY- GIS: SPARES: 400KV, OPERATING MECHANISM FOR CIRCUIT BREAKER COMPLETE IN ALL RESPECT	Set	1	
4.02	SUPPLY- GIS: SPARES: 400KV, OPERATING MECHANISM FOR DISCONNECTOR	Set	1	
4.03	SUPPLY- GIS: SPARES: 400KV, OPERATING MECHANISM FOR MAINTENANCE EARTHING SWITCH COMPLETE IN ALL RESPECT	Set	1	
4.04	SUPPLY- GIS: SPARES: 400KV, OPERATING MECHANISM FOR FAST ACTING/ HIGH SPEED GROUNDING SWITCH COMPLETE IN ALL RESPECT	Set	1	
4.05	SUPPLY- GIS: SPARES: 400KV, MAINTENANCE EARTHING SWITCH WITH ENCLOSURE COMPLETE IN ALL RESPECT	Set	1	1 SET= 1 NO. of POLE each type and each rating.
4.06	SUPPLY- GIS: SPARES: 400KV, FAST ACTING/ HIGH SPEED GROUNDING SWITCH WITH ENCLOSURE COMPLETE IN ALL RESPECT	Set	1	1 SET= 1 NO. of POLE each type and each rating.
4.07	SUPPLY- GIS: SPARES: 400KV, CURRENT TRANSFORMER (2 CORE) WITH ENCLOSURE COMPLETE IN ALL RESPECT	Set	1	1 SET= 1 NO. of each type and each rating.
4.08	SUPPLY- GIS: SPARES: 400KV, CURRENT TRANSFORMER (3 CORE) WITH ENCLOSURE COMPLETE IN ALL RESPECT	Set	1	1 SET= 1 NO. of each type and each rating.
4.09	SUPPLY- GIS: SPARES: 400KV, CURRENT TRANSFORMER (5 CORE) WITH ENCLOSURE COMPLETE IN ALL RESPECT	Set	1	1 SET= 1 NO. of each type and each rating.
4.1	SUPPLY- GIS: SPARES: 400KV, SINGLE PHASE BUS BAR	Mtrs	1	Complete in all respect.
4.11	SUPPLY- GIS: SPARES: 400KV, GIS METALLIC ENCLOSURE	Kgs	50	
4.12	SUPPLY- GIS: SPARES: 400KV, EXPANSION JOINTS	Set	1	1set= 1 nos. of each type and each rating.
4.13	SUPPLY- GIS: SPARES: 400KV, FLEXIBLE CONNECTIONS	Set	1	1set= 1 nos. of each type and each rating.
4.14	SUPPLY- GIS: SPARES: 400KV, BARRIER INSULATOR	Set	1	1set= 1 nos. of each type and each rating.
4.15	SUPPLY- GIS: SPARES: 400KV, NON-BARRIER INSULATOR	Set	1	1set= 1 nos. of each type and each rating.
4.16	SUPPLY- GIS: SPARES: 400KV, GAS SEALS	Set	1	1set= 1 nos. of each type and each rating.
4.17	SUPPLY- GIS: SPARES: 400KV, GAS DENSITY MONITOR SWITCH	Set	1	1set= 1 nos. of each type and each rating.

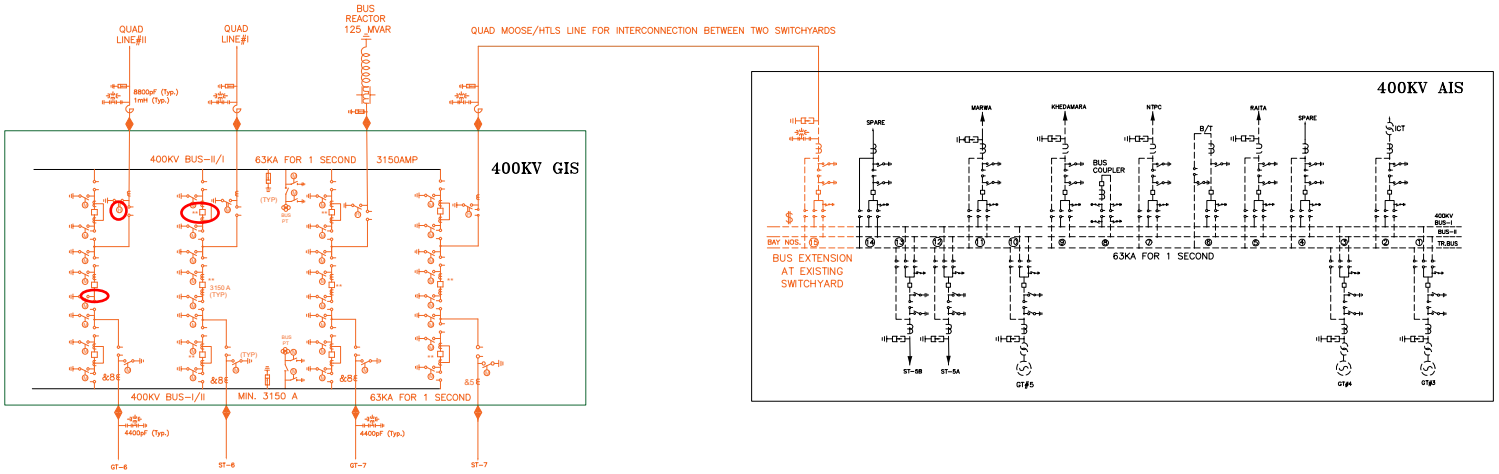
Sl. No.	Item Description	Unit	Qty.	Remarks
4.18	SUPPLY- GIS: SPARES: 400KV, GAS PRESSURE SWITCH	Set	1	1set= 1 nos. of each type and each rating.
4.19	SUPPLY- GIS: SPARES: 400KV, TEE BEND	Set	1	1set= 1 nos. of each type and each rating.
4.20	SUPPLY- GIS: SPARES: 400KV, ANGLE BEND	Set	1	1set= 1 nos. of each type and each rating.
4.21	SUPPLY- GIS: SPARES: 400KV, L-BEND	Set	1	1set= 1 nos. of each type and each rating.

ANNEXURE: BOQ_400kV GIS_SERVICE_CSPGCL KORBA
REV No: 00
DATE: 05.05.2024

Sl. No.	Description	Unit	Quantity	Remarks
5.0	**SERVICES- GIS : 400KV, 63KA FOR IS, GAS INSULATED SWITCHGEAR (GIS) AS PER TS**			
5.01	SERVICES- 400kV GIS: SUPERVISION OF ERECTION OF GIS	Bays	12	Supervision of erection of GIS with main bus, bus PT bat complete as per TS in all respect including LCC and its accessories. It also includes verification of materials for proper storage at site for final storage. Earthing, SF6 Gas Filing works, Internal Cabling from GIS to LCC, including Structure Works are covered under this item. GIS Bus Duct, SF6 to Air Bushing (SAB), Surge Arrester are not covered in this BOQ item.
5.02	SERVICES- 400kV GIS: SUPERVISION OF ERECTION OF 1- PHASE GAS INSULATED BUS DUCT	MTR	1100	Supervision of erection of GIB complete as per TS in all respect. GIB shall be considered from first equipment of GIS. Earthing, SF6 Gas Filing works, Internal Cabling including Structure Works are covered under this item.
5.03	SERVICES- 400kV GIS: SUPERVISION OF ERECTION OF 1 PHASE SF6 TO AIR BUSHING	SET	24	Earthing, SF6 Gas Filing works, including Structure Works are covered under this item.
5.04	SERVICES- 400kV GIS: SUPERVISION OF ERECTION OF 1 PHASE SURGE ARRESTER WITH SURGE COUNTER	SET	6	Earthing, SF6 Gas Filing works, including Structure Works are covered under this item.
5.05	SERVICES- 400kV GIS: TESTING & COMMISSIONING OF GIS	Bays	12	Testing and commissioning of complete GIS system including main bus, LCC and associated system (LA, VT, CSD etc.) is to be executed by bidder. All the special testing instruments, kits, T&P etc. are to be arranged by bidder on returnable basis. Please refer relevant section of technical specification for details.
5.06	SERVICES- 400kV GIS : TESTING & COMMISSIONING OF GAS INSULATED BUS DUCT	MTR	1100	Testing and commissioning of GIB complete as per TS in all respect. GIB shall be considered from first equipment of GIS. All the special testing instruments, kits, T&P etc. are to be arranged by bidder on returnable basis. Please refer relevant section of technical specification for details.
5.07	SERVICES- 400kV GIS : FINAL SUCCESSFUL HV/ POWER FREQUENCY TESTING OF GIS INCLUDING ARRANGING OF HV TEST KIT ALONG WITH OPERATOR	Bays	12	Carrying out successful HV/ Power Frequency Testing of GIS as per IEC including Arrangement of HV Test kit with operator (on returnable basis) shall be in scope of bidder, which includes charges of HV test kit with operator, accessories & tools required for completion of HV testing. The quoted price shall include GIS bays including Main Bus, GIB, SAB, SOB and other common items as per TS complete in all respect. In this BOQ item, mobilization and demobilization for HV test kit is considered for once. In case of more, for reasons not attributable to bidder, same shall be paid extra as per BOQ Item.
5.08	SERVICES- 400kV GIS : INSULATION CO-ORDINATION STUDIES FOR GIS SYSTEM	LOT	1	1 Lot means Complete study report as per technical specification, Including VFTO report.

Sl. No.	Description	Unit	Quantity	Remarks
5.09	SERVICES- 400kV GIS : TRAINING FOR GIS AT MANUFACTURER WORKS (MIN. 8 NO. CUSTOMER/ BHEL OFFICIAL)	DAY	5	GIS equipments including system description, Basic Design and engineering, Quality Assurance concepts, Erection and operational aspects for the offered equipments. Boarding & Lodging shall be borne by Bidder.
5.10	SERVICES- 400kV GIS : TRAINING FOR GIS AT SITE (MIN. 6 NO. CUSTOMER/ BHEL OFFICIAL)	DAY	5	Operation, Maintenance, Site Testing and Trouble shooting for GIS.
6.0	**SERVICES- GIS : REFERENCE UNIT PRICE FOR ADDITION / DELETION OF SERVICES:** (UNIT PRICES OF INDIVIDUAL SERVICES INCLUDED HERE ARE REQUIRED FOR ANY ADDITION/DELETION OF EQUIPMENT AND REPLACEMENT OF DAMAGED ITEMS. VENDOR TO ENSURE THAT THE UNIT PRICES HAVE A LOGICAL RELATIONSHIP WITH PRICES OF ASSEMBLIES IN MAIN ITEMS. QUOTING FOR UNIT PRICES IS MANDATORY AND SHALL BE CONSIDERED FOR EVALUATION)			
6.01	SERVICES- 400kV GIS: REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - **SERVICES FOR SUPERVISION OF ERECTION OF GIS**	MANDAY	10	Charges for repetition of services - (if required due to reasons not attributed to the bidder) This item will be executed only if repetition of services is required by BHEL.
6.02	SERVICES- 400kV GIS: REF. UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - **SERVICES FOR TESTING & COMMISSIONING OF GIS**	MANDAY	10	Charges for repetition of services - (if required due to reasons not attributed to the bidder) This item will be executed only if repetition of services is required by BHEL.
	DEMOBILIZATION AND REMOBILIZATION CHARGES			
6.03	SERVICES- 400kV GIS: DEMOBILIZATION AND REMOBILIZATION CHARGES FOR GIS **ERECTION SUPERVISION TEAM**	Set	2	THIS BOQ ITEM SHALL BE PAYABLE IF REQUIRED FOR REASONS NOT ATTRIBUTABLE TO BIDDER.
6.04	SERVICES- 400kV GIS: DEMOBILIZATION AND REMOBILIZATION CHARGES FOR GIS **TESTING & COMMISSIONING TEAM**	Set	2	BOQ ITEM SHALL BE PAYABLE IF REQUIRED FOR REASONS NOT ATTRIBUTE TO BIDDER. HV TESTING IS NOT PART OF THIS ITEM.
6.05	SERVICES- 400kV GIS: DEMOBILIZATION & REMOBILIZATION CHARGES OF **HV TEST KIT** ALONG WITH OPERATOR	Lot	1	In this BOQ item, mobilization and demobilization chages for HV test kit is considered for second time or more , for reasons not attributable to bidder. HV testing charges shall be paid per bay basis as per main HV testing charge.

NIT No.83362_61Q2500150 Dtd: 24-06-2024



NOTES :

1. PRESENT SCOPE IS MARKED AND HIGHLIGHTED WITH ORANGE COLOR.
2. NUMBER OF LA/SURGE ARRESTER AND THEIR RATING AND LOACTIONS ARE TENTATIVE AND THE SAME SHALL BE DECIDED BASED ON ON INSULATION CO-ORDINATION/TRANSIENT ANALYSIS STUDIES. HOWEVER THE LA's INDICATED IN THE SLD ARE THE MINIMUM NUMBERS OF LA TO BE PROVIDED BY BIDDER.
3. PIR NOT REQUIRED FOR 400KV GIS CIRCUIT BREAKERS FOR LINE BAYS.
4. DISTRIBUTION OF FEEDERS ON BOTH THE BUSES TO BE MAINTAINED AS PER THIS SLD IRRESPECTIVE OF BUS NOMENCLATURE FOLLOWED.
5. $ EXTENSION OF MAIN BUS-1, MAIN BUS-2 AND TRANSFER BUS OF EXISTING SWITCHYARD IS IN THE SCOPE OF BIDDER. NECESSARY MODIFICATION/AUGMENTATION OF EXISTING STRUCTURES IS IN THE BIDDERS SCOPE.
6. BIDDER SHALL SUITABLY CONSIDER NECESSARY PROVISIONS SUCH AS GIB/GIL, GIS TO AIS TERMINATION AIS GANTRIES ETC, FOR TRANSMISSION LINE TERMINATION.

&7. SEPERATE GIS CT SHALL BE PROVIDED FOR METERING PURPOSE.

8. SEPERATE OPGW OF MIN 24 CORES SHALL BE PROVIDED FOR THE INTERCONNECTION LINE.
9. BIDDER SHALL SUITABLE CONSIDER NECESSARY PROVISIONS SUCH AS GIB/GIL, GIS TO AIS TERMINATION, AIS GANTRIES ETC. FOR TRANSMISSION LINE TERMINATION.

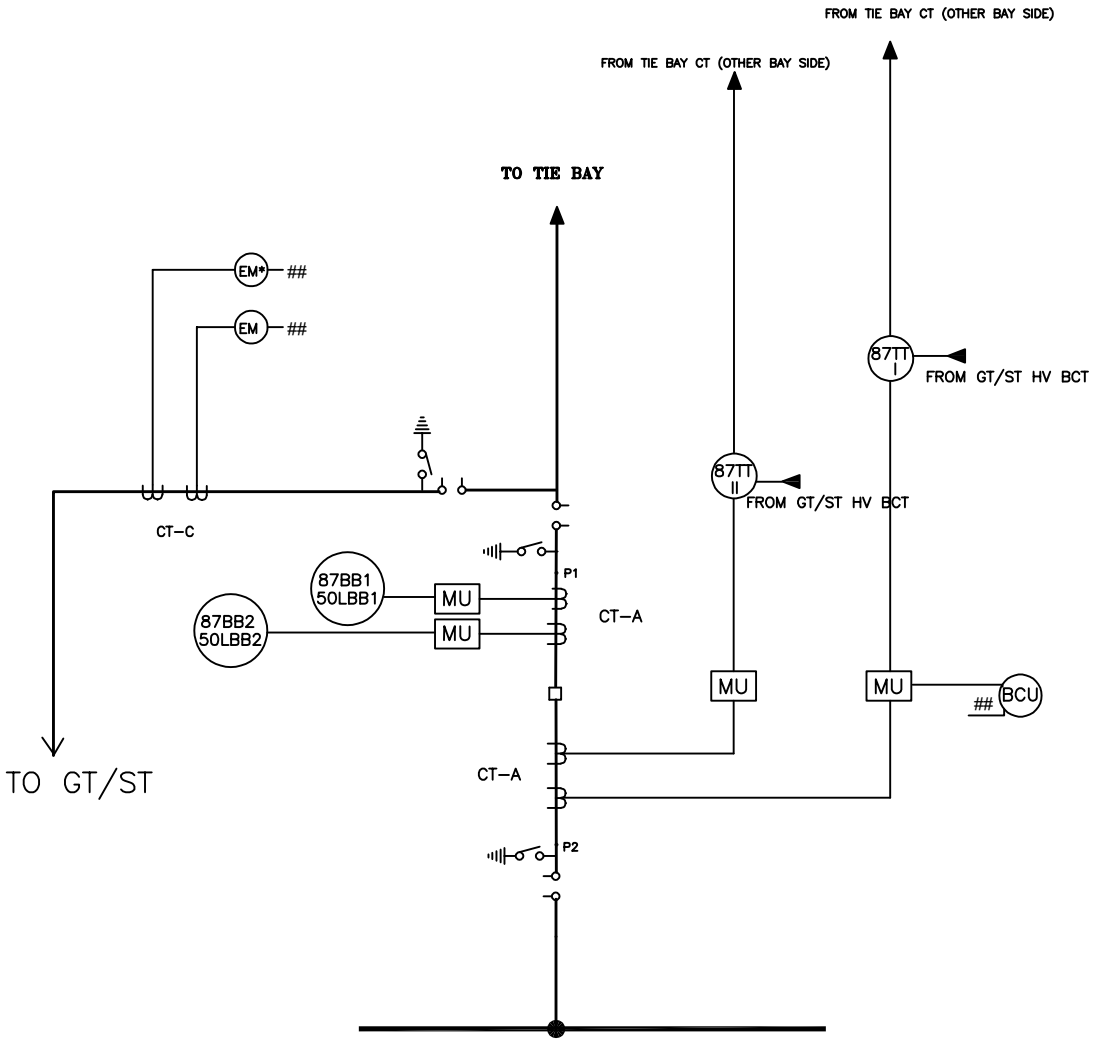
LEGEND:

- CIRCUIT BREAKER
- MOTORISED DISCONNECTOR-GIS
- MOTORISED 3 POLE EARTHING SWITCH
- HIGH SPEED MOTORISED EARTH SWITCH
- BUSHING CT
- WAVE TRAP
- LIGHTNING ARESTOR
- CVT
- CT
- SF6/AIR BUSHING
- ** BREAKER HAVING CONTROLLED SWITCHING FACILITY FOR ST AND BR BAYS.

FOR TENDER PURPOSE ONLY

REV.	DESCRIPTION	DRAWN	DESIGN	CHKD.	CLEARED BY	APPD	DATE
A	RELEASED FOR DPR PURPOSE						04.08.25

OWNER	CHATTISGARH STATE POWER GENERATION COMPANY LTD.
CONSULTANT	NTPC Limited (A GOVT. OF INDIA ENTERPRISE) ENGINEERING DIVISION
PROJECT	2X660MW SUPER CRITICAL THERMAL POWER PROJECT KORBA WEST, CHATTISGARH
TITLE	SWITCHYARD SINGLE LINE DIAGRAM 400KV ARRANGEMENT
SIZE A1 / SCALE / DRG.NO.	11255-999-POE-J-002
REV.	1



MAIN BUS (ONE AND HALF BREAKER SCHEME)

LEGEND:–

50/51 – BACKUP OVERCURRENT PROTECTION
50N/51N – BACKUP EARTH FAULT PROTECTION
50LBB – BREAKER FAILURE PROTECTION
50LBBT – BREAKER FAILURE PROTECTION FOR TIE BAY CB
87TT–I, 87TT–II – "TEE" DIFFERENTIAL PROTECTION
BCU – BAY CONTROL UNIT
EM – ABT COMPLIANT ENERGY METER
87ST – ST DFFERENTIAL PROTECTION
64RHV – ST HV REF PROTECTION
64RLV – ST LV REF PROTECTION

NOTE:

– Voltage from selected CVT
* – To be provided by owner
** – Breaker with CSD

FOR TENDER PURPOSE ONLY

CONSULTANT: एन टी पी सी NTPC — NTPC Ltd. (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

TITLE: PROTECTION S.L.D. FOR GT BAY

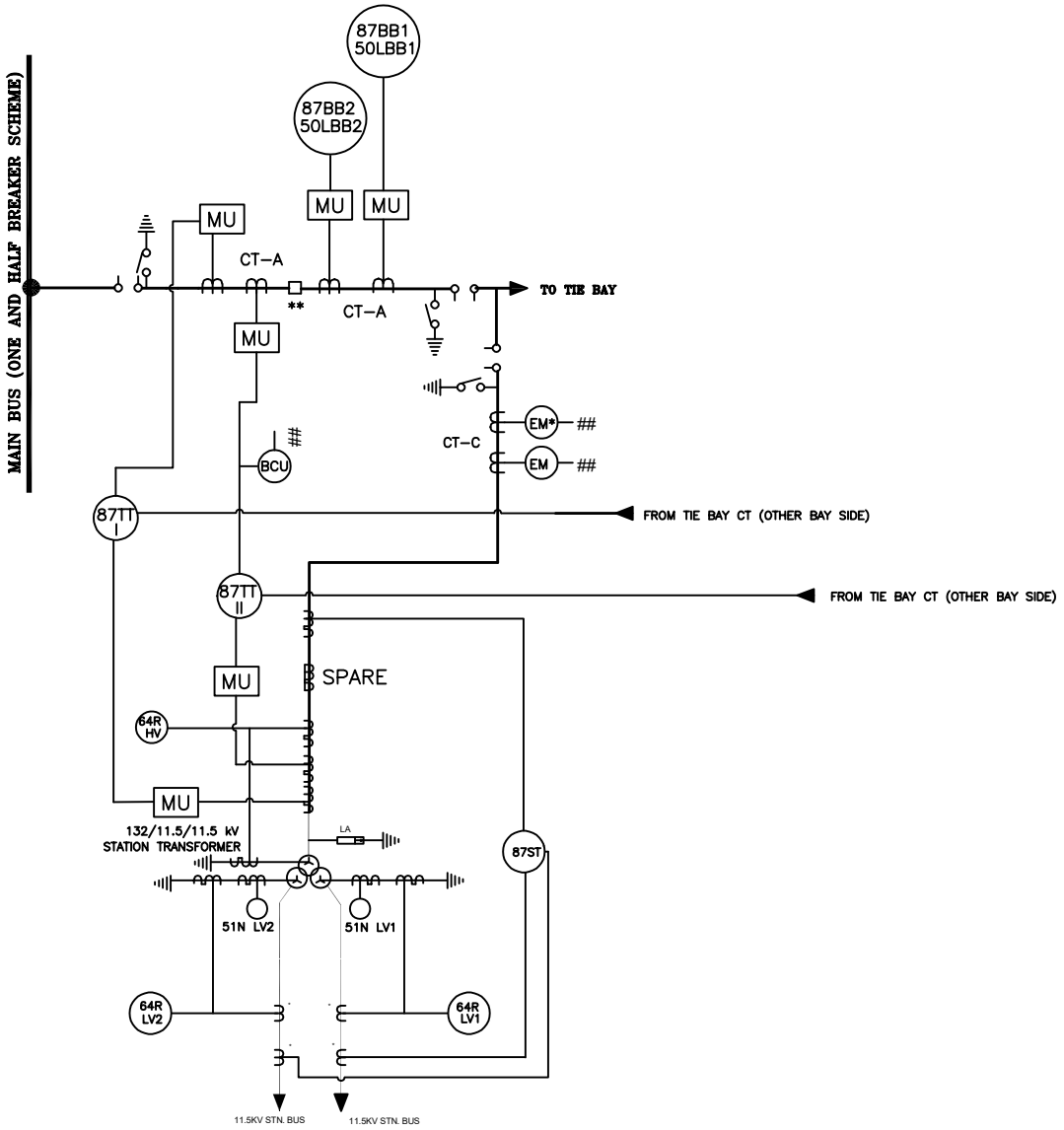
REV.NO.	DESCRIPTION	DESIGN	CHKD.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
						A4	N.T.S.	XXXX–999–POE–J–005	0

BUS BAR arrangemnet shown is indicative only.For actual arrangement please refer key tender SLD.
NIT No.83362_61Q2500150 Dtd: 24-06-2024

NOTE– 1. ST RELAY PANEL WILL BE PLACED ALONG SIDE GRP

2. ST REF CTs SHALL BE OF SAME MAKE AND CHARACTERISTICS (RATIO, KNEE POINT & RESISTANCE).

3. EPC VENDOR TO COORDINATE MATCHING OF REF CTs AT TRANSFORMER AND SWITCHGEAR END.



LEGEND:–

50/51 – BACKUP OVERCURRENT PROTECTION

50N/51N – BACKUP EARTH FAULT PROTECTION

50LBB – BREAKER FAILURE PROTECTION

50LBBT – BREAKER FAILURE PROTECTION FOR TIE BAY CB

87TT–I
87TT–II
– "TEE" DIFFERENTIAL PROTECTION

BCU – BAY CONTROL UNIT

EM – ABT COMPLIANT ENERGY METER

87ST – ST DFFERENTIAL PROTECTION

64RHV – ST HV REF PROTECTION

64RLV – ST LV REF PROTECTION

NOTE:

– Voltage from selected CVT

* – To be provided by owner

** – Breaker with CSD

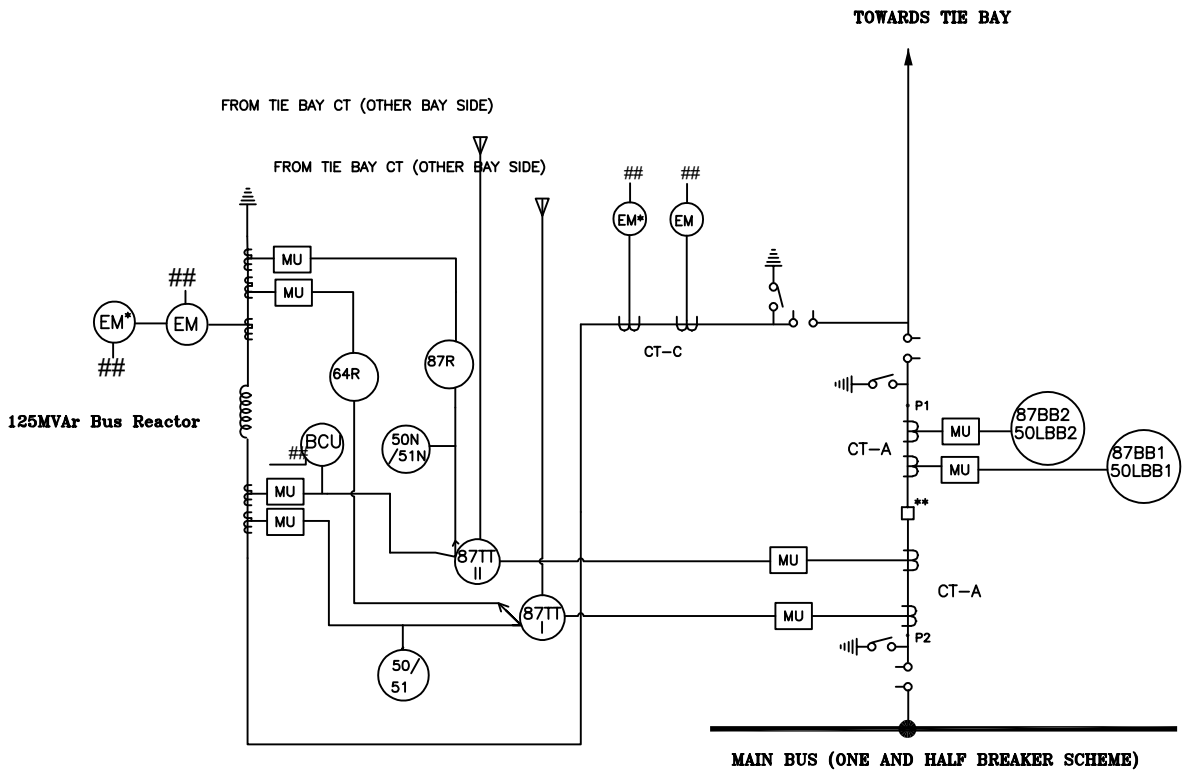
FOR TENDER PURPOSE ONLY

एन टी पी सी NTPC

NTPC Ltd.
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

TITLE: PROTECTION S.L.D. FOR ST BAY

REV.NO.	DESCRIPTION	DESIGN	CHKD.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
						A4	N.T.S.	XXXX–999–POE–J–006	0



LEGEND:–

64R – REACTOR REF PROTECTION

87R – REACTOR DFFERENTIAL PROTECTION

50/51 – BACKUP OVERCURRENT PROTECTION

50N/51N – BACKUP EARTH FAULT PROTECTION

50LBB – BREAKER FAILURE PROTECTION

87TT–I, 87TT–II – "TEE" DIFFERENTIAL PROTECTION

BCU – BAY CONTROL UNIT

EM – ABT COMPLIANT ENERGY METER

NOTE:

– Voltage from selected CVT

* – To be provided by owner

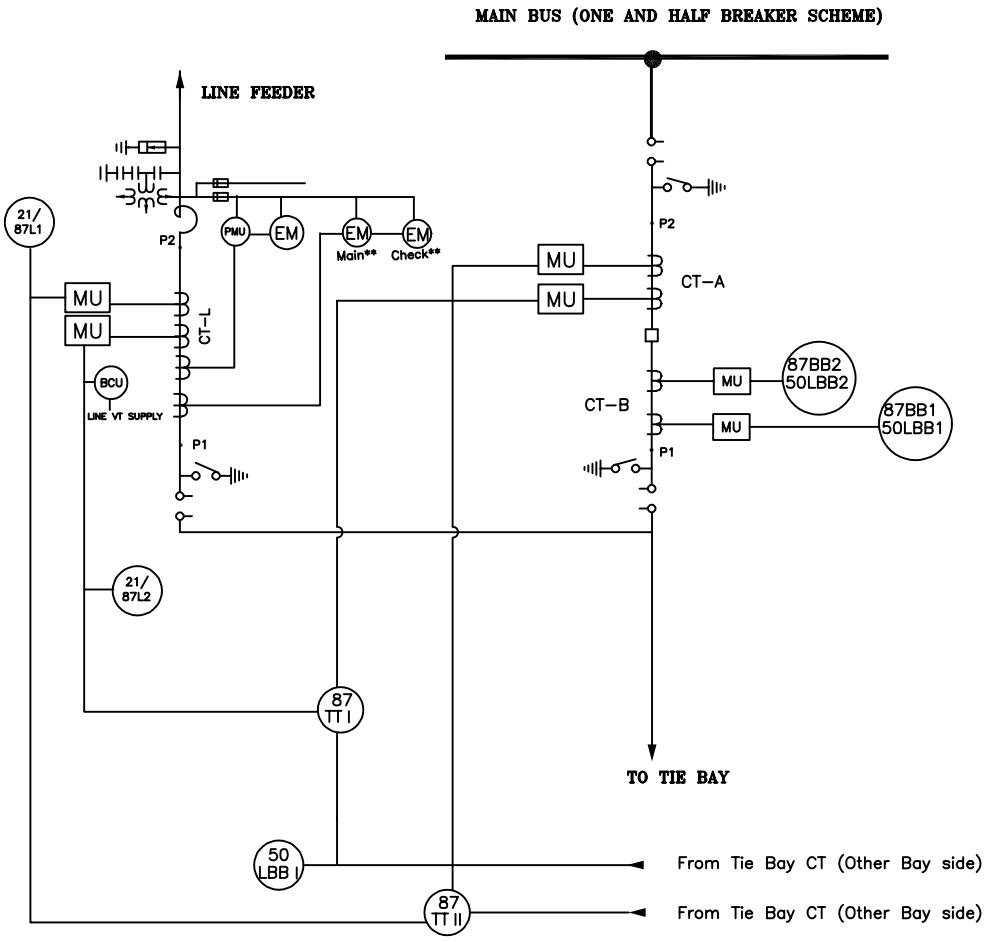
** – Breaker with CSD

FOR TENDER PURPOSE ONLY

CONSULTANT: एन टी पी सी NTPC — NTPC Ltd. (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

TITLE: PROTECTION S.L.D. FOR BUS REACTOR BAY

REV.NO.	DESCRIPTION	DESIGN	CHKD.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
						--	N.T.S.	XXXX-999-POE-J-008	0



LEGEND:–

21L1	– LINE MAIN–I DISTANCE PROTECTION
21L2	– LINE MAIN–I DISTANCE PROTECTION
87L1	– LINE MAIN–I DIFFERENTIAL PROTECTION
87L2	– LINE MAIN–II DIFFERENTIAL PROTECTION
59L1, 59L2	– LINE OVER VOLTAGE PROTECTION
46L	– LINE OPEN JUMPER PROTECTION
97	– VT FUSE FAILURE PROTECTION
87TT–I, 87TT–II	– "TEE" DIFFERENTIAL PROTECTION
87BB M–I, 87BB M–II	– BUSBAR DIFFERENTIAL PROTECTION
79	– MAIN CB AUTORECLOSER RELAY
79T	– TIE CB AUTORECLOSER RELAY
EM	– ENERGY METER ABT
EM–MAIN	– ENERGY METER MAIN ABT TYPE
EM–CH	– ENERGY METER CHECK ABT TYPE
50LBB	– BREAKER FAILURE PROTECTION
50LBB TB	– BREAKER FAILURE PROTECTION TIE BAY
DR	– DIGITAL FAULT RECORDER
FL	– FAULT LOCATOR
BCU	– BAY CONTROL UNIT
MU	– MERGING UNIT

NOTE:

** – EM Main/check to be provided by owner

– SELECTED BUS CVT

FOR TENDER PURPOSE ONLY

CONSULTANT: एन टी पी सी NTPC — NTPC Ltd. (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

TITLE: PROTECTION S.L.D. FOR LINE BAY

REV.NO.	DESCRIPTION	DESIGN	CHKD.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
						--	N.T.S.	XXXX-999-POE-J-007	0

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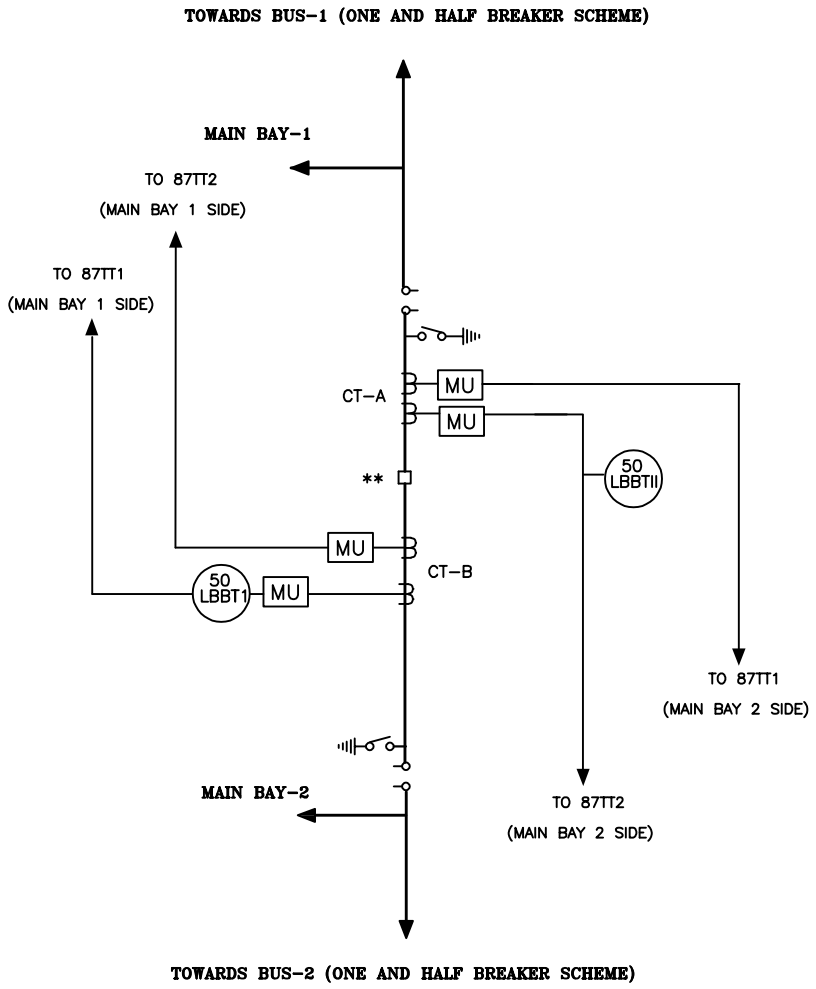
BUS BAR arrangemnet shown is indicative only.For actual arrangement please refer key tender SLD.



LEGEND:-

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64RHV – ST HV REF PROTECTION
64RLV – ST LV REF PROTECTION

NOTE:

– Voltage from selected CVT
* – To be provided by owner
** – Breaker with CSD (in case of ST/Reactor Bay)

FOR TENDER PURPOSE ONLY

NTPC Ltd.
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

TITLE: PROTECTION S.L.D. FOR TIE BAY

REV.NO.	DESCRIPTION	DESIGN	CHKD.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
						A4	N.T.S.	XXXX-999-POE-J-009	0

TRANSMISSION LINE CORRIDOR FOR OUTGOING LINES

WATCH TOWER

RW PIPE LINE

WWRO

DM & PT PLANT SWGR

XFMER

XFMER

CR

CR

AHU

ALUM./LIME SOLUTION STORAGE AREA

LAB BLDG.

AERATOR

RL(+)300.00 M

CLARIFIER

CLARIFIER

DM

DM

SHED BUILDING

TREATED WATER TANK

CMB 02

WSWS

SLUDGE PIT

ETP/WSWS

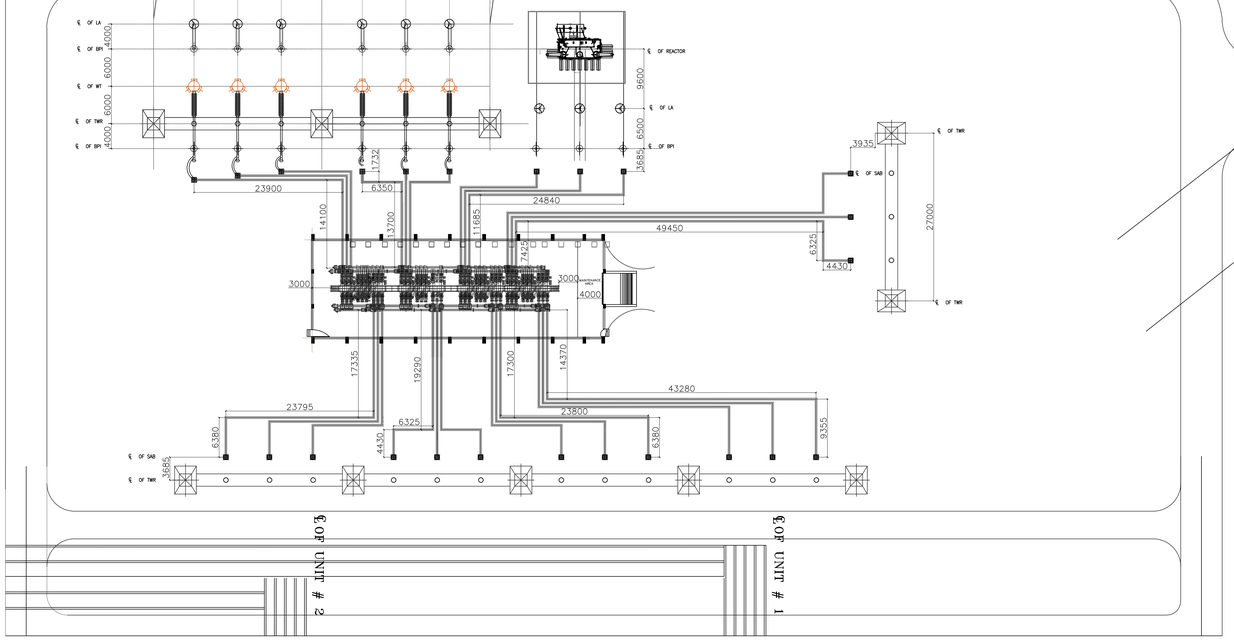
DM PH.

ACID/ALKALI STORAGE AREA

TRANSMISSION LINE CORRIDOR FOR INTERCONNECTION WITH EXISTING SWITCHYARD

TRANSMISSION LINE CORRIDOR FOR INTERCONNECTION WITH EXISTING SWITCHYARD

HYDROGEN GENERATION PLANT



NOTE:

1. THE DIMENSIONS ARE IN MM UNLESS MANSIONED OTHERWISE.
2. THIS IS TYPICAL LAYOUT FOR REFERENCE PORPOSE WHICH MAY CHANGE AS PER ACTUAL FILE REQUIREMENT.

OWNER .\unnamed.jpg
CHHATTISGARH STATE POWER GENERATION COMPANY LTD.

CONSULTANT
NTPC Limited
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT 2X660MW SUPERCRITICAL THERMAL POWER PROJECT, KORBA WEST, CHHATTISGARH

TITLE

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ES	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
B															
A															
						CLEARED BY						A0	1:4000		

CHAPTER: SWITCHYARD ELECTRICAL

SCOPE AND GENERAL INFORMATION:

1.01.01 In addition to the detailed scope and other requirements specified in Part-A, the intent of the specifications for various electrical equipments shall also cover the following scope:

1.01.02 Contractor shall be responsible for design and engineering of overall system/station, and all elements, systems, sub-systems, facilities, equipments, material, etc. The Contractor shall submit design calculations, drawings, codes, codes of practices, construction drawings, etc. for Employer's approval.

a) The basic design shall include, but not limited to, the following:
b) Development of general arrangement.
c) Development of detailed layout (plan & section/elevation) drawings.
d) Development of single line diagram with parameters of equipment and details of protection.
e) Protection and control philosophy and selection of protection, control and annunciation schemes.
f) Development of interlocking schemes.
g) Development of switchyard structure loading details.
h) Development of earthing system.
i) Development of direct stroke lightning protection system.
j) Insulation coordination of the EHV equipment.
k) Calculation of static and dynamic force load, and selection of spacer spans and equipment terminal loading.
l) Development of clearance diagrams.
m) Lighting design, Lux level calculation and conduit wiring diagram.
n) Development of power & control cable laying and termination schedules.
o) Relay setting calculations.
p) Development of erection key diagram with bill of material.
q) Foundation design and construction drawings.
r) Development of cable trench layout and sections and construction drawings.

1.01.03 Contractor shall furnish the detailed drawings for the various equipments covered in their scope, design calculations and construction drawings for all civil works, schematics, schedules, panel wiring diagrams , general arrangement drawings, schedules, interconnection schemes, cable schedules , interconnection schedules. etc for employers approval. Contractor shall also furnish the recommended relay settings to be adopted

1.01.04 Exposed live parts shall be placed high enough above ground to meet the requirements of Indian Electricity Rules and other statutory codes. All responsibilities regarding co-ordination

with Electrical Inspection Agencies and obtaining clearance certificate from them rests with the Contractor. The necessary fees for such clearances shall be borne by the Bidder.

1.01.05 All equipment shall be supplied with suitable terminal connectors. The terminal connectors shall be well coordinated with type/size of conductor and equipment to be connected. The conductor terminations for equipment shall be either rigid or expansion type suitable for horizontal or vertical take off suitable for tube/quadruple/twin/single moose conductor. For Jack Bus Line side Quad ACSR Moose and rest Twin ACSR Moose shall be used. The sub conductor spacing for quadruple and twin moose ACSR conductor shall be 450 mm for 400kV. The terminal pads shall preferably be capable of taking the required conductor span under normal, short circuit and meteorological conditions, without effecting the performance of the equipment.

1.01.06 The rigid busbars for equipment inter connections shall have rigid connections at one end and expansion /flexible at other end. The tubular Al. connections shall have not more than one joint per span. Corona Bell shall be provided at the end of the rigid busbars.

1.01.07 Not used

1.01.07A The line take off arrangement from GIS building up to line take off/intermediate gantry (as required) shall be through GIS ducts as indicated in Single line diagram. The line side insulators and hardware shall be provided by the line contractor for the lines which are not in the scope of contract, however the clamps and connectors for droppers to equipments are in the bidders scope. Location of line take off gantry and intermediate gantry (as required) for termination of Transmission line dead end tower to switchyard shall be finalized during detailed engineering based on the technical requirements. All the terminations shall be done as indicated in the Single line diagram. High speed earth switches(HES) shall be provided wherever required, HES shown in the SLD are the minimum requirements.

1.01.08A The minimum sizing criteria of the control room and GIS building shall be as given below:

i)The GIS building shall be adequately designed so as have a passage of 2.0 m on either side and adequate overhead clearance for the movement of equipments without any obstruction, from the top of the GIS equipment to EOT Crane. The GIS Control Room Building shall have with provision of Switchgear room, Battery room, charger room, office, cable vault, SAS room, Lab room, CRP Panel room, conference room, Pantry, toilet etc. The GIS & control room building is to be designed keeping future provision for extension if any as shown in the Single line diagram. The GIS building shall have adequate provision (at least 4.0m) for maintenance bay shall be provided one side of GIS building considering the future provision for GIS extension.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	ii)Maintenance room (as a part of GIS building) shall be constructed for carrying out repair works / small part assembly, storage of material, test equipment and tools and tackles to be stored separately from GIS hall in this room. iii) GIS building shall have with provision of Toilet room etc..
1.01.08B	The EOT crane to be provided inside the GIS building shall be of min. 6T capacity or as per the calculation of capacity required to move heaviest part for maintenance.
1.01.09	All equipments shall be suitable for hot lie washing .The sag tension, conductor spacing, short circuit forces, spacer location, conductor swing and clearances shall be carried out in accordance with IEC 60865 to achieve the specified clearances. Short circuit force calculation shall be submitted by the bidder as per relevant IEC for Flexible bus and rigid bus. This short circuit force shall be considered for designing of Tower, Girder and equipment structure and their foundation.
1.01.10	All overhead stringing shall be carried out by minimum double tension string insulator assembly. The earth wire for shielding purpose shall be double anchored at the towers/ other locations and shall run through with out cutting wherever feasible so as to avoid snapping. The earth wires crossing each other shall also be bolted together for additional safety.
1.01.11	Bus Post insulators shall be provided at line entry and near transformers and other jumpers to avoid mechanical forces on the LA's and Bushings etc.
1.01. 12	Necessary fire wall shall be provided between single phases of reactors. The fire wall height shall be 500mm above reactor bushing.
1.01. 13	The pit size of reactors shall be designed for minimum 1000mm beyond the physical dimension of the reactor.
1.01. 14	i)The towers and gantries shall be suitable for a normal conductor tension of minimum 2T/conductor in case of twin moose and 1.5T/conductor in case of quad moose conductor. The foundations and structures etc. shall be designed accordingly. ii)The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or supporting insulators to the bottom of the equipment structure, where it rests on the foundation pad shall be 2550 mm. All gantries and towers (including intermediate/required for turning etc.) as required for GT & ST O/H stringing & its anchoring on A-Row column of TG Building and line take off, are to be provided by the contractor. Minimum height of 400KV gantry for AIS shall be 16M+8.5MPeak however intermediate gantry height for O/H connection for GT shall be min. 22m+8.5m. Minimum height of 400KV AIS equipment level shall be 8.0M from the plinth level. The gantry width for 400kV AIS shall be min.27mt. In case of space constraint in the switchyard, the bidder

may design considering the bay width of <27mtr for 400KV Level subjected to meet the statutory electrical clearances etc.

Various minimum heights of the 400KV AIS switchyard shall be as given below from plinth level:

Voltage Level	Equipmt.1st level	2nd level	3rd level
400KV (1½ breaker scheme.)	8000mm	16000mm	23000mm

1.01.15 The switchyard shall be provided with peripheral roads and roads for maintenance/approach for GIS equipment, GIS Duct, major AIS equipment for maintenance purpose. The specification for Roads (RCC / B.T) some where else specified in the specification.

1.01.16 CVT JB shall have fuses for each core of the CVT.

1.01.17 The illumination level for AIS shall be 20 lux in general and minimum 50lux on equipment boxes. No lighting fixture shall be mounted on gantries, they shall be mounted on Structured Lightning Cum Lighting Masts or Structured Lighting Masts / towers only . For Approach / work roads , Lighting pole to be used . Specification of lighting is provided elsewhere in the specification. Detailed specification covered in Section -VI, Part-B, B-11(Lighting)..

1.01.18 Contractor shall provide panel mounted automatic start / stop type centrifugal self-priming pump for sump pit to drain the water in approximately one (1) hour. The contractor shall also provide suitable pedestal / foundation for this pump. The pump shall be complete with all necessary fittings such as NRV, inlet & outlet pipes of suitable length and dia. The out door cable trenches shall be connected to common sump pit with necessary slope shall be maintained. In side GIS building , Switchyard MCC room , control room etc for cable trenches , panel mounted automatic start / stop type centrifugal self-priming pump shall be provided to drain the water in approximately one (1) hour.

1.01.19 All 'T' off connections at 'A' row of TG Building associated with transformers shall be provided with a bye pass utilizing two PG clamps for each T off. As far as possible the conductor shall pass without cut/joint unless otherwise necessary for planned shutdown/maintenance.

CLAUSE NO.	TECHNICAL REQUIREMENTS
1.01.20	75mm thick base layer of M5 grade PCC shall be provided over the prepared sub grade in the entire area of the Switchyard inside the fence excluding foundations, roads, drains, cable trenches as per detailed engineering drawing. In switchyard area earth resistance measurement points shall be marked in the layout where the PCC shall not be provided. For easy drainage of water, adequate slope is to be provided from the ridge to the nearest drain. A final layer of minimum 75mm thickness of stone aggregate of 40mm nominal size shall be spread uniformly over PCC layer. In Switchyard before laying of PCC layer, the subgrade shall be properly compacted, and the top layer of the soil shall be treated for anti-weed considering the type of weeds found in the vicinity.
1.01.21	Adequate AC & Ventilation of Control room building and Ventilation of GIS Building, switchgear room etc. is to be provided by the contractor. Specification of AC & Ventilation is specified elsewhere in the specification (Part-B Mechanical) .
1.01.22	The cable trenches from control room to switchyard shall be designed to cater as required for bays indicated in SLD. The contractor shall construct the common sections suitably of appropriate sizes upto common points so that the same can be extended in future.
1.01.23	Voltage drop for sizing of power cables shall not be more than 6%.
1.01.24	one no(1no) suitable industrial socket and suitable power cable for oil filtration equipment for Bus reactor shall be provided.
1.01.25	The cable trenches , cable trays & supports, accessories , Roads , drains & its interconnection to storm water drain , fencing with gate required for present scope of bays.
1.01.26	Contractor shall make earth resistivity measurements at site (based on four electrode method) and design the earthing grid as per IEEE: 80 (Latest edition) and Gravel filling of switchyard . Earthing of all switchyard equipments and its connection to earthing grid. Also connection of switchyard earthing grid with main plant earthing grid. Earth pit as per IS 3043 as required.
1.01.27	Complete Direct Stroke Lightning Protection using Lightning Mast and/or shield wire and its connection to earth mat as required of 400kV switchyard of present scope of Bays , Transformer yard.
1.01.28	Supply & laying of power, control cables , Screen cable, Fibre optic cable and cabling between Contractor supplied equipment and Owner supplied equipment required. etc , from owner feeders , panels and from present scope of panels to existing panels to complete the system is in the scope of Bidder.
1.01.29	Lighting, earthing , lightning protection of Present scope of bays.

However any items though not specifically mentioned but which are required to make the switchyard complete in all respects for its safe, efficient, reliable and trouble free operation shall be supplied and erected by the Contractor, unless they are specifically excluded in the text of exclusions given in the specification.

1.02.00 **CLEARANCES :** The minimum clearances for 400kV AIS shall be as given below:

Description	400kV
Phase to earth clearance	3500mm
Phase to Phase clearance	4000mm
Sectional clearance	6500mm

The Contractor shall supply the structures suitable to meet the above clearances. The Contractor shall furnish clearance diagram in support of same for approval of Owner.

1.03.00 **EARTHING :** For earthing 50x6 mm GS flat shall be used in all cabinets, MOM boxes, panels and balance all other earthing such as all equipments, towers, cable trenches etc shall be through 75x12mm GS Flat. The Switchyard earthing criteria is given in **Annexure-II of this specification.**

1.04.00 **LIGHTING :**The illumination level shall be minimum 20 lux in general and 50 lux on equipment boxes, at equipments of switchyard . Detailed specification covered in Section -VI, Part-B, B-11(Lighting).

1.05.00 **EQUIPMENT CONNECTOR RATING** :The connectors and clamps shall be rated same as the connected equipments

1.06.00 **CIVIL DESIGN** :The civil design criteria is given in Civil Chapter of Technical specification

1.07.00 **CONTROL PHILOSOPHY** :The switchyard control philosophy and protection system is described in chapter B13 Substation Automation System of section-VI Part-B.

1.08.00 **SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING SUPPLIED:**

The system shall be designed to limit the power frequency over voltage of 1.5 p.u. and the switching surge over voltage to 2.5 p.u. In 400 kV system the initial value of temporary over voltage could be 2.0 p.u. for 1-2 cycles. All the equipment/materials covered in this specification shall perform all its function satisfactorily without undue strain, restrike etc. under such over voltage conditions.

1.09.00 **SITE SUPERVISION OF EQUIPMENTS:**

The contractor shall ensure that, erection, testing and commissioning of, GIS, Circuit Breaker, Isolator, Instrument Transformer, Surge Arrestor, Substation Automation System & protective relays is carried out, under the supervision of manufacturer of respective equipment.

1.10.00 **Insulation Co-Ordination and Selection of Surge Arrestor:**

1.10.01 The contractor shall be fully responsible for complete insulation co-ordination of switchyard. Contractor shall ensure that adequate protective margin is available. If surge arrestors at some more locations other than those indicated in the tender drawings are required to be provided, the same shall be deemed to be included in the offer.

1.11.00 **SYSTEM PARAMETERS For GIS (400kV)** :

Sl.no	Description	
a	i)Highest System voltage	420kV rms
	ii)Rated / Nominal system voltage	400kV rms
b)	Lightning impulse voltage (ph to earth& between phases)	±1425kVp
	Across isolating distance	1425(+240) KVp
c)	Switching impulse voltage (ph to earth)	±1050kVp
	Across isolating distance	900(+345) KVp
d	Power frequency withstand (for I min. rms.) to earth & between phases	650kVrms
	Across isolating distances	815kVrms
e	Max.fault level(1sec)	63kA
d	Rated dynamic with stand current	157.5 kAP
f	PD Level for GIS	<5pico coulomb
g	Rated frequency	50Hz
h	Rated Ambient Temperature	50.deg.Cen
i	System earthing	Effectively earthed

1.11.01 **FOR AIS (400kV)** :

Sl.no	Description	
a	i)Highest System voltage	420kV rms
	ii)Rated / Nominal system voltage	400kV rms
b)	Lightning impulse voltage (ph to earth& between phases)	±1425kVp
	Across isolating distance	1425(+240) KVp
c)	Switching impulse voltage (ph to earth)	±1050kVp
	Across isolating distance	900(+345) KVp
d	Power frequency withstand (for I min. rms.) to earth & between phases	630kVrms

e	Max.fault level(1sec)	63kA
d	Rated dynamic with stand current	157.5 kAP
f	PD Level	<5pico coulomb
g	Rated frequency	50Hz
h	Rated Ambient Temperature	50.deg.Cen
i	System earthing	Effectively earthed
j	Min.creepage (31mm/kV)	13020mm
k	Seismic acceleration	0.3g
l	Max. radio interference for freq. between 0.5 MHz and 2.0 MHz at 266 kV rms	1000micro volt
m	Corona extinction voltage	Not less 320kV rms

Note: Bidder to consider above parameters for all the equipment's of GIS & AIS. For other Parameters bidder to refer respective chapter.

1.12.00 **TYPE TEST REQUIREMENTS:**

1.12.01 **TYPE TEST REQUIREMENTS FOR EQUIPMENTS OTHER THAN GIS :**

a) All equipments to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification. The validity period of reports shall be as per CEA Guidelines for the validity period of Type test(s) conducted on Major Electrical Equipment in power Transmission-May2020 & with latest amendments for the from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a Client.

b) However if contractor is not able to submit report of the type test(s) conducted as per CEA Guidelines for the validity period of Type test(s) conducted on Major Electrical equipment in power Transmission-May2020 & with latest amendments from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/ owners representative and submit the reports for approval.

c) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

CLAUSE NO.	TECHNICAL REQUIREMENTS	सी एस पी जी सी एल CSPGCL

1.12.02 **TYPE TEST REQUIREMENTS FOR 400 GIS CIRCUIT BREAKER:**

a) The Contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The Bidder shall indicate the charges for each of these type tests separately in the relevant schedule of BPS and the same shall be considered for the evaluation of bids. The type test charges shall be paid as per the charges quoted for each of these type tests separately in the relevant schedule of BPS (Bid Proposal Sheet) & no qty variation is allowed. only for the test(s) conducted successfully under the contract and upon certification by the Employer's engineer.

b) Bidder refer to Sub section -IIB -Electrical Systems / Equipments Clause Type Test:

c) In case the Contractor has conducted such specified type test(s) according to the relevant standard and / or specification as per CEA Guidelines for the validity period of Type test(s) conducted on Major Electrical equipment in power Transmission-May2020 & with latest amendments as on date of bid opening, submit the type test reports to the Employer for waiver of conductance of such type test(s). These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a Client. The Employer reserves the right to waive conducting of any or all the specified type tests(s) under this contract. In case the type tests are waived, the type test charges shall not be payable to the Contractor.

1.12.03 Common requirements (For GIS):

a) The Employer will have the right of getting any test of reasonable nature carried out on any component or completely assembled equipment at Contractor's premises or at site or in any other place in addition to the aforesaid type and routine tests, to satisfy that the materials/equipment comply with the specification.

b) Failure of any equipment to meet the specified requirements of tests carried out at works or at site shall be sufficient cause for rejection of the equipment. Rejection of any equipment will not be held as a valid reason for delay in the completion of the works as per schedule. Contractor shall be responsible for removing all deficiencies and supplying the equipment that meet the requirement.

c) All equipments with their terminal connectors, control cabinets, main protective relays, energy meters etc. as well as insulators, insulator strings with hardware, clamps and connectors, marshalling boxes etc. shall be subjected to routine and acceptance tests in accordance with the requirements stipulated under respective equipment sections. Charges for the same shall be deemed to be included in the equipment price.

d)

The following type tests (as applicable) are proposed to be conducted on a complete single pole assembly of one typical GIS switchgear bay module as per IEC 62271-203. The one Typical GIS switchgear bay module consists of equipment like Circuit breakers, Current transformers, Disconnectors / isolator, earth switches etc. of each type / rating.

Sl.No	List of Type tests as per IEC.
i)	Lightning impulse voltage dry tests.
ii)	Switching impulse voltage dry tests
iii)	Power frequency voltage dry tests.
iv)	Partial discharge tests
v)	Radio Interference Voltage test (as applicable)
vi)	Test to prove the temperature rise of any part of the equipment and measurement of the resistance of the main circuit.
vii)	Test to prove the ability of the main circuit and earthing circuit to carry the rated peak and the rated short time withstand current.
viii)	Test to verify the making and breaking capacity of the included switching devices.
ix)	Test for satisfactory operation of the included switching devices
x)	Test to prove the strength of enclosures
xi)	Gas tightness test
xii)	Electromagnetic capability test (if applicable)
xiii)	Test on partitions
xiv)	Internal arc tests.
xv)	Mechanical operation tests.
xvi)	Test to prove the satisfactory operation at limit temperature
xvii)	Verification of degree of protection of auxiliary and control circuits
xviii)	Test to prove performance under thermal cycling and gas tightness test on gas barrier insulators
xix)	Capacitive Current switching test
xx)	Shunt reactor current switching test

For surge arrestor and Bus VT following type tests are proposed to be conducted as per relevant IEC.

Surge Arrestor (As per IEC 60099-4)

a)Insulation with stand test on housing	b)Residual voltage test
c)Long duratrion current impulse with stand test	d)pressure relief test (if applicable)
e)operating duty test	f) Partial discharge test
g) leakage test	

BUS VT (As per IEC 60044-2)

a) Temparature rise test	b)Lightning impulse test
c) switching impulse test	d) Determination of errors
e) short circuit with stand capability	f)chopped lightning impulse test

1.13.00 **CORONA AND RIV TESTS AND SEISMIC WITHSTAND TEST (for 400kV AIS only):**

The corona and RIV tests shall confirm to the requirements as per **Annexure- A** to this chapter. The seismic withstand test shall conform to requirements as per **Annexure -B** to this section.

Annexure – A

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST (For 400 kV AIS only)

1.0 **)** **General**

Unless otherwise stipulated, all equipment together with its associated connectors where applicable shall be tested for external corona both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and measurement of radio interference voltage (RIV).

2.0**)** **Test Methods for RIV:**

i. RIV tests shall be made according to measuring circuit as per International Special – committee on Radio Interference (CISPR) Publication 16 -1 (1993) Part – I. The measuring circuit shall preferably be tuned to frequency with 10 % of 0.5 MHz but other frequencies in the range of 0.5 MHZ to 2 MHz may be used, the measuring frequency being recorded. The result shall be in microvolts. Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107 – 1964 except otherwise noted herein. In measurement of RIV only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.

ii. Ambient noise shall be measured before and after each series of tests to ensure that there is no variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100%, 115% and 130% for the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 420 KV is listed in the detailed specification together with maximum permissible RIV level in microvolts.

CLAUSE NO.	TECHNICAL REQUIREMENTS

3.0) **Test Methods for visible Corona :**

The purpose of this test is to determine the corona extinction voltage of the apparatus, connectors etc. The test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltage, when the test voltage is raised and lowered to determine their precise values. The test voltage shall be raised to 130 % of RIV test voltage and maintained there for five minutes. In case corona inception does not take place at 130 %, the voltage level shall be raised till inception of corona or rated voltage whichever is lower. The voltage will then be decreased slowly until all visible corona disappears. The test procedure shall be repeated at least 4 times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purposes of determining compliance with the specification shall be the lowest of the four values at which the visible corona (negative or positive polarity) disappears.

Annexure – B

SEISMIC WITHSTAND TEST (for 400 kV AIS only):

The seismic withstand test on the complete equipment (except BPI) shall be carried out along with supporting structure.

The seismic level specified shall be applied at the base of the structure. The accelerometers shall be provided at the terminal pad of the equipment and at any other point as agreed by the owner. The seismic test shall be carried out in all possible combinations of the equipment. The seismic test procedure shall be furnished for approval of the purchaser.

2.00.00 REQUIREMENTS FOR GAS INSULATED SWITCHYARD:

2.01.00 GENERAL:

2.01.01 The GIS shall comply to IEC – 62271-203.The GIS shall be modular in structure and shall be housed indoor. The modules shall be single phase encapsulated and provided with hooks for handling by EOT cranes to be provided in the building. The modular design shall be capable of extension on either side without any major dismantling. The GIS equipments shall be housed in GIS building of overall height and width determined by the layout arrangement. The bus bars shall be rated for the duty specified and current rating shall be as per tender Single line Diagram (SLD). All the SF6 gas insulated circuit breakers, disconnectors, grounding switches and bus bars shall be of single-phase isolated type.

2.02.00 TECHNICAL REQUIREMENTS:

2.02.01 The VT's for GIS shall be installed within the GIS enclosure and shall be SF6 gas insulated or cast resin type. The secondary terminals shall be brought out in a dust proof enclosure suitably. The Surge arrestors for main buses shall be of GIS type only .

2.02.02	The earthing of the GIS shall be carried out considering the safety requirements as per relevant standards. The continuity of earthing shall be ensured considering electrical and thermal stresses caused by current they may have to carry. Each section & phase of the GIS enclosure shall be monitored for leakage of SF6 gas and suitable indication shall be provided in the control room.
2.02.03	Each breaker module of the GIS shall have a local control cabinet suitably located and shall be ground mounted meeting the requirements specified elsewhere for cabinets. Suitable interlocking arrangements shall be provided for the entire GIS.
2.03.00	**DESIGN AND SAFETY REQUIREMENT**
2.03.01	The compartments shall be such that maintenance on one feeder may be performed without de-energizing the adjacent feeders. These compartments shall be designed to minimize the risk of damage to adjacent sections and protection of personnel in the event of a failure occurring within the compartments. Stainless steel carbon impregnated or nickel plate rupture diaphragms with suitable deflectors shall be provided to prevent uncontrolled bursting pressures developing within the enclosures under worst operating conditions..
2.03.02	Gas barrier insulators shall be provided to divide the GIS into separate compartments. They shall be suitably located to minimize disturbance in case of leakage or dismantling. They shall be designed to withstand 1.5 times full rated pressure on one side while vacuum is exerted on the other side.
2.03.03	The material and thickness of the enclosures shall be such as to withstand an internal flash over without burn through for a period of 300ms till the backup relay protection clears the fault. Sufficient inspection windows/access openings shall be provided at the switchgear..
2.03.04	Each pressure filled enclosure shall be designed and fabricated to comply with the requirements of the applicable pressure vessel codes and based on the design temperature and design pressures as defined in IEC -62271-203.The contractor shall guarantee that the pressure loss within each individual gas-filled compartment shall not be more than half percent (0.5%) per year.
2.03.05	Each gas-filled compartment shall be equipped with static filters, density switches, filling valve and safety diaphragm. Each gas compartment shall be fitted with separate non-return valve connectors for evacuating & filling the gas and checking the gas pressure etc.
2.03.06	The thermal rating of all current carrying parts shall be minimum for one sec. for the rated symmetrical short-circuits current.

CLAUSE NO.	TECHNICAL REQUIREMENTS
2.03.07	The arrangement of gas section or compartments shall be such as to facilitate extension of any make on either end without any drilling, cutting, or welding on existing equipments. The GIS shall be designed such that a future requirement as per single line diagram can be extended with-out any necessity to move or dislocate the existing switchgear bays. It shall be kept in view that very little shutdown time is needed for adding future requirement.
2.03.08	All the elements shall be accessible without removing support structures for routine inspections and possible repairs. The removal of individual enclosure part or entire breaker bays shall be possible without disturbing the enclosures of neighboring bays.
2.03.09	The actual position of circuit breakers, disconnectors and grounding switches must be positively displayed by mechanical indicators visible from the operating position.
2.03.10	The breaker enclosure shall have provision for easy withdrawal of the interrupter assemblies/complete CB pole.
2.03.11	The enclosure shall be designed to practically eliminate the external electromagnetic field and thereby electrodynamics stresses even under short circuit conditions.
2.03.12	The switchgear shall have provision for connection with ground mat risers. This provision shall consist of grounding pads to be connected to the ground mat riser in the vicinity of the equipment. The connection between the grounding pads of switchgear and ground mat risers shall be provided by the contractor. The contractor shall furnish the design details & drawings for ground mat for GIS.
2.03.13	The layout of Switchgear such that each equipment shall be easily accessible for monitoring, maintenance, and testing purpose. The fixed type walkways , approaches shall be provided for access to the equipment for viewing, maintenance and testing purpose. In addition to this hydraulic portable ladder shall also be provided by the contractor.
2.03.14	The heaters shall be rated for 240V AC supply and shall be complete with thermostat, control switches and fuses, connected as balanced 3-phase, 4-wire load. The distribution of AC / DC power supply to LCC, Switchgear equipmments such that isolation of AC / DC supply to One particular Bay equipments will not effect the other bay equipments.
2.03.15	Viewing window shall be provided to visually observe the contact position for all phases of disconnecting switches and earth switches. Also clearly identifiable local, positively driven mechanical position indicator, Open / Close Indication for all phases of disconnecting and earth switches shall be provided.
2.03.16	The enclosure & support structure shall be designed that a mechanic 1780mm in height and 80 Kg in weight shall be able to climb on the equipment.

2.03.17 The sealing provided between flanges of two modules / enclosures shall be such that long term tightness is achieved.

2.03.18 Alarm circuit shall not respond to faults for momentary conditions. The following indications in addition to those required elsewhere in the specifications shall be provided in the alarm & indication circuits in Bay Module Control Cabinets:

I) I)Gas Insulating System

Sl.No	Description
a)	Loss of density, loss gas pressure
b)	Loss of Heater power (if required)
c)	Any other alarm necessary to indicate deterioration of the gas insulating system
II)	Operating System
a)	Low operating pressure, loss of control, loss of heater power, loss of operating power
b)	Loss of control , pole discordance

In addition, all the above alarms shall also be hooked up to the Substation Automation system.

2.03.19 The supplier shall submit guarantee that all offered SF6 GIS equipment has a Min.service life of 10,000 normal operations. The maintenance free period for any of its external components shall not be less than 5 years intervals. Internal components including refilling of gas shall not be less than 10 years. The supplier shall submit the O&M manuals of all GIS equipment, trouble shooting, recommended spares parts etc. The supplier shall propose the recommended period for schedule maintenance.

2.03.20 Online Partial Discharge Monitoring system for GAS insulated switchgear and Busduct shall be provided to monitor the entire GIS installation as per the Specification mentioned at **Annexure-C:**

Annexure-C: ONLINE PD MONITORING SYSTEM FOR GAS INSULATED SWITCHGEAR:

GIS equipment shall be designed to minimize partial discharge or other electrical discharge. A state-of-the art Partial Discharge Monitoring system shall be provided to monitor the entire GIS installation.

i)An on-line continuous Partial Discharge Monitoring (PDM) system shall be designed to provide an automatic facility for the simultaneous collection of PD data at multiple points on the GIS & its associated GIB ducts and Voltage Transformers adopting UHF technique.

ii)On-line continuous Partial Discharge Monitoring (PDM) system shall be capable for measuring PD in charged GIS environment as EHV which shall have bandwidth in order of 100 MHz–2GHz with possibility to select a wide range of intermediate bandwidths for best measurement results. The principle of operation shall be based on UHF principle of detection.

iii)The scope shall cover Engineering, supply, installation, testing and commissioning of partial discharge continuous monitoring system, with all necessary auxiliaries and accessories to make a complete system as per technical specification, including site demonstration of successful operation. The PDM system shall be provided with all its hardware and software, with readily interfacing to the UHF PD couplers installed in the GIS of present bays and future bays as shown in SLD plus 20% additional as extra. Details of this shall be submitted during engineering stage for approval.

The number of UHF PD coupler for future bays shall be decided based on GIS layout finalized under present scope (considering present GIS equipment with future provision).

iv)The PD Monitoring PC Work Station shall be in the control room of the GIS substation. Workstation PCs shall be pre-loaded with all necessary Hardware & Software. The PCs shall have each Combo drive & Retrievable disk drive (1 TB), Ethernet port 100Mbps, colour printer. The workstation PC shall be powered by suitable dedicated UPS. PDM system shall have built in self-checking facility.

Design of on-line PDM System:

1.)The sensitivity of the offered system shall be in accordance with CIGRE Document No. 654 that will be verified as part of site sensitivity tests.

2.) UHF attenuation data of GIS shall be submitted for the switching devices, spacers, bends etc.

3.) The signal attenuation level of co-axial cable per meter length and justification for the length of cable connection between the couplers and detector units shall be furnished.

4.)The overall sensitivity of PD detection system shall consider the spacing between couplers and the associated cabling, filters, amplifiers, etc.

5.) The PD sensors shall be identified / coordinated with the corresponding detector unit etc. with proper identification labelling and indicated in the substation PDM SLD.

6) Supply requirement (AC & DC) to be specified for the complete monitoring system.

7.) Power supply to PDM PC shall have protection against surges, overload and short circuit. A dedicated on-line UPS system shall also be provided as a backup during supply interruption, to ensure trouble-free & reliable running of the PDM System for a minimum of 15 minutes duration.

8.) PDM System shall be provided with a user security for accessing the system with a log-on and password entry procedure. The user levels shall be defined as a Master User and other users for the modification of system, update, and entry of parameters or manual operation. System shall be able to generate 3D point on wave pattern whenever any PD activity detected by the system. System shall be able to give online 3D point on wave pattern, online PRPD (phase resolved PD) and online short time trend etc. System shall be able to generate the all the logs related to system fault, system access, PD event, and any changes in system setting etc.

9.)The selected mode of propagation of PD signal (electromagnetic wave) inside GIS for the design of sensors shall be furnished.

The applicable standards to meet IEC & IEEE requirements for electromagnetic compatibility shall be specified. The offered system should have been tested for the same for working in a 400kV & above substation environment. The necessary documentation must be submitted in this regard.

10)Calibration:

i) The UHF Couplers must be first calibrated as per CIGRE procedure TF 15/330305 as part of factory acceptance tests to guarantee detection sensitivity of 5pC or better. The GIS of same design shall be used as test specimen during the coupler calibration. The pulse injection level determined through above factory calibration tests shall only be used as reference for site sensitivity checks during commissioning of PDM system. The data sheet/frequency response characteristics shall be submitted for reference.

11) The system shall generate alarms if suspected partial discharge activity is noticed or the system itself is in failure, thereby eliminating the necessity of periodic system access by the user and one such alarm shall be connected to Substation automation system (SAS). The alarms shall be configured coupler wise.

12) Filtering Facility: The filtering facility must be provided to distinguish real PD from internal/external noise such as switching operations, self-test signal, radio, communication signal etc.

CLAUSE NO.	TECHNICAL REQUIREMENTS

13) Diagnostic Software: To interpret various types of PD defects, intelligent diagnostics software (expert system) shall be built- in as part of the PDM software capability. This is mainly to reduce the dependence on PD specialist. The bidder shall also make available typical point-on-wave patterns as library pictures to train the user.

14)Special tools and critical spare parts for trouble free operation of the system are also to be supplied along with the PDM system. Pulse generator for UHF sensor sensitivity test shall also be supplied as a standard accessory.

2.03.21 Adequate number of gas leak detectors shall be installed at various locations at the base of the GIS structure to detect presence of gas which may be harmful for human. The detector shall send alarm signal locally as well as at remote stations.

2.04.00 MANDATORY MAINTENANCE EQUIPMENTS:

The maintenance equipment necessary for the operation and maintenance of GIS shall be supplied. In addition to this maintenance equipment specified at **Annexure-D** of this section shall also be supplied and covered in the contractor's scope.

2.05.00 MANDATORY MONITORING EQUIPMENTS:

THE MONITORING EQUIPMENT NECESSARY FOR THE OPERATION AND MAINTENANCE OF GIS SHALL BE SUPPLIED. A LIST OF SUCH EQUIPMENTS IS ENCLOSED AT **ANNEXURE-E** OF THIS SECTION.

2.06.00 BELLOWS OR COMPENSATING UNITS:

Adequate provision shall be made to allow for the thermal expansion of the conductors and of differential thermal expansion between the conductors and the enclosures. The metallic bellows (preferably of stainless steel) of following types or other suitable arrangement shall be provided wherever necessary:

2.07.00 INDICATION AND VERIFICATION OF SWITCH POSITIONS:

Local Indicators shall be provided on all circuit breakers, For Disconnectors and earth switches local indicators (3ph / 1ph - preferably local indicators for all phases of disconnectors and earth switches) shall be provided, which shall clearly show whether the switches are open or closed. The indicators shall be mechanically coupled directly to the main contact operating drive rod or linkage and shall be mounted in a position where they are clearly visible through glass windows.

2.08.00 PRESSURE RELIEF :

Pressure relief devices shall be provided in the gas sections to protect the main gas enclosures from damage or distortion during the occurrence of abnormal pressure increase or shock waves generated by internal electrical fault arcs (preferably) in downward direction). Pressure relief devices shall be achieved either by means of diaphragms or plugs venting directly into the atmosphere in a controlled direction.

2.09.00 PRESSURE VESSEL REQUIREMENTS:

The enclosure shall be designed for the mechanical and thermal loads to which it is subjected in service. The enclosure shall be manufactured and tested according to the pressure vessel code (ASME/CENELEC code for pressure Vessel.) The bursting strength of Aluminum casting must be at least 5 times the design pressure. A bursting pressure test shall be carried out at 5 times the design pressure as a type test on each type of enclosure. Each enclosure must be tested as a routine test at 1.5 times the design pressure for one minute.

2.10.00 BUSBARS:

2.10.01 The conductors of the bus bars shall be fabricated from aluminum/copper tubular sections of cross- sectional area suitable to meet the current rating requirements. The bus bars shall be housed in single phase enclosure. The tubular bus section shall be housed in corrosion resistant aluminum enclosures, filled with pressurized SF6 gas. The conductors shall be supported from the enclosures by insulators shaped to ensure uniform electrical field distribution and zero corona at rated voltage. The bus end connections shall be made with multi-contact connectors to allow for axial thermal expansion of the bus. The enclosure connections shall be flanged and shall be fitted with gaskets or O-ring seals to provide an effective gastight joint between sections.

2.10.02 Main bus bars shall be designed to have future extension bay if any as indicated in the single line diagram. The bus conductor end connectors and enclosure flanges shall be designed accordingly.

2.10.03 Each gas compartment barrier shall be easily identifiable from the outside of the switchgear. The means of identification used shall be a black band, approx. 10mm wide, permanently affixed to the barrier insulator on the outer surface of the enclosure at the location of the barrier insulator. In case of leakage of the gas from any compartment, indication of respective compartments should be provided on the annunciator.

2.11.00 BAY MODULE CONTROL CABINETS:

2.11.01 Each switchgear bay module shall be suitable for local control and remote control. The contractor shall supply the main control cabinet of the floor standing type along with GIS equipments. The cabinet shall have double, full height, hinged, gasketed, lockable doors. One door shall have a safety glass window through which the various switchgear controls can be viewed without opening the doors.

2.11.02 The following equipment's shall be mounted on the cabinet door with Mimic diagram of the Bay .

Sl.No	Description
a)	Remote/local control transfer switch for the circuit breakers and disconnector switches
b)	Normal operation/maintenance control transfer switch for disconnector of remote electrical controls
c)	Mimic diagram of the switchgear bay complete with semaphore indicators for the switchgear component position indication and local control switches for open / close or close-trip control of the circuit breaker, isolators and grounding switches as per the standard practice , system requirement for smooth operation , maintenance shall be provided.

2.11.03 The annunciator system shall have sufficient modules and illuminated windows for providing annunciation for low / high gas pressure / density, alarms & trips for circuit breaker operating mechanism and all other abnormal conditions.

2.11.04 Each annunciator panel shall be complete with an audible warning horn, acknowledge/reset for horn silence and lamp test push buttons. Apart from annunciator system in LCC, alarm contacts for remote alarm indication shall have to be wired separately in LCC terminal block. The control cabinets shall be suitable for bottom entry of cables.

2.12.00 SUPPORTING STRUCTURES:

2.12.01 The Contractor shall design, fabricate and supply the equipment supporting framework including all rails, transverse & longitudinal beams and supporting members with all necessary hardware & embedded parts. General structural designs and structural details shall be subject to the approval of the Employer.

2.12.02 Non-corrosive metal or cadmium plated steel shall be used for bolts and nuts throughout the work when either or both are subjected to frequent adjustment or removal. All steel structure members shall be hot dip galvanised.

2.13.00 MONITORING:

2.13.01 The gas density in each gas compartment shall be monitored by electrically isolated & independently adjustable temperature compensated density switches. The factory set density switches shall also be acceptable. Two level density switches shall be provided for each GIS bus compartment to initiate remote devices of level-I alarm and level-II tripping. The setting of level-I alarm and level – II tripping shall be such that the dielectric strengths of SF6 gas are maintained. The necessary indication shall be provided at the circuit breaker control cabinet identifying the gas compartment from which a level-I alarm is initiated. Two level density switches shall be provided for each circuit breaker compartment to initiate the following:

i) Level-I- Remote alarm and prevent closing of the breaker in case it is open.

ii) Level-II- Initiation of Zone trip, Contact shall be in accordance with the requirement.

2.13.02 Gas pressure monitoring devices shall be fitted with test valves such that field testing of the monitoring device can be performed without draining the main gas system. Each gas section shall be fitted with a suitable valve for routine gas sampling.

2.14.00 HIGH VOLTAGE TRANSIENTS:

High voltage transients from switching operations and internal faults are coupled to the external enclosure of the GIS. .

2.15.00 HEATERS: All the heaters shall be suitable for connection to a 240V AC, single phase, 50 Hz supply. The heater in the mechanism housing shall be connected inside the housing to this supply and shall be thermostatically controlled. The leads to the tank heaters shall be enclosed in a conduit.

2.16.00 SERVICE LIFE:

SF6 circuit breakers, disconnecting switches and grounding switches will be subjected to frequent and occasionally repetitive, no load / full load operations and switching off short circuit currents, capacitive and inductive currents within their ratings. The Contractor shall propose the recommended period for scheduled maintenance.

2.17.00 Shop test:

2.17.01 Each transport section of switchgear shall be shop tested. The routine tests of GIS equipments which have been covered under other relevant IEC standards)

Sl.No	Routine tests (On transport section)
i)	Dry Power frequency voltage withstand tests on the main circuit.
ii)	Dielectric tests on auxiliary and control circuit
iii)	Tests to verify the resistance of the main circuit
iv)	Partial discharge tests
v)	Pressure test on enclosures
vi)	Gas tightness test.
vii)	Mechanical operation tests.
viii)	Tests of auxiliary, electrical, and hydraulic devices
ix)	Checking of wiring
x)	Power frequency voltage dry tests
xi)	Voltage tests on auxiliary and control circuits
xii)	Fluid leakage tests (where applicable).
xiii)	other tests as per OEM recommendations , practice

The applicable standards for the above tests shall be IEC 62271-203, IEC 62271-100, and IEC 62271-1.In addition, corrosion protection tests at random on all equipment shall be performed.

2.18.00 **Type Tests:**

For Type Test requirement, please refer respective clauses mentioned elsewhere in the specifications.

2.19.00 **Performance Tests:**

The performance tests shall comprise of:

a) Field stage tests, to be carried out during erection, to demonstrate that the equipment or any component or subassembly has been properly erected and functions correctly.

b) Commissioning tests, precedent to the acceptance of work, in respect of the equipment or any section of the equipment, to demonstrate proper operation.

2.20.00 **Field Stage Tests**:

From time to time at various stages of erection, tests of sub-assemblies of the equipment shall be carried out as instructed by the Employer. The contractor shall make records of all measurements and shall make corrections or adjustments as required. A record of all stage tests shall be embodied in a report.

2.21.00 **Commissioning Tests:**

On completion of the erection and installation, following commissioning tests shall be performed as per IEC 62271-203, CIGRE working Group 23.03, 1975-Electra No.42, 7-29:

(a) One minute power frequency withstand tests for the main circuits. As per IEC 62271-203 high voltage tests at site with lightning impulse and switching impulse voltages are also acceptable as alternative. The Contractor may carry out either of the above tests but relative merits of particular type of test over the other tests to be carried out by the contractor should be indicated in the offer.

(b) Partial discharge measurement tests.

(c) Voltage tests for the main circuits

(d) Voltage tests for the auxiliary and control circuits.

(e) Tests to verify the resistance of the main circuits.

(f) Operation tests for various components.

(g) Gas leakage tests.

(h) Calibration/checking of SF6 gas pressure/density switches.

Measurement of moisture.:

After erection, a test shall be made to prove the absence of the dangerous voltages in the enclosure and other metal parts such as pipes and framework. If the tests prove the existence of any fault or faults in the equipment, or any failure to meet the requirements of the specifications the Employer may direct Contractor to rectify the defects or repair, reconstruct or replace faulty work and Contractor shall without delay, carry out the instructions of the Employer in this respect.

Commissioning tests shall be as per the IEC standard and shall not be restricted to the tests stated above. The Contractor shall also recommend any additional commissioning tests.

2.22.00 **Final Acceptance Tests:**

After commissioning tests have been satisfactorily completed, the contractor shall carry out tests as per relevant standards.

2.23.00 **Test Reports:**

The contractor shall record all the relevant facts and the quantities on the basis of which a final test report shall be prepared. Such reports will be prepared in a form approved by the Employer and reproduced at the expense of the contractor in six copies for submission to the Employer.

TRAINING: BIDDER SHALL PROVIDE TRAINING TO THE EMPLOYER'S PERSONNEL AS PER THE DETAILS GIVEN BELOW:

Sl No.	Description of Training	Training Duration (Days)	Place of Training	Number of Trainees from Employer	Boarding & Lodging
1	GIS				
a)	GIS equipments including system description, Basic Design and engineering, Quality Assurance concepts, Erection and operational aspects for the offered equipments.	5 days	Manufacturers works	8	To be provided by Bidder

Sl No.	Description of Training	Training Duration (Days)	Place of Training	Number of Trainees from Employer	Boarding & Lodging
b)	Operation, Maintenance, Site Testing and Trouble shooting for GIS.	5 days	Site	6	-

Annexure-D -SPECIFICATION OF MANDATORY MAINTENANCE EQUIPMENT

1.0 SF6 Gas Handling Plant:-

a) SF6 gas filling and evacuating equipment (Portable**), Qty : 1no**

The capacity of this plant shall be such that it shall not take appreciable time for filling or evacuating of a GIS bay including all equipments compartment. The required vacuum for complete evacuation shall be attained with the help of this plant.

b) SF6 gas filtering, drying, storage and recycling plant- **Qty : 1no** .

i)The plant shall be complete with accessories and fittings so that SF6 gas from the breaker can be directly filled in the plant storage reservoir.

ii) In case purging of the equipment before filling with SF6 gas is desirable, then the required equipment for dry gases etc. shall be furnished as a part of the plant.

iii)For heavy items within the plant, the lifting hooks shall be provided for lifting and moving with the overhead cranes.

iv))This shall include all the necessary devices for measurement of purity, moisture content, decomposition products etc. of SF6 gas mixing with air/oil/moisture during above process should be proved to be Nil during testing. The capacity of the plant shall be such as to handle and store min 300 litres of SF6 gas or Sf 6 Gas quantity of largest compartment.

v) These SF6 gas handling plants shall be complete with all the necessary pipes, couplings flexible tubes and valves for coupling to the equipment.

vi) The design and construction of the plant, valves, couplings, connections shall be such that leakage of SF6 gas shall be minimum. Similarly valves, couplings and pipe work shall be so arranged that accidental loss of gas to the atmosphere shall be minimum.

CLAUSE NO.	TECHNICAL REQUIREMENTS

2.0 **SF6 Gas leak detector - Qty: 1no.**

The SF6 gas leak detector shall meet the following requirements:

a) The detector shall be free from induced voltage effects.
b) The sensing probe shall be such that it can reach all the points on the GIS where leakage is to be sensed.
c) The accuracy of the equipment shall be at least 10 ppm.

3.0 **Operational analyser with DCRM kit- Qty:1no**

a) It shall have facility to record the breaker contact movement during opening, closing, auto reclosing and make-break operation, the speed of contacts at various stages of operation, travel of contacts, opening time, closing time and make break time etc.The analyser shall have provisions for recording at least 12 different functions of the circuit breaker. All necessary transducers (i.e., three nos. for complete 3 phase speed and travel record of breaker), cables, pickups, attachments required for the breaker shall be supplied with the analyser. The cables supplied shall be sufficient for recordings at site on a completely assembled and erected breaker.

b) All the necessary catalogues write up for operation and maintenance of the analyser shall be furnished along with each analyser and peripheral system. The necessary equipments for monitoring various parameters of circuit breaker termed as signature analysing shall be supplied along with all software, laptop computer, devices etc. with the breaker. The same shall be demonstrated at site on a fully assembled breaker.

4.0) Self-powered hydraulic aerial working platform with articulated and fly boom for General purpose maintenance in switchyard and Transformer yard. (Suitable for 24m working height)- **Qty : 1no**

All above maintenance equipments shall be demonstrated at site during handover.

Annexure-E

MANDATORY MONITORING EQUIPMENTS:

1.0 Dew Point Meter, Qty : 1no

i) The meter shall be capable of measuring the dew point of SF6 Gas of the Circuit Breaker/GIS equipment It should be portable and adequately protected for outdoor use. The meter shall be provided with due point hygrometer with digital indication to display the dew point temperature in degree C. or PPM. It should be capable of measuring the

corresponding pressure at which due point is being measured. The measurement direct without the use of any other material/chemical like dry ice/acetone etc. It should be battery operated with rechargeable batteries.

The equipment should have the following parameters :a)Measuring range: Up to -100 degree C Dew Point (b) Accuracy: + 2-degree C. (c) Display: 4-digit LCD, inch. High

2.0 PORTABLE PD MONITORING SYSTEM FOR GAS INSULATED SWITCHGEAR , Qty: 1no

i) GENERAL: The equipment shall be used for detecting different types of defects in Gas Insulated Stations (GIS) such as Particles, Loose shields and Partial Discharges as well as for detection of Partial discharges in other types of equipment such as Cable Joints, CTs and PTs.

ii) It shall be capable for measuring PD in charged GIS environment as EHV which shall have bandwidth in order of 10 KHz – 500 KHz with possibility to select a wide range of intermediate bandwidths for best measurement results. The principal of operation and the method of measurement shall be non-intrusive. The instrument is able to detect partial discharges in cable joints, terminations, CTs and VTs etc., with the hot sticks.

iii) Detection and measurement of PD and bouncing particles shall be displayed on built in large LCD display and the measurement shall be stored in the instrument and further downloadable to a PC for further analysis to locate actual source of PD such as free conducting particles, floating components, voids in spacers, particle on spacer surfaces etc.

iv) The equipments should have the following parameters:

a) Measurement shall be possible in noisy environment.

b) The equipment shall be battery operated with built-in battery charger. It shall also be suitable for 230V AVC/50 Hz input.

c) Measurement shall be possible in the charged switchyard in the presence of EMI/EMC. Supplier should have supplied similar detector for GIS application to other utilities. Performance certificate and the list of users shall be supplied along with the offer.

d) Instrument shall be supplied with standard accessories i.e. connecting cables (duly screened) to sensors, Lap-top PC, diagnostic software, carrying case, rechargeable battery pack with charger suitable for 230V AC, 50 Hz supply connecting cables (duly screened) to view in storage. Contractor shall provide adequate number of sensors in the offered GIS for detection of Partial discharge, the number and location of these sensor shall be subject to approval of the employer.

e) The function of software shall cover the following :

- Data recording, storage and retrieval in computer
- Data base analysis

CLAUSE NO.	TECHNICAL REQUIREMENTS

- Template analysis for easy location of fault inside the GIS
- Evaluation of PD measurement i.e., Amplitude, Phase Synchronisation etc.
- Evaluation of bouncing/loose particles with flight time and estimation on size of particle.
- Report generation

f) To prove the suitability of working in charged switchyard condition, practical demonstration shall be conducted before acceptance.

g) Supplier shall have "Adequate after sales service" facility in India.

k) Necessary training may be accorded to personnel to make use of the kit for locating PD sources inside the GIS. Instrument shall be robust and conform to relevant standard

3.0) **SF6 gas analyzing equipment and instruments should have capacity for performing the following functions**: **Qty: 1no**

a) The moisture content measurement or alternatively dew point measurement.

b) The SF6 gas content measurement.

c) Sensitivity should not be affected by dust, humidity, heat & wind etc.

d) Acidic product detection

4.0**)** **Portable Leakage current analyzer (for Gapless Surge Arrester), Qty: 1no**

3.00.00 **CIRCUIT BREAKER:**

3.01.00 **GENERAL :**

Circuit Breakers shall be metal enclosed SF6 gas insulated, single phase encapsulated for GIS, both comprising three identical single pole units, complete in all respects with all fittings and wiring. The controlled switching device for circuit breakers (as indicated in single line diagram) shall meet the requirements as specified in **Annexure-I.**

3.02.00 **DUTY REQUIREMENTS :**

3.02.01 The circuit breaker shall meet the requirements of Capacitive Class: C2, Mechanical Endurance: M2, Electrical Endurance class: E2 type of duty as per IEC for 400kV.

3.03.00 **CONSTRUCTIONAL FEATURES:**

3.03.01 All the three poles of the breaker shall be linked together either electrically/pneumatically or electro hydraulically, In case of 400kV.

3.03.02 Circuit breakers shall be provided with two (2) independent trip coils, suitable for trip circuit supervision. The trip circuit supervision relay would also be provided. Necessary terminals shall be provided in the central control cabinet of the circuit breaker.

3.04.00 **SULPHUR HEXAFLOURIDE (SF6) GAS CIRCUIT BREAKER:**

CLAUSE NO.	TECHNICAL REQUIREMENTS

Circuit breakers shall be single pressure type. Each pole shall form an enclosure filled with SF6 gas independent of two other poles. Common monitoring of SF6 gas can be provided for the three poles of circuit breaker having a common drive. The interconnecting pipes in this case shall be such that the SF6 gas from one pole could be removed for maintenance purposes. Sufficient SF6 gas shall be supplied to fill all the circuit breakers installed plus an additional 20% of the quantity as spare.

3.05.00 **OPERATING MECHANISM:**

3.05.01 Circuit breaker shall be operated by pneumatic mechanism or electrically spring charged mechanism or electro-hydraulic mechanism or a combination of these. It shall be gang operated in case of 3-phase reclosing operation as applicable.

3.05.02 The pneumatically operated mechanism shall offer unit compressor with each circuit breaker with the breaker local air receivers having a capacity for two 'CO' operations of the breaker at the lowest pressure for reclose duty without refilling.

3.05.03 The Spring-operated mechanism shall be complete with motor, opening spring & closing spring with limit switch for automatic charging and other necessary accessories to make the mechanism a complete operating unit. If power is available to the motor, a continuous sequence of closing and opening operations shall be possible. The motor shall have adequate thermal rating for this duty. After failure of power supply to the motor, one close-open operation shall be possible with the energy contained in the operating mechanism. Motor ratings shall be such that it requires not more than 30 seconds for fully charging the closing spring.

3.05.04 The hydraulic mechanism shall be suitable for at least two close open operations after failure of ac supply to the motor starting at pressure equal to lowest pressure of auto-reclose duty. All hydraulic joints shall have no oil leakage under the site conditions and joints shall be tested at factory against oil leakage at a minimum of 1.5 times maximum working pressure.

3.06.00 **FITTINGS AND ACCESSORIES:**

3.06.01 **UNIT COMPRESSED AIR SYSTEM:**

a) The unit compressed air system for each breaker shall be provided with compressed air piping, piping accessories, control and non-return valves, filters, coolers of adequate capacity, pressure reducing valves (if any), isolating valves, drain ports, etc. The air compressor shall be driven by automatically controlled motor. It shall be of air-cooled type complete with preferably oil-less cylinder lubrication. The compressors or pumps shall be

mounted within the operating mechanism housing or a separate weather-proof and dust-proof housing. Each compressor shall be equipped with a time totaliser.

b) The compressor size shall be such that it can perform following operations satisfactorily:
i) Total running time of compressor not exceeding 45 minutes per day, considering 2% leakage and 2 CO-operations.
ii) Air charging time not exceeding 20 minutes after one CO operation of the breaker.

c) Air Receivers**:**
i) The capacity of receivers shall be sufficient for two (2) CO operations of the breaker.
ii) Air receiver shall be designed in accordance with the latest edition of the ASME Code for Pressure Vessel - Section VIII of BS:5179. A corrosion allowance of 3.0 mm shall be provided for shell and dished ends. Receivers shall be hot dip galvanized.

d) Controls and Control Equipment**:**
i) The compressor control shall be of automatic start stop type initiated by pressure switches on the receiver. Supplementary manual control shall also be provided.
ii) All control equipment shall be housed in a totally enclosed cabinet. Pressure gauges and other indicating devices, control switches shall be mounted on the control cabinet.
iii) Facility to annunciate failure of power supply to the compressor control shall also be provided.

e) Compressed Air Piping, Valves and Fittings:
i) The flow capacity of all valves shall be at least 20% greater than the compressor capacity.
ii) The high-pressure system shall be such that after one 0 - 0.3 Sec - CO operation, the breaker shall be capable of performing one CO operation within 3 minutes.
iii) All compressed air piping shall be bright annealed, seamless phosphorous Deoxidized Non-Arsenical Copper alloy or stainless-steel pipe (C-106 of BS: 2871).

3.07.00 **TESTS : Type test :**

a) 400KV GIS circuit breaker shall be type tested in accordance with the requirement stipulated under respective clause mentioned elsewhere in the specifications.

3.07.02 **Routine Tests :**

Routine tests as per IEC on the complete breaker/ pole along with its own operating mechanism and pole column shall be performed on all circuit breakers.

3.07.03 **SITE TESTS :**

All routine tests except power frequency voltage dry withstand test on breaker shall be repeated on the completely assembled breaker at site.

3.08.00 **PARAMETERS :GENERAL**

Sl.no	Description	
a)	Type of Circuit breaker	SF6 insulated
b)	No. of poles	Three(3poles)
c)	Rated operating duty cycle	O - 0.3 sec. - CO - 3min. – CO
d)	Total closing time	Not > than 150ms
e)	Reclosing	1ph & 3ph high speed auto reclosing
f)	Trip and closing coil voltage	220V DC
g)	Auxiliary contacts	As required plus10NO & 10NC contacts per breaker as spare.

3.08.01 **400kV Class Circuit Breakers (GIS)**

Sl.no	Description	
a)	Rated line charging breaking current(voltage factor of 1.4)	600A at 90deg.cen
b)	First pole to clear factor	1.3
c)	Rated break time	As per IEC

ANNEXURE-I

Requirement of Controlled Switching Device for 400KV Circuit Breaker

The circuit breaker with controlled switching as indicated in single line diagram shall meet the following requirement:

1. The Switching controlled Device shall be used to reduce increased over voltages, re ignition between circuit breaker contacts that may be caused by normal switching of high voltage circuit breakers and hence optimize the stresses on circuit breaker while switching the circuit. The switching-controlled device will be called device henceforth.
2. Circuit breaker should be able to be switched while switching controlled device is not in operation e.g., during maintenance work or power supply is not connected, a bypass shall be provided to the device. In these cases, the switching commands will then be forwarded directly to the circuit breaker via this Bypass. The switching time will not be controlled with these switching operations.
3. The controller shall get command to operate the breakers manually or through auto re-close relay at random. The controller shall be able to analyze the current and voltage waves available through the signals from secondaries of CTs & CVTs for the purpose of calculation of optimum moment of the switching the circuit breaker and issue command to circuit breaker to operate.

CLAUSE NO.	TECHNICAL REQUIREMENTS

4. The device should have display facility at the front for the settings and measured values, alternatively a laptop shall be supplied with each CSD to facilitate display at the front for the setting and measured values.
5. The device shall have self-monitoring facility.During the switching operations, current and voltage waveforms and other parameters shall be recorded and saved together with calculated values. The control switching device provided shall be networked to an Engineering workstation (EWS) located in the switchyard control room. It shall be possible to extract the switching oscillographic records and to do CSD parameterization from this EWS. All necessary software & hardware shall be in bidder's scope. .
6. It shall have self-monitoring facilities. Faults which impair the functioning of the device or peripheral components, failure of trip voltage or sensors shall be displayed visually and shall give alarm.
7. The device shall be designed to operate correctly and satisfactorily with the excursion of auxiliary A/C & DC voltages and frequency as specified elsewhere in the specification.
8. The device shall have time setting resolution of 0.1 ms or better.
9. Test reports for the following type tests shall be submitted:
    a. Dielectric withstand test as per IEC 60255-27.
    b. High voltage Impulse test as per IEC 60255-27.
    c. Slow damped oscillatory wave test as per IEC60255-26
    d. Fast transient test as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-4)
    e. Electrostatic Discharge test as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-2)
    f. Surge Immunity test as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-5)
    g. Power frequency magnetic field test as per IEC 60255-26 (class 5 installation as per base standard IEC 61000-4-8)
    h. Radiated radio frequency electromagnetic field test as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-3)
    i. Conducted disturbance induced by radio frequency field as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-6)
    j. Power frequency immunity test on binary input as per IEC 60255-26 (class 4 installation as per base standard IEC 61000-4-16)

4.00.00 DISCONNECTOR : GENERAL:

4.01.01 The isolators and accessories shall conform in general to relevant IEC 62271-102 (or equivalent Indian Standard) except to the extent explicitly modified in specification. Earth switches shall be provided on isolators as marked on SLD. Isolators shall be horizontal centre break type, Pantograph Isolators as indicate din SLD..

4.01.02 The isolators and earth switches shall be A. C / D.C. motor operated.

CLAUSE NO.	TECHNICAL REQUIREMENTS

4.02.00 **DUTY REQUIREMENTS:**

Isolators and earth switches shall be capable of withstanding the dynamic and thermal effects of the maximum possible short circuit current of the system in their closed position. They shall be constructed such that they do not open under influence of short circuit current and wind pressure together. The earth switches wherever provided shall be constructional interlocked so that the earth switches can be operated only when the isolator is open and vice-versa.

4.02.01 The earth switches wherever provided shall be constructional interlocked so that the earth switches can be operated only when the isolator is open and vice-versa. Mechanical Endurance : M2 type of duty as per IEC for 400kV earthing switches shall be of class M0 / M1 duty

4.02.02 In addition to the constructional interlock, isolator and earth switches shall have provision to prevent their electrical and manual operation unless the associated and other interlocking conditions are met. All these interlocks shall be of failsafe type. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply and within a variation range as stipulated in relevant section. The interlock coil shall be provided with adequate contacts for facilitating permissive logic for 'DC' control scheme of the isolator as well as for AC circuit of the motor to prevent opening or closing of isolators when the interlocking coil is not energised

4.02.03 The earthing switches shall be capable of discharging trapped charges of the associated lines. Isolator and earth switches shall be able to bear on the terminals the total forces including wind loading and electrodynamic forces on the attached conductor without impairing reliability or current carrying capacity.

4.02.04 The isolator shall be capable for making / breaking normal currents when no significant change in voltage occurs across the terminals of each pole of the isolator on account of making / breaking operation.

4.03.00 **(A) CONSTRUCTIONAL FEATURES (For GIS):**

a) The three pole/ Single pole group operated disconnectors shall be operated by electric motor suitable for use on 220 V DC ungrounded system/415V AC system and shall be equipped with a manual operating mechanism for emergency use. The motor shall be protected against over current & short circuit.

b) Disconnectors shall be designed as per relevant IEC. These shall be suitable to make and break the capacitive charging currents during their opening and closing. They shall also be able to make & break loop current which appears during transfer between bus bars. The

contact shielding shall also be designed to prevent restrikes and high local stresses caused by the transient recovery voltages when these currents are interrupted.

c) The disconnecting switches shall be arranged in such a way that all the three phases operate simultaneously. All the parts of the operating mechanism shall be able to withstand starting torque of the motor mechanism without damage until the motor overload protection operates.

d) It shall be possible to operate the disconnecting switches manually by cranks or hand wheels. The contacts shall be both mechanically and electrically disconnected during the manual operation.

e) The operating mechanisms shall be complete with all necessary linkages, clamps, couplings, operating rods, support brackets and grounding devices. All the bearings shall be permanently lubricated or shall be of such a type that no lubrication or maintenance is required.

f) The opening and closing of the disconnectors shall be achieved by either local or remote control. The local operation shall be by means of a two-position control switch located in the bay module control cabinet.

g) Remote control of the disconnectors from the BCU in Relay room & switchyard control room shall be made through remote / local transfer switch.

h) The disconnector operations shall be interlocked electrically with the associated circuit breakers in such a way that the disconnector control is inoperative if the circuit breaker is closed.

i) Each disconnector shall be supplied with auxiliary switch having eight normally open and eight normally closed contacts for use by others over and above those required for disconnector operation purposes. The auxiliary switch contacts are to be continuously adjustable such that, when required, they can be adjusted to make contact before the main switch contacts. Additionally, MBB contact as required shall also be provided.

j) The signaling of the closed position of the disconnector shall not take place unless it is certain that the movable contacts will reach a position in which the rated normal current, peak withstand current and short time withstand current can be carried safely.

k) The signaling of the open position of the disconnector shall not take place unless the movable contacts have reached such a position that the clearance between the contacts is at least 80 percent of the rated isolating distance.

CLAUSE NO.	TECHNICAL REQUIREMENTS

l) All auxiliary switches and auxiliary circuits shall be capable of carrying a current of at least 10 A DC continuously.

m) The auxiliary switches shall be capable of breaking at least 2 A in a 220-V DC circuit with a time constant of not less than 20 milliseconds.

n) The disconnectors and safety grounding switches shall have a mechanical key (padlocking key) and electrical interlocks to prevent closing of the grounding switches when disconnector switches are in the closed position and to prevent closing of the disconnectors when the grounding switch is in the closed position.

o) The local control of the disconnector and high-speed grounding switches from the bay module control panel should be achieved from the individual control switches with the remote/local transfer switch set to local.

p) All electrical sequence interlocks will apply in both remote and local control modes.

q) Each disconnector for all phases shall have a clearly identifiable local, positively driven mechanical position indicator, together with position indicator on the bay module control cabinet and provisions for taking the signals to the power house control room. The details of the inscriptions & colouring for the indicator are given as under:

Sign	Background	Colour
Open position	Open	Green
Closed position	Closed	Red

r) All the disconnector and earth switches shall be provided with inspection window so that the travel of the switch contacts in both open and close positions can be verified by visual inspection. Also for all 3phases of Disconnector and earth switches local indication of close / open position indicator , viewing window shall be provided .

s) The disconnecting switches shall be provided with rating plates and shall be accessible for inspection.

t) The disconnecting switches shall be capable of being padlocked in both the open and closed positions with the operating motor automatically disengaged. The padlocking device shall be suitable for a standard size lock with a 10mm shank. The padlock must be visible and directly lock the final output shaft of the operating mechanism. Integrally mounted lock when provided shall be equipped with a unique key for such three-phase group. Master key is not permitted.

4.03.00 (B) **CONSTRUCTIONAL FEATURES (For AIS)**

CLAUSE NO.	TECHNICAL REQUIREMENTS

4.03.01	The isolators shall be provided with high pressure current carrying contacts on the hinge/ jaw ends and all contact surfaces shall be silver plated. The thickness of silverplating should not be less than 25 microns. The contacts shall be accurately machined and self aligned.
4.03.02	The isolator shall be provided with a galvanised steel base provided with holes and designed for mounting on a lattice/pipe support structure. The base shall be rigid and self supporting. The position of movable contact system (main blades) of each of the isolator and earthing switch shall be indicated by a mechanical indicator at the lower end of the vertical rod of shaft for the isolator and earthing switch. The indicator shall be of metal and shall be visible from operating level.
4.03.03	The isolator shall be provided with a galvanised steel base provided with holes and designed for mounting on a lattice/pipe support structure. The base shall be rigid and self supporting. The position of movable contact system (main blades) of each of the isolator and earthing switch shall be indicated by a mechanical indicator at the lower end of the vertical rod of shaft for the isolator and earthing switch. The indicator shall be of metal and shall be visible from operating level.
4.03.04	The isolators shall be so constructed that the switch blade will not fall to the closed position if the operating shaft gets disconnected. Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by gravity, wind pressure, vibrations shocks or accidental touching of the connecting rods of the operating mechanism. The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals
4.03.05	The insulator of the isolator shall conform to the requirements stipulated under clause no: 08.00.00 as specified in the specification and shall have a min. cantilever strength of 800 kg for 400kV. Pressure due to the contact shall not be transferred to the insulators after the main blades full close. The insulators shall be so arranged that leakage current will pass to earth and not between terminals of the same pole or between phases. The terminal connectors shall conform to requirements stipulated under clause no:08.00.00 as specified else where in the specification.
04.03.06	EARTHING SWITCHES: Where earthing switches are specified these shall include the complete operating mechanism and auxiliary contacts. The earthing switches shall form an integral part of the isolator and shall be mounted on the base frame of the isolator. Earthing switches shall be suitable for local operation only. The earthing switches shall be constructional interlocked with the isolator so that the earthing switches can be operated only when isolator is open and vice versa.

CLAUSE NO.	TECHNICAL REQUIREMENTS

04.03.07 **OPERATING MECHANISM AND CONTROL:**

The Contractor shall offer, motor operated switches having padlock arrangement on both 'ON' and 'OFF' positions. Limit switches for control shall be fitted on the isolator/ earth switch shaft, within the cabinet to sense the open and close positions of the isolators and earth switches. It shall not be possible, after final adjustment has been made for any part of the mechanism to be displaced at any point in the travel sufficient enough to allow improper functioning of the isolator when the isolator is opened or closed at any speed. Control cabinet/operating mech. box shall conform to requirements stipulated in clause no: 08.00.00 else where in the specification and IS:5039/IS 8623/IEC 439 as applicable

04.03.08 **OPERATION:**

Isolator shall be gang operated for main blades and earth switches. The operation of the three poles shall be well synchronized and interlocked.

04.03.09 The design shall be such as to provide maximum reliability under all service conditions. All operating linkages carrying mechanical loads shall be designed for negligible deflection. The length of inter insulator and interpole operating rods shall be capable of adjustments

04.03.10 The design of linkages and gears be such so as to allow one man to operate the handle with ease for isolator and earth switch

04.03.11 TESTS:

04.03.11 In continuation to the requirements stipulated under Part-I the isolator along with operating mechanism shall conform to the type tests and shall be subjected to routine tests and acceptance tests in accordance with IEC 62271-102. Minimum 50 nos. mechanical operations will be carried out on 1 (one) isolator assembled completely with all accessories as acceptance test. During final testing of isolator sequential closing/ opening of earth switch shall also be checked only after isolator is fully open/close. Acceptance test shall be carried out with operating box

4.04.00A **SAFETY GROUNDING SWITCHES & HIGH SPEED GROUNDING SWITCHES:**

a) Three-pole/ Single pole, group operated, safety grounding switches shall be operated by electric motor for use on 220V DC ungrounded system and shall be equipped with a manual operating mechanism for emergency use. The motor shall be protected against over current and short circuit.

b) In order to provide test facilities for CTs, transformers, cables etc., certain ground switches may require to be electrically insulated from the enclosures and have easily removable ground connections.

c) Each safety grounding switch shall be electrically interlocked with its associated disconnector and circuit breaker such that it can only be closed if both the circuit breaker and disconnector are in open position. Safety grounding switch shall however be mechanically key interlocked with its associated disconnector.

d) Each safety grounding switch for all phases shall have clearly identifiable local positive driven mechanical indicator together with position indicator on the bay module control cabinet and provision for taking the signal to Powerhouse Control Room.

e) The details of the inscription and colouring for the indicator are given as under:

Sign	Background	Colour
Open position	Open	Green
Closed position	Closed	Red

f) Each ground switch shall be fitted with auxiliary switches having six normally open and six normally closed contacts for use by others over and above those required for local interlocking and position indication purposes.

g) Provision shall be made for padlocking the ground switches in either the open or closed position.

h) The safety grounding switches shall conform to the requirements of IEC 62271-102

I) Mechanical position indication shall be provided locally at each switch along with remote indication at each bay module control cabinet & in the power house control room.

j) The short circuit making current rating of each ground switch shall be at least equal to its peak withstand current rating of 125KA. The switches shall have inductive / capacitive current switching capability as per IEC-62271-102.

k) The high speed grounding switches shall conform to the requirements of IEC-62271-102. The electrical duty class : E1 & Mechanical duty class : M1 as per IEC shall be provided .

l) 400KV GIS disconnector, Earth, Grounding/ safety / high speed earth switches shall be type tested in accordance with the requirement stipulated under clause no 1.12.00.

4.05.00 **PARAMETERS: General(GIS)**

Sl.no	Description	
a)	Type of isolator	Metal enclosed,SF6 insulated
b)	No. of poles	Three(3poles)
c)	Rated operating time	Not > than 12sec
d)	Control voltage	220VDC
e)	Auxiliary contacts on isolator	Min.8NO & 8NC contacts per pole/isolator .
f	Auxiliary contacts on earth/ safety/grounding/high speed switch	Min.6NO & 6NC contacts per pole/isolator .
g)	Operating mechanism of isolator and earth switch	AC/DC/universal motr

General (AIS) :

	Description	Parameter
a)	Type of isolator	Out door type , 50Hz
b)	No. of poles	Three(3poles)
c)	Rated operating time	Not > than 12sec
d)	Control voltage	220VDC
e)	Auxiliary contacts on isolator	Min.8NO & 8NC contacts per pole/isolator .
f	Auxiliary contacts on earth/ safety/grounding/high speed switch	Min.6NO & 6NC contacts per pole/isolator .
g)	Operating mechanism of isolator and earth switch	AC/DC/universal motor
h)	Minimum creepage distance	31mm/Kv
i)	Rated ambient temperature	50 degree Celsius
j)	Support structure height	Adequate so that lowest part of support insulator of equipment is minimum 2550 mm from plinth level
k	Temperature rise	As per Table III of IEC 60694 for an ambient of 50 deg. C

5.00.00 **INSTRUMENT TRANSFORMER : CODES AND STANDARDS,**

Current transformers	IEC 61869-1&2, IS: 2705,IS:16227
Voltage transformers	IEC 61869-1&5, IEC 60358, IS: 3156
Insulating oil	IS: 335, IEC:60296

5.01.00 GENERAL REQUIREMENTS (FOR GIS):

a) The instrument transformers i.e., current and voltage transformers shall be single phase transformer units. Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.

b) The contractor is required to submit the VA burden calculations and obtain approval from the Employer before proceeding with design of the cores. The other characteristics of CTs shall be as given below:

5.02.00 PARAMETERS AND CONSTRUCTION DETAILS (GIS):

5.02.01 GENERAL FOR CURRENT TRANSFORMER (GIS):

Sl.No	Description	Rating
a)	One minute power frequency Withstand voltage between Secondary terminal and Earth is :	**5kV**
b)	Partial discharge level	Max.10pico Coulombs
c)	Type of insulation	Class A
d)	Number of cores	Details are given **in Table-I** below
e)	Number of terminals in box	All terminals of control circuits wired in marshalling box plus 20 terminals as spare.
f)	Rated extended primary current	120% of rated primary current

5.02.02 Construction Details:

a)The current transformers incorporated into the GIS will be used for protective relaying and metering. The secondary windings shall be air/gas insulated. All the current transformers shall have effective electromagnetic shields to protect against high frequency transients.

b)Each current transformer shall be equipped with a marshalling box with terminals for the secondary circuits, which are connected to the local control cubicle. The star / delta configuration and the inter connection to the line protection panels will be done at the CT terminal block located in the local control cubicle.

c) The rated extended current rating voltage and rated thermal current shall also be marked on the name plate. The diagram plate shall show the terminal markings and relative physical arrangement of the current transformer cores with respect to the primary terminals(P1 & P2).

d)The position of each primary terminal in the current transformer SF_6 gas section shall be clearly marked by two plates fixed to the enclosure at each end of the current transformer.

e)Current transformers guaranteed burdens and accuracy class are to be intended as simultaneous for all cores. The current transformers shall be suitable for high-speed auto reclosing.

f)Electromagnetic shields to be provided against high frequency transients typically 1-30 MHz.

g)Provision shall be made for primary current injection testing of current transformers.

5.03.00 BUS VOLTAGE TRANSFORMERS (GIS):

5.03.01 General :

a)The voltage transformers and accessories shall conform to IEC and other relevant standards except to the extent explicitly mentioned in the specification. Voltage transformers shall be of the electromagnetic type with SF_6 gas insulation. The earth end of high voltage winding and the ends of secondary winding shall be brought out in the terminal box.The rating and diagram plate shall be provided complying with the requirement of IEC specification incorporating the year of manufacture and including turn's ratio, voltage ratio, burden, connection diagram etc.

b)The beginning and end of each secondary winding shall be wired to suitable terminals accommodated in a terminal box mounted directly on the voltage transformer section of SF6 switchgear.

c)All terminals shall be stamped or otherwise marked to correspond with the marking on the diagram plate. Provision shall be made for earthing of the secondary windings inside the terminal box.

d)The transformer shall be able to sustain full line voltage without saturation of transformer. Core details are given in **Table-II.**

5.03.02 Constructional Details:

a)The voltage transformers shall be located in a separate bay module on the bus and will be connected phase-to ground and shall be used for protection, metering and synchronizing. The

	voltage transformers shall be of induction type, nonresistant and shall be contained in their own- SF6 compartment, separated from other parts of installation.
5.04.00	**GENERAL REQUIREMENTS (For AIS):**
5.04.01	The instrument Transformers i.e Current and voltage transformers / CVT shall be single phase transformer units and shall be supplied with a common marshaling box for a set of three single phase units. All exposed mild steel shall be hot dip galvanised or painted with Grey color of shade RAL 9002.The instrument transformers shall be hermetically sealed units. The instrument transformers shall be provided with filling and drain plugs. Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block. For Current transformers , no oil shall come in contact with zinc galvanized surface.
5.04.02	The Instrument transformer shall be with Polymer Insulator. For Current transformer shall have cantilever strength of not less than 500kg for 400kV. For 400kV CVT cantilever strength shall not be less than 250kg..
5.04.03	Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block
5.05.00	**CURRENT TRANSFORMERS (CTs):**
	i)The CTs shall have single primary of either ring type or hair pin type or bar type. Wound primary is not acceptable.
	ii) In case of "Bar Primary" inverted type CTs, the following requirements shall be met:
	a)The secondaries shall be totally encased in metallic shielding providing a uniform equipotential surface for even electric field distribution.
	b) The lowest part of insulation assembly shall be properly secured to avoid any risk of damage due to transportation stresses.
	c) The upper part of insulation assembly sealing on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly and top dome.
	iii)The insulator shall be one piece without any metallic flange joint. The CT shall be provided with oil sight glass.

CLAUSE NO.	TECHNICAL REQUIREMENTS	सी एस पी जी सी एल CSPGCL

iv) The core lamination shall be of cold rolled grain oriented silicon steel or other equivalent alloys. The cores shall produce undistorted secondary current under transient conditions at all ratios with specified parameters.

v) Different ratios shall be achieved by secondary taps only, and primary reconnections shall not be accepted.

vi)The guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.

vii)The instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CT/reactor is used, then all parameters specified shall be met treating auxiliary CTs/reactors as integral part of CT. The auxiliary CT/reactor shall preferably be in-built construction of the CT. In case it is separate, it shall be mounted in secondary terminal box.

viii)The physical disposition of protection secondary cores shall be in the same order as given under CT requirement table(s) given below.

ix) The CTs shall be suitable for high speed auto-reclosing.

x)The secondary terminals shall be terminated on stud type suitable no's of non disconnecting and disconnecting terminal blocks inside the terminal box of degree of protection IP:55 at the bottom of CT.

xi)The CTs shall be suitable for horizontal transportation,

xii)The CTs shall have provision for taking oil samples from bottom of CT without exposure to atmosphere to carry out dissolved gas analysis periodically. Contractor shall give his recommendations for such analysis, i.e. frequency of test, norms of acceptance, quantity of oil to be withdrawn, and treatment of CT. Contractor shall supply 2nos. oil sampling device for every 20nos. Minimum 2nos. oil sampling device for each substation.

xiii)The CT shall have provision for measurement of capacitance and tan delta as erected at site

5.06.00 **VOLTAGE TRANSFORMERS (CVTs) (AIS):**

5.06.01 Voltage transformers shall be of capacitor voltage divider type with electromagnetic unit.The CVTs shall be thermally and dielectrically safe when the secondary terminals are loaded with guaranteed thermal burdens. The electro-magnetic unit (EMU) shall comprise of compensating reactor, intermediate transformer, and protective and damping devices. The oil level indicator of EMU with danger level marking shall be clearly visible to maintenance personnel standing on ground.

CLAUSE NO.	TECHNICAL REQUIREMENTS

5.06.02 The secondaries shall be protected by HRC cartridge type fuses for all windings. In addition fuses shall also be provided for protection and metering windings for connection to fuse monitoring scheme. The secondary terminals shall be terminated on stud type non-disconnecting terminal blocks via the fuse inside the terminal box of degree of protection IP: 55. The access to secondary terminals shall be without the danger of access to high voltage circuit.

5.06.03 The damping device shall be permanently connected to one of the secondary winding and shall be capable of suppressing ferro-resonance oscillations.

5.06.04 CVTs shall be suitable for high frequency (HF) coupling for power line carrier communication. Carrier signals must be prevented from flowing into potential transformer (EMU) metering circuit by means of RF choke/reactor suitable for effective blocking the carrier signals over the entire frequency range of 40 to 500 kHz. HF terminal shall be brought out through a suitable bushing and shall be easily accessible for connection to the coupling filters of the carrier communication equipment. The HF terminal shall be provided with earthing link with fastener.

5.06.05 A protective surge arrester/spark gap shall preferably be provided to prevent break down of insulation by incoming surges and to limit abnormal rise of terminal voltage of shunt capacitor, tuning reactor, RF choke, etc. due to short circuit in transformer secondary. The details of this arrangement (or alternative arrangement) shall be furnished by Contractor for Employer's review.

5.06.06 The accuracy of metering core shall be maintained through the entire burden range upto 50VA on all four windings without any adjustments during operations. The protection cores shall not saturate at about 1.5 times the rated voltage for a min. duration of 30 secs.

5.07.00 MARSHALLING BOX : Marshaling box shall conform to all requirements as given in part auxiliary. The wiring diagram for the interconnection of three phase instrument transformer shall be pasted inside the box. Terminal blocks in the marshaling box shall have facility for star/delta formation, short circuiting and grounding of secondary terminals. The box shall have enough terminals to wire all control circuits plus 20 spare terminals

5.08.00 **GENERAL PARAMETERS FOR CURRENT TRANSFORMERS**:

Sl.no	Description	Parameter
a)	One minute power frequency withstand voltage between secondary terminal and earth	5kV
b)	Partial discharge level	10 pico Coulombs max.

c)	Temperature rise	As per IEC
d)	Type of insulation	Class A
e)	Number of cores	Five (5): Details are given in table-1 below
f	Rated frequency	50 Hz
g)	System neutral earthing	Effectively earthed
h)	Installation	Outdoor (up right)
i)	Seismic acceleration	0.3 g horizontal
j	Number of terminals in marshalling box.	All terminals of control circuits wired up to box marshalling box plus 20 terminals spare.

5.08.01 **400 kV Current Transformers (oil filled type) :**

Sl.no	Description	Parameter
a)	Rated Short time thermal current	63kA for 1sec
b)	Rated Dynamic current	157.5kA(peak)
c)	Rated Extended Primary current	120% of rated primary current as per SLD

5.09.00 **PARAMETERS FOR VOLTAGE TRANSFORMERS (For AIS): General Parameters:**

Sl.no	Description	
a)	Standard reference range of frequencies	96% to 102% for protection. 99% to 101% for measurement
b)	High frequency .capacitance	With in 80% to 150%
c)	Equivalent resistance over entire carrier frequency range	<40 ohms
d)	One min.power frequency with stand voltage (B/W LV(HF) terminal	10KV rms & earth for exposed terminals or 4kV rms for terminals enclosed in weather proof box
e)	No of terminals in cabinet mFor secondary winding	Required , plus 10nos spare.
f	Rated thermal burden	750VA.
g)	Partial discharge	Max.10 pico coulombs
h)	Rated voltage factor	1.2continuous, 1.5 for 30sec
i)	No of cores	As per details given I Table-II below
j	CVT HF capacitance	4400/8800pf (as required)

5.10.00 **TESTS:**

a) 400KV GIS Instrument transformer shall be type tested in accordance with the requirement stipulated under clause no 1.12.00

b) The Current and voltage transformers (For AIS) shall confirm to type tests and subjected to routine tests in accordance with the relevant IEC/IS and shall also conform to the following additional type tests as applicable:

Sl.No	Description
i)	Radio Interference and Corona test
ii)	Thermal withstand test i.e. application of rated voltage and rated current simultaneously by synthetic circuit (For CT only) Seismic withstand test along with structure (for 400kV only)
iv)	Thermal co-efficient test i.e. measurement of Tan-Delta as function of temperature (at ambient and between 80 deg. C and 90 deg. C) and voltage (at 0.3, 0.7, 1.0 and 1.1 Um).(for CT only)
v)	Multiple chopped impulse test on Primary winding.
vi)	In addition to routine tests as per IEC/IS, measurement of partial discharge in continuation with power frequency withstand test required for 400 kV current transformer. ISF (Instrument Security Factor) test will be done as part of Routine acceptance test

TABLE-I

CORE DETAILS OF 400kV CTs-Protection (GIS) CT-A

Following details shall be applicable for all protection class CT cores.
The rated extended primary current of the CTs shall be 120% continuous of 3000A.

CT No.	Current Ratio (A)	Output Burden (VA)	Accuracy Class as per IEC	Min Knee Point Voltage (Vk)	Max CT Sec Winding Res. (Ohm)	Max Exciting Current in mA at Vk
1	3000/ 2000/ 1000/1	-----	PS	6000/4000 / 2000	15/ 10/ 5 Ohm	20/ 30/ 60
2	3000/ 2000/ 1000/1	-----	PS	6000/4000 / 2000	15/ 10/ 5 Ohm	20/ 30/ 60

Physical arrangement of CTs shall be as per Protection SLD.

CORE DETAILS OF 400kV CTs-Protection (GIS) CT-B

Following details shall be applicable for all protection class CT cores.
The rated extended primary current of the CTs shall be 120% continuous of 3000A.
Physical arrangement of CTs shall be as per Protection SLD.

CT No.	Current Ratio (A)	Output Burden (VA)	Accuracy Class as per IEC	Min Knee Point Voltage (Vk)	Max CT Sec Winding Res. (Ohm)	Max Exciting Current in mA at Vk
1	3000/ 2000/ 1000/1	-----	PS	6000/4000/ 2000	15/ 10/ 5 Ohm	20/ 30/ 60
2	3000/ 2000/ 1000/1	-----	PS	6000/4000/ 2000	15/ 10/ 5 Ohm	20/ 30/ 60

CORE DETAILS OF 400kV CTs-Protection (GIS) CT-C (ST / GT/ Bus reactor)

Following details shall be applicable for all protection class CT cores.

The rated extended primary current of the CTs shall be 120% continuous of 3000A.

CT No.	Current Ratio (A)	Output Burden (VA)	Accuracy Class as per IEC	Min Knee Point Voltage (Vk)	Max CT Sec Winding Res. (Ohm)	Max Exciting Current in mA at Vk
1	3000/ 2000/ 1000/ 500/1, (EM)	20/20/20/20	0.2S, ISF<5	-	-	-

Physical arrangement of CTs shall be as per Protection SLD.

CORE DETAILS OF 400kV CTs-Protection (GIS) CT-C CTL (Line Side)

Following details shall be applicable for all protection class CT cores.

The rated extended primary current of the CTs shall be 120% continuous of 3000A.

Physical arrangement of CTs shall be as per Protection SLD.

CT No.	Current Ratio (A)	Output Burden (VA) (*)	Accuracy Class as per IEC	Min Knee Point Voltage (Vk)	Max CT Sec Winding Res. (Ohm)	Max Exciting Current in mA at Vk
1	3000/ 2000/ 1000/1 (Main#1)	-----	PS	6000/4000 / 2000	15/ 10/ 5 Ohm	20/ 30/ 60
2	3000/ 2000/ 1000/1 (Main#1)	-----	PS	6000/4000 / 2000	15/ 10/ 5 Ohm	20/ 30/ 60
3	3000/ 2000/ 1000/ 500/1 ABT Metering (EM), PMU	20/20/20/20	0.2S, ISF<5	-	-	-
4	3000/ 2000/ 1000/ 500/1 ABT Metering (EM-Main, Check)	20/20/20/20	0.2S, ISF<5	-	-	-

CORE DETAILS OF 400kV Bus VT / VT (GIS)				TABLE – II
Secondary Core	Application	Rated Secondary Voltage (V)	Accuracy	Output Burden (Maximum) (*)
I	Protection	110/√3	3P	50 VA
II	Protection	110/√3	3P	50 VA
III	Metering	110/√3	0.2	50 VA
The accuracy of 0.2 on secondary III should be maintained through the entire burden range up to total simultaneous burden 50 VA on all the three windings without any adjustments during operation.				
* The rated burden of cores shall be closer to the maximum burden requirement of metering and protection system for better sensitivity and accuracy. The supporting calculation for burden to be furnished during detail engineering.				

NOTE

CORE DETAILS OF 400kV CTs (AIS):

Following details shall be applicable for all protection class CT cores.

The rated extended primary current of the CTs shall be 120% continuous of 3000A./ 2000A

CT No./Core No.	Current Ratio (A)	Output Burden (VA) (*)	Accuracy Class as per IEC	Min Knee Point Voltage (Vk)	Max CT Sec Winding Res. (Ohm)	Max Exciting Current in mA at Vk	Application
1	3000/ 2000//1000/ 1	-----	PS	3000/2000 /1000	15/10/5 Ohm	20/30/ 60	Bus Differential check
2	3000/2000/1 000/1		PS	3000/2000 /1000	15/10/5 Ohm	20/30/ 60	Bus Differential main
3	3000/2000/1 000/500/1	20/20/ 20/20	0.2S				Metering and synch.
4	do	do	0.2S				For ABT Metering
5	3000/2000/ 1000/500/1		PS	3000/2000 /1000/500 /1	15/10/5 /2.5Ohm	20/30/ 60/120	Transformer Back up / line protection
6	3000/2000/ 1000/500/1		PS	3000/2000 /1000/500 /1	15/10/5 /2.5Ohm	30/ 60/120	Trans Diff./ Line protection

Physical arrangement of CTs shall be as per Protection SLD.

CALCULATION

Note : The supporting calculation to be furnished during detail engineering For CT Parameters.

CORE DETAILS OF 400kV CVT(AIS)				TABLE – II
Primary Voltage : 400/ v3 for Primary I,II,III				
Secondary Core	Application	Rated Secondary Voltage (V)	Accuracy	Output Burden – Maximum (*)
I	Protection	110/v3	3P	50 VA
II	Protection	110/v3	3P	50 VA
III	Metering	110/v3	0.2	50 VA
IV	ABT Metering	110/v3	0.2	50VA
The accuracy of 0.2 on secondary III should be maintained through the entire burden range up to total simultaneous burden 50 VA on all the three windings without any adjustments during operation.				
* The rated burden of cores shall be closer to the maximum burden requirement of metering and protection system for better sensitivity and accuracy .The supporting calculation for burden to be furnished during detail engineering.				

6.00.00 SURGE ARRESTOR:

6.01.00 **GENERAL : T**he surge arrestors shall conform in general to IEC-60099-4 and IS:3070 / IS:15086(part-4) except to the extent modified in the specification.

6.01.01 Arrestors shall be hermetically sealed single phase units, self-supporting construction, suitable for mounting on lattice/tubular type support structures.

6.02.00 **DUTY REQUIREMENTS:**

6.02.01 The Surge Arresters (SAs) shall be capable of discharging over-voltages occurring due to switching of unloaded transformers, reactors and long lines. The reference current of SAs shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage. The SAs shall be capable of withstanding meteorological and short circuit forces under site conditions.

6.03.00 **CONSTRUCTIONAL FEATURES (FOR AIS):**

CLAUSE NO.	TECHNICAL REQUIREMENTS
6.03.01	The non linear blocks shall be sintered metal oxide material. The SA construction shall be robust with excellent mechanical and electrical properties. SAs shall have pressure relief devices suitable for preventing violent failure of insulator housing and providing path for flow of rated fault currents in the event of arrester failure.
6.03.02	Outer insulator of Surge arrestor shall be of Polymer type. The SA shall not fail due to polymer contamination. Polymer housing shall be so coordinated that external flashover will not occur due to application of any impulse or switching surge voltage up to maximum design value for SA. The cantilever strength of the complete assembled surge arrestor is min.350kg or as per the actual calculation which ever is higher shall be provided for 400kV and above voltage class system .
6.03.03	The end fittings shall be made of corrosion proof material and preferably be non-magnetic. The sealing arrangement of the Surge Arrester stacks shall be done incorporating grooved flanges with O-rings/elliptical cross section gasket of Neoprene or Butyl rubber.
6.04.0	**CONSTRUCTIONAL FEATURES FOR GAS INSULATED SURGE ARRESTOR:**
	a)It will be SF6 gas insulated, metal enclosed surge arrestor of the gapless nonlinear zinc oxide, heavy duty, station type. The arrestor enclosure shall be vertically or horizontally mounted to suit the layout of the switchgear and shall be fitted with a discharge counter located in an easily accessible position.
	b)The main grounding connection from the surge arrestor to the earth shall be provided by the Contractor. The size of the connecting conductor shall be such that all the energy is dissipated to the ground without getting overheated.
6.05.00	**FITTINGS AND ACCESSORIES FOR AIS:**
6.05.01	Each SA shall be complete with insulating base for mounting on structure. SAs shall be provided with grading and/or corona rings as required.
6.05.02	i)Self-contained discharge counters, suitably enclosed for outdoor use (with Min.IP:56 degree of protection) and requiring no auxiliary or battery supply shall be fitted with each SA along with necessary connections to SA and earth. Suitable leakage current meters shall also be supplied in the same enclosure. The reading of milliammeter and counter shall be visible through an inspection glass panel to a man standing on ground and the same shall be mounted at eye level height to facilitate easy reading of the counter and leakage current A pressure relief vent/suitable provision shall be made to prevent pressure build up.
	ii)The surge counter shall be provided with a potential free contact which shall close whenever a surge is recorded by the surge monitor. Necessary arrangement shall be provided for extending the contact information to substation Automation system.

iii) Insulated copper conductor of adequate size and length shall be used for connecting discharge counter terminal and lightning arrester earth terminal. Insulation level of the conductor shall not be less than 5 kV.

Suitably sized bypass copper shunts shall be provided for bypassing the discharge counter for removal / maintenance of the counter.

iv) (Note: Optional) : Surge monitor comprising a digital type counter, leakage current detector shall be provided for each arrester and the same shall be mounted at eye level height to facilitate easy reading of the counter and leakage current detectors. Necessary arrangement shall be provided for extending the reading of surge counter, leakage current indication in the SAS.

6.06.00 **PARAMETERS: General (400kV) :**

Sl.no	Description	
a)	Nominal discharge current	20kA of 8/20 microsec.wave
b)	Long duration discharge class	3 or 4
c)	Current for pressure relief test	63kA rms
d)	Prospective symmetrical fault current	63kA rms
e)	Low current duration test value	As per IEC.
f	Partial discharge at 1.05MCOV	Not >than 50pc

(The arrestor voltage / rating shall be as per the study of insulation co-ordination of system)

06.06.01 **400kV Class Surge Arrestor :**

Sl.no	Description	
a)	Rated Arrestor Voltage	Min.336kV
b)	Minimum Discharge capability	12 kJ/kV
c)	Continuous operating voltage (COV) at 50 deg. C	267rms
d)	Min. Switching surge residual (1 kA)	730 kVp minimum, 780 kVp maximum
e)	RIV at 266 kV (rms)	Less than 1000 micro volts

(The arrestor voltage / rating shall be as per the study of insulation co-ordination of system)

The surge arrestors are provided to protect the following equipment whose insulation levels are indicated in the **Table#**I given below. The contractor shall carry out the insulation coordination studies for deciding the location of the surge arrestors.

TABLE#1:

Sl.no	Equipment to be Protected	Lightning impulse(kVp)	Switching impulse(kVp)
a)	Power Transformer	± 1425	± 1050
b)	Instrument Transformer	± 1425	± 1050
c)	Reactor	± 1300	± 1050
d)	CB/isolator (Ph to ground)	± 1425	± 1050
	Across open contacts	± 1425(± 240)	± 900(± 340)

Surge arrestors shall be capable of discharge on severe re-energisation switching surges on a 400 kV line upto 450 km. length with surge impedance of 300 ohms and capacitance of 11.986 nF/km amd over voltage factor of 2.3 p.u. Surge arrestor shall be capable of discharging energy equivalent to class 3 or 4 of IEC for a 420 kV system on two successive operations followed immediately by 50 Hz energization.

6.07.00 **TESTS:**

6.07.01 Surge arrestor (GIS) shall be type tested in accordance with respective clauses mentioned elsewhere in the specifications. Surge arrestors (AIS) shall confirm to all type tests (as applicable) as per IEC 60099-4 and shall be subjected to routine and acceptance tests in accordance with IEC-60099-4. The resistive current drawn by the arrestor for at rated voltage shall be indicated in the routine test report.

7.00.00 POST INSULATOR:

7.01.00 **GENERAL :**The post insulators shall conform in general to latest IS: 2544 and IEC – 60815, 60168.

7.02.00 **CONSTRUCTIONAL FEATURES:**

7.02.01 Post type insulators shall consist of a porcelain / Polymer part permanently secured in a metal base to be mounted on the supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand any shocks to which they may be subjected to by the operation of the associated equipment. Only solid core insulators shall

11 .00.00 SITE TESTING AND COMMISSIONING:

11.01.00 **INTRODUCTION:**

An indicative list of tests for AIS and GIS as applicable is given below. Contractor shall perform any additional test based on specialties of the items as per the field QP/ instructions of the equipment supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall get the list of instruments approved from the Employer.

11.02.00 **GENERAL CHECKS:**

a) Check for physical damage.
b) Visual examination of zinc coating/ plating
c) Check from name plate that all items are as per older/ specification.
d) check tightness of all bolts, clamps and connecting terminals using toque wrenches.
e) For oil filled equipment check for oil leakage, if any. Also check oil level and top up.
f) Check ground connections for quality of weld and application of zinc rich paint over weld joint of galvanized surfaces.
g) Check cleanliness of insulator and bushings.
h) All checks and tests specified by the manufactures in their drawings and manuals as well as all tests specified in the relevant code of erection.
i) Check for surface finish of grading rings (corona control ring.)
j) Pressure test on all pneumatic lines at 1.5 times the rated pressure shall be conducted.

11.03.00 **CIRCUIT BREAKERS:**

a) Insulation resistance of each pole.
b) Check adjustments, if any, suggested by manufacturer.
c) Breaker closing and tripping time.
d) Slow and power closing operation and opening
e) Trip free and anti-pumping operation.
f) Minimum pick-up volts of coils
g) Contact resistance
h) Functional checking of compressed air plant and all accessories
i) Functional checking of control circuits, interlocks, tripping through protective relays and auto-reclose operation.
j) Insulation resistance of control circuits, motor etc.
k) Resistance of closing and tripping coils.

11.04.00 **ISOLATORS:**

a) Insulation resistance of each pole
b) Manual and electrical operation on interlocks
c) Insulation resistance of control circuits and motors.
d) Ground connections
e) Contact resistance
f) Proper alignment to minimise the vibration to the extreme possible during operation.
g) Measurement of operating torque for isolator and Earth switch
h) Resistance of operating and interlocking coils.

11.05.00 **CURRENT TRANSFORMERS:**

a) Insulation Resistance Test
b) Polarity test.
c) Ratio identification test-checking of all ratios on all cores by primary injection of current.
d) Dielectric test of oil (wherever applicable).
e) Magnetizing characteristics test.
f) Capacitance and tan delta measurement at minimum 10kV.

11.06.00 **VOLTAGE TRANSFORMERS/CAPACITOR VOLTAGE TRANSFOREMER:**

a) Insulation resistance test.
b) Polarity test.
c) Ratio test.
d) Dielectric test of oil (if applicable).
e) Capacitance and tan delta measurement at minimum 10kV.

11.07.00 **SURGE ARRESTER:**

a) Grading leakage current.
b) Resistance of ground connection.
c) Resistive current drawn at rated voltage after energisation.

11.08.00 **PHASING OUT:**

The phasing out of all supplies in the station system shall be carried out.

11.09.00 **STATION EARTHING:**

a) Check soil resistivity
b) Check continuity of grid wires
c) Check earth resistance of the entire grid as well as various sections of the same.
d) Check for weld joint and application of zinc rich paint on galvanised surface.
e) Dip test on earth conductor prior to use.

1	Nominal voltage	400 kV
2	Maximum system voltage	420kV
3	Lighting Impulse	+-1425kVp
4	Switching Impulse	+-1025kVp
5	Power frequency withstand voltage (wet)	630 kV (rms)

LIST OF STANDARDS :

ALL STANDARDS, SPECIFICATIONS AND CODES OF PRACTICE REFERRED TO HEREIN SHALL BE THE LATEST EDITIONS INCLUDING ALL APPLICABLE OFFICIAL AMENDMENTS AND REVISIONS AS ON DATE OF OPENING OF BID.

Sl.no	Standard No	Description	Equivalent code
1	IS:209	Specification for Zinc	
2	IS:2062	Structural Steel (Standard Quality)	
3	IS:269	Specification of Ordinary Portland Cement	
4	IS:278	Specification of Galvanized Steel Barbed Wire for Fencing	
5	IS:383	Specification of Coarse and Fine Aggregate for Concrete	
6	IS:398	Specification of Aluminium conductors for overhead transmission purposes	
7	IS:406	Methods of Chemical Analysis of Slab Zinc	
8	IS:432	Mild steel and medium tensile bars and	

		hard drawn steel wire for concrete reinforcement	
9	IS:456	Code of practice for plan and reinforced concrete	
10	IS:731	Porcelain Insulators for Overhead lines with Nominal Voltage greater than 1000volts	BS:137-1973 (I & II) Power, IEC:274-1968, IEC:383-1976
11	IS:800	General Construction in Steel - Code of Practice	
12	IS:802	Code of practice for use of structural steel in overhead transmission Line (Load, Permissible stresses, Fabrication Galvanizing, Inspection and packaging and testing)	
13	IS:1367	Technical supply conditions for threaded fasteners	
14	IS:1489	Portland Pozzolena Cement	
15	IS :1608	Metallic materials - Tensile testing	
16	IS:1573	Electroplated Coating of Zinc on Iron & steel	
17	IS:1778	Reels and Drums of Barewire	
18	IS:1786	High strength deformed steel bars and wires for concrete reinforcement	
19	IS:1893	Criteria of Earthquake resistant design of structures	
20	IS:2016	Plain Washers	
21	IS:2070	Method of impulse voltage testing	
22	IS:2071	Method of high voltage testing	

23	IS:2121	Specification for conductors and earthwire Accessories for Overhead Power Lines	
	Part-I	Armour Rods	
	Part-II	Mid-span joints & repair sleeves for conductors	
24	IS:2131	Method of Standard penetration test for soils	
25	IS:2551	Danger Notice Plates	
26	IS:2486	Specification for Insulator Fittings for overhead Power Lines with a nominal voltage greater than 1000 volts.	
		Part- I General Requirements and Tests	BS:3288-1972
		Part-II Dimensional Requirements	IEC:120-1960
		Part-III Locking Devices	IEC:372-1976
27	IS:2629	Recommended practice for hot dip galvanising of iron & steel	
28	IS:2633	Method of testing uniformity of coating of zinc coated articles	
29	IS:3043	Code of Practice for earthing	
30	IS:3063	Single Coil Rectangular Section spring washers for bolts, nuts, screws.	
31	IS:3188	Characteristics of string insulator units	IEC:60305-2021
32	IS:4091	Code of practice for design and construction of foundation for transmission line tower and poles	

33	IS:4218	Metric Screw Threads.	
34	IS:4826	Galvanised coatings on round steel wire	
35	IS:5300	Porcelain Guy strain insulators	
36	IS:1367	Hot dip galvanised coatings on Threaded fasteners	
37	IS:5613 (Part-II)	Code of practice for Design, installation & maintenance of overhead power lines	
38	IS:6610	Specification for heavy washers for steel structures	
39	IS:6639	Hexagonal bolts for structure	
40	IS:6745	Methods for determination of weight of Zinc coated iron and steel articles	
41	Pub. No. 19 (N)/700	Regulation for Electrical Crossing of Railway Tracks	
42	IS:7814	Phosphor bronze sheet, strip and foil	
43	IS:8263	Method of Radio Interference tests on high voltage insulators	NEEMA:107 – 1964. , CISPR/IEC:437-1973
44	IS:8269	Method of switching impulse test on high voltage insulators	
45	IS:9708	Specifications for Stockbridge Vibration Dampers for overhead power lines	
46		Thermal mechanical performance test and mechanical performance test on String insulator units	IEC:60575

MANDATORY SPARES - ELECTRICAL

Sr. No.	Description	Quantity
1.	**Switchyard 400kV GIS**	
1.00.00	**400kv Gas Insulated Switchgear**	
1.01.01	SF6 Gas Pressure Relief Devices of each type along with O-Rings	3 Nos
1.01.02	SF6 Pressure gauge with coupling device cum switch or density monitors and pressure gauge, as applicable (of each type)	5% of total population (Max 5nos and min,1no)
1.01.03	Coupling device of each type for pressure gauge cum switch for connecting Gas handling plant	2 Sets
1.01.04	Rubber gaskets, "O" Rings and seals for SF6 gas, including Circuit Breaker, Disconnector and other GIS equipment's	3 Set
1.01.05	Molecular filter for SF6 gas with filter bags	5% of Total weight
1.01.06	All type of control valves for Sf6gas of each type	3nos
1.01.07	SF6 gas cylinder of 50Kgs / cylinder	20% of total gas qty
1.01.08	Locking device to keep the Dis-connectors and Earthing switches in close or open position in case of removal of the driving mechanism (If applicable)	3 No.
1.01.09	Spares for Local control cabinet including MCB, fuses, timers, Aux Relays, contactors, push buttons, switches, lamps, annunciation windows etc of each type & rating, terminals of each type (Set)	2sets
1.01.10	UHF PD sensors of each type if applicable	5% of total population(max 5nos and min 1no)
1.01.11	Bus Support insulator / gas Barrier of each type along with associated contacts and shields	5nos
1.01.12	SF6 to air bushing of each type & rating along with conductor and enclosure for 1 phase enclosure	1no

MANDATORY SPARES - ELECTRICAL

1.01.13	All types of Corona shield (3 Nos. of each type)	1set
1.02.00	**GIS Circuit Breaker – 400KV**	
1.02.01	One complete pole (1phase unit) of circuit breaker including CSD/Closing resistor, grading capacitor(as applicable), of each type & rating complete with , interrupter, main circuit , enclosure and marshalling Box with operating Mechanism to enable replacement of any type / rating of CB by spare	1no of each type & rating
1.02.02	Tripping coils assembly with resistors as applicable (3nos of each type)	2sets
1.02.03	closing coil assembly with resistor as applicable (3nos of each type)	2sets
1.02.04	Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating(If applicable)	1set
1.02.05	Aux. switch assembly, 3 Nos. of each type	1set
1.02.06	Operation counter, 3 nos. of each type	1set
1.02.07	Window scope/ Observing window, 3 Nos. of each type (if applicable)	1set
1.02.08	1)Spare of Hydraulic operated mechanism if Applicable: a. Hydraulic operating mechanism with drive Motor of each type – 1 no. b. Ferrules and joints & couplings of each type – 1 Set c. Hydraulic Filter of each type – 1 Sets d. High Pressure Hose of each type– 1 Set e. N2 accumulator of each type– 2 No. f. Pressure Transducers – 1No. g. Valves of each type – 1 Set	1 Set for each type of Circuit Breaker

	h. Orings, gaskets and seals – 1 Set i. Pressure gauges with coupling device of each type – 1 Set j. Hydraulic oil – 20% of total used quantity in substation k. Limit switch – 1 no. of each type l. Pipe length (Copper & steel) of each size & type -1set m. Pressure switch of each type -2nos n. Pressure Relief device of each type - 1set	
1.02.09.00	Complete Spring operating Mechanism including charging mechanism etc of each type & rating if applicable	1set
1.02.09.01	Spring charging motor of each type & rating	2nos
1.03.00	**Disconnector- GIS 400KV**	
1.03.01	Complete set of 3 nos. of single phase / one 3-ph isolator of each type , dimension , current & voltage rating including main circuit , enclosure , driving mechanism and support insulator etc to enable replacement of any type / rating of isolator by spare	1 Set
1.03.02	Complete set of 3 nos. of single phase / one 3-ph Maintenance earthing switch of each type , dimension , current & voltage rating including main circuit , enclosure , driving mechanism and support insulator etc to enable replacement of any type / rating of isolator by spare	1 Set
1.03.03	Complete set of 3 nos. of single phase / one 3-ph Fast earthing switch of each type , dimension , current & voltage rating including main circuit , enclosure , driving mechanism and support insulator etc to enable replacement of any type / rating of isolator by spare	1 Set

MANDATORY SPARES - ELECTRICAL

1.03.04	Copper Contact fingers for isolator male & female contact along with corona shield -for one complete (3phase) isolator of each type and rating	1 Set
1.03.05	Copper Contact fingers for Maintenance earthing switch male & female contact along with corona shield -for one complete (3phase) isolator of each type and rating	1 Set
1.03.06	Copper Contact fingers for Fast earthing switch male & female contact along with corona shield -for one complete (3phase) isolator of each type and rating - If Applicable	1 Set
1.03.07	Open/ close contactor assembly, timers, key interlock, interlocking coils, relays , push buttons indicating lamps , power contactors, resistors, fuses MCBs & drive control cards etc for one complete MOM box (3-lh gang operated or 1-ph unit) disconnector and (3ph) earthing switch of each type and rating for one complete (3phase) disconnector and earthing switch of each type & rating (if applicable)	
	a) For Disconnector	1 Set
	b) For Maintenance Earth switch	1 Set
	c) For Fast Earthing switch	1 Set
1.03.08	Limit switches and Aux. switches for complete 3-phase equipment	
	a) For Disconnector	1 Set
	b) For earth switch	1 Set
	c)For high-speed earth switch	1 Set
1.03.09	Drive Mechanism of each type	
	a) For isolator	1set
	b) For Maintenance Earth switch	1set
	c) For Fast Earthing switch	1set
1.03.10	Motor Drive Mechanism of each type	

	For isolator	1set
	For Maintenance Earth switch	1set
	For Fast Earthing switch	1set
1.04.00	**Current Transformer- GIS – 400KV**	
	Complete CT, of each type and with enclosure to enable replacement of any type / rating of CT as spare	1no of each type/ rating
1.05.00	**Voltage Transformer**	
	Complete VT of each type and with enclosure to enable replacement of any type / rating of VT as spare	1no of each type / rating
1.06.00	**GIS Surge Arrestor – 400 KV**	
1.06.01	Complete Surge Arrestors of each type and with enclosure with surge monitor counter to enable replacement of any type / rating of VT as spare	1no of each type / rating
1.06.02	Surge Monitor and counter of each type / rating	1no of each type / rating
2.	**400kv Air Insulated Switchgear**	
2.01.00	**Circuit Breaker**	
	a. Relays, power contactors, switch-fuse units, limit switches, Auxiliary switch assembly, push buttons, timers & MCB for electrical control circuit (consisting of one no. each of all types and ratings)	1 Set
	b. Rubber Set of gaskets, "O" rings & seals	1 Set
	c. Molecular filter for Circuit breaker	1 Set
	d. Tripping coils with resistors and closing coil with resistor (each type)	6 Nos
	e. Density / pressure monitoring system for circuit breaker	1 Set
	f. Set of spares for pneumatic/ Spring/ hydraulic operated mechanism (as applicable) as per the main supply of circuit breaker applicable.	1 Set
	Spares of pneumatic/spring/hydraulic operated mechanism:	1 Set for each type of Circuit Breaker

PROJECT INFORMATION

1.00.00 BACKGROUND

Chhattisgarh State Power Generation Company Limited (CSPGCL), a Govt. of Chhattisgarh Undertaking, commissioned 4x210 MW & 1x500 MW Hasdeo Thermal Power Plant together with all other infrastructures at Korba village in Korba district of Chhattisgarh in three stages i.e., Stage-I, Stage-II & Stage-III respectively using coal from Kusmunda, Junadih coal mine blocks of Coal India's South-eastern Coal Field Limited (SECL).

The Present proposal is for setting up of two (2) units of 660 MW capacity each as an extension of the existing Power Plant within the available land inside the premises of existing Plant and surrounding area.

2.00.00 LOCATION AND APPROACH

The Hasdeo Thermal Power Station project is located at Korba Village in Korba District of Chhattisgarh. Access to the Project Site by Road is through State Highway No. 39 from Raipur and Bilaspur.

The Site is located at latitudes of 22°24'38.5" N and longitudes of 82°41'39" E, respectively.

The nearest airport is Swami Vivekanand Airport at Raipur at about 214 Km from the project site. Other Major Towns / City nearer to the Project site are Korba at about 10 Kms, Champa at about 45 Kms and Bilaspur at about 125 Kms.

2.01.00 RAIL LINK

Nearest railway station is Korba railway station, located on Gevra Road – Champa section under Bilaspur railway division of South-East Central Railway zone.

2.02.00 AIRPORT

The nearest commercial airport is Swami Vivekanand Airport, Raipur which is at a distance of 214 Kms from the Project site.

The vicinity Plan is placed in **Annexure-I.**

3.00.00 CAPACITY

Stage-I	:	420 MW (2x210 MW) – Under commercial Operation
Stage-II	:	420 MW (2x210 MW) – Under commercial Operation
Stage-III	:	500 MW (1x500MW) – Under commercial Operation
Stage-IV	:	1320 MW (2x660 MW) – Present Proposal

Ultimate Capacity : 2660 MW (After installation of proposed units)

4.00.00 LAND

The expansion project is envisaged to be accommodated in the available unutilized land of approx. 187 Acres within existing premises of HTPS, Korba west. Additional land of approx. 124

Acres adjacent to Plant boundary on the southern side shall be acquired for railway siding and CHP facilities.

5.00.00 WATER

Water requirement for the proposed project would be about 40 Cusec. Water requirement for the project will be met from upstream of Hasdeo barrage on the Hasdeo river. Water shall be pumped from raw water pumps house, located at Hasdeo river, to PT Plant and Ash handling Plant through raw water pipelines.

Water cooled Condenser with closed cycle cooling water system and Natural Draft Cooling Tower (NDCT) is envisaged for the proposed units.

6.00.00 COAL

6.01.00 The coal requirement for the project is estimated at about 6.5 MTPA corresponding to 85% PLF considering GCV of 3300 Kcal/Kg.

6.02.0 Coal Transportation

The coal shall be transported primarily to the proposed project through Rail Mode.

Two (2) nos. long distance coal conveyors (LDCC) available for the existing 4x210 MW units shall also be utilized after due renovation & modernization for coal transportation from newly constructed 20000 MT coal bunker at SECL mine for the proposed 2x660 MW units. For this additional, 02 nos interconnections from Existing Coal stackyard shall be provided.

6.03.00 Coal Quality

The primary fuel for the main steam generator shall be coal. The coal quality parameters indicated in **Annexure-IV-2** are to be considered for steam generator design.

7.00.00 Fuel Oil

The fuel oil to be used for start-up, coal flame stabilization and low load operation of the steam generator shall be Light Diesel Oil having the characteristics given in **Annexure-IV-1**.

8.00.00 MODE OF OPERATION : Middle load (two shifting and load cycling)

9.00.00 STEAM GENERATOR TECHNOLOGY

The steam generators shall be super critical, once through, water tube type, direct pulverized coal fired, top supported, balanced draft furnace, single reheat, radiant, dry bottom type, suitable for outdoor installation. The gas path arrangement shall be single pass (Tower type) or two pass type.

10.00.00 FLUE GAS DESULPHURIZATION SYSTEM (FGD) AND DENOX READY:

The project is envisaged with environmental emission control devices and steam generator design towards compliance with the applicable emission norms. The secondary NOx control system (SCR/SNCR or a hybrid of both) is not included in the

scope of this contract. Necessary provisioning as detailed in specifications shall however be in the scope of the Contractor. The limestone to be used for the design of the FGD system shall be as per the characteristic given in **Annexure-IV-5**.

11.00.00 CONSTRUCTION POWER

Construction power shall be taken from the 11KV substation inside the plant boundary provided at one location by the employer. The bidder has to tap off the Supply from the proposed 11KV substation and suitably rated 11/11.5KV transformers and associated 11KV RMU Panels, HT cables, LT cables and modifications required in existing 11KV feeders etc. is also in the scope of Bidder. A power line ring main will be constructed at 11kV encompassing the construction area for feeding construction power at pre-determined locations where it will be stepped down to 415 V. The Contractor will be provided power connection at 415 V for them to supply power to various work centres.

12.00.00 POWER EVACUATION SYSTEM

Power generated from the proposed 2x660 MW units would be evacuated at 400 kV level through new/ existing lines. For this, a new 400 kV switchyard will be constructed to accommodate the following bays required for proposed units' Power evacuation.

- Two (2) – 400 kV circuits for Generator Transformers
- Two (2) – 400 kV circuits for Station Transformers
- Three (3) – 400 kV circuits for outgoing lines to nearest Grid S/S. (2 for outgoing line for two units & 1 for interconnection with existing 400kV Switchyard of Stage- III)
- One (1) – 400 kV circuit for Bus reactor.

13.00.00 PLANT WATER SCHEME

The Plant water scheme is described below.

13.01.00 Equipment Cooling Water (ECW) System

All plant auxiliaries shall be cooled by De-mineralized water (DM) in a closed circuit. The primary circuit DM water shall be cooled through plate type heat exchangers by Circulating Water tapped from CW system in a closed secondary circuit. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system.

It is proposed to provide independent primary cooling water circuit for TG & its auxiliaries and Steam Generator & auxiliaries (including station auxiliaries) on Unit basis.

13.02.00 Condenser Cooling (CW) Water System

It is proposed to adopt a recirculating type cooling water system with cooling towers for the project. For the re-circulating type CW system, it is proposed to supply

clarified water as make up. Circulating water from CW pumps to TG area and from TG area to cooling tower will be carried through pipes/ducts. Cooled water from cooling tower will be led to CW pump house through the cold water channel by gravity.

To reduce the Suspended Solids in the cooling water, Circulating Water shall be passed through Automatic Valve less Gravity Filter Units (SSF system). After filtration, the filtered water will be returned to the CW Channel under gravity. Required pumping system shall be installed to pump the circulation water from SSF feed sump to filter units.

The Plant water scheme is a part of tender drawing which is to be included in **Part E.**

13.03.00 Other Miscellaneous Water Systems

CW system blow down water shall be used for the FGD process requirement, ash slurry pumps sealing, sealing of Vacuum pumps (if applicable) of Ash Handling plant, make-up to fire water system. The service water shall be taken from clarified water tank of Pre-treatment plant and also from treated water of plant wastewater. The service (wash water) water collected from various areas and coal handling plant shall be treated as per requirement and reused. The drinking water requirement shall be provided from water treatment plant.

The quality of Raw water is given in this sub-section at **Annexure-III.**

14.00.00 ENVIRONMENTAL ASPECTS

The upcoming units are proposed to be constructed on the land already acquired for ultimate capacity of HTPS, which conforms to the siting criteria for thermal power plants. Environment Clearance for proposed units has already been applied and expected to be accorded by MOEF&CC soon.

15.00.00 METEOROLOGICAL DATA

The meteorological data from nearest observatory is placed at **Annexure-II.**

16.00.00 CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Part-B Civil Works D-1-12(E) of this section.

17.00.00 CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part-B Civil Works D-1-12(D) of this section.

18.00.00 Vulnerability Atlas of India (VAI), prepared by Building Materials, Training and Promotion Council (BMTPC) under Ministry of Housing and Urban Affairs, is a

comprehensive document which provides existing hazard scenario for the entire country and presents the digitized State/UT-wise hazard, maps with respect to earthquakes, winds and floods for district-wise identification of vulnerable areas. It also includes additional digitized maps for thunderstorms, cyclones and landslides. The main purpose of this Atlas is its use for disaster preparedness and mitigation at policy planning and project formulation and construction stage. The VAI provides necessary information for risk analysis and hazard assessment and is available at website www.bmtpc.org.

As per Government's directive, it is mandatory for the bidders to refer VAI for multi-hazard risk assessment and include the relevant hazard proneness specific to project location while planning, designing and execution of the project in terms of following details:

i) Seismic zone (II to V) for earthquakes
ii) Wind velocity
iii) Area liable to floods and Probable max. surge height
iv) Thunderstorms history
v) Number of cyclone storms/sever cyclone storms and max sustained wind specific to coastal region
vi) Landslides incidences with Annual rainfall normal
vii) District wise Probable Max. Precipitation

Accordingly, bidder should refer VAI while planning, designing and execution of the project.

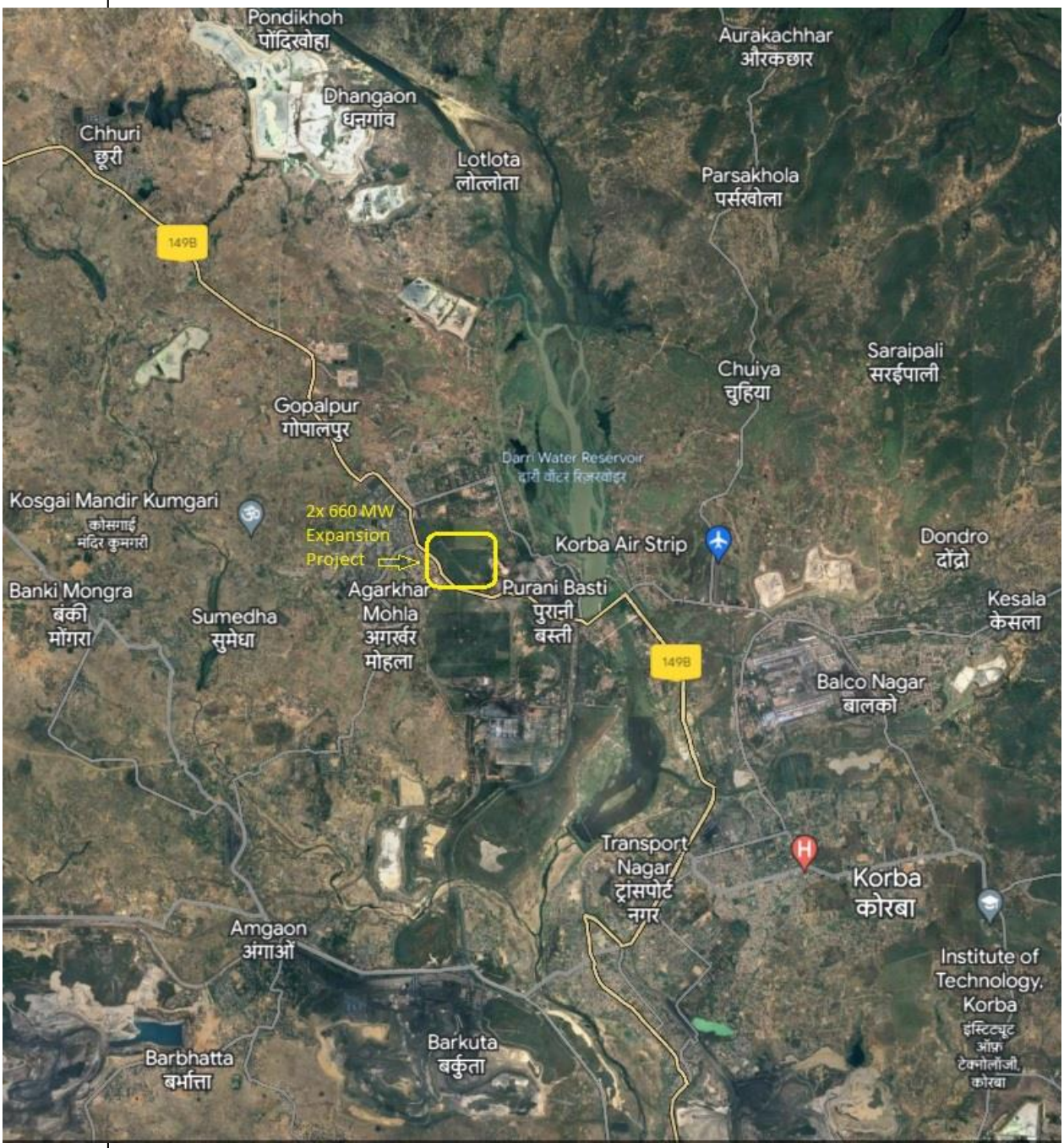
However, for design of structures/facilities and equipment, the criteria for earthquake resistant design of structures and equipment, the criteria for Wind Resistant Design of Structures and Equipment and design parameters for drainage facilities, stipulated in the Technical Specification shall be followed.

For other information like area liable to floods, probable max. surge height, landslide, thunderstorm, cyclone etc. agencies are required to refer the VAI.

PROJECT INFORMATION

Annexure-I

VICINITY MAP



Annexure-II

CLIMATOLOGICAL DATA STATION: IMD - AMBIKAPUR

Month	Atmospheric Pressure (mb)		Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)
	0830	1730	Max	Min	Mean Max	Mean Min	
January	947.9	945.1	27.6	4.8	77	50	25.8
February	946.3	943.5	31.5	7.2	67	40	20.1
March	944.5	941	37	11.5	51	29	19.5
April	941.8	937.9	41.1	16.6	39	23	13.6
May	938.1	934.3	42.8	20.6	43	28	21.3
June	934.7	931.8	41.9	21.4	66	55	235
July	934.6	932.4	34	21.4	86	81	411.2
August	935.5	933.2	32.4	21.5	88	83	352.2
September	939	936.4	32.5	20	86	79	227
October	944.2	941.5	31.9	13.4	79	64	48.4
November	947.2	944.5	29.1	8.7	77	57	14
December	948.5	945.6	26.4	5.5	77	54	11.2
						Total	**1399.3**

Source: Climatological Norms 1981-2010

NORMALS AND EXTREMES OF RAINFALL

KORBA

STATION	No. of Years of Data		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL RAINFALL AS % OF NORMAL & YEARS** HIGHEST	ANNUAL RAINFALL AS % OF NORMAL & YEARS** LOWEST	HEAVIEST RAINFALL IN 24 HOURS* AMOUNT (mm)	HEAVIEST RAINFALL IN 24 HOURS* DATE
Kartala	10	a	7.4	8.0	7.9	3.2	1.1	160.9	450.2	383.8	224.9	63.1	8.9	2.3	1321.7	134 (2003)	82 (2006)	207.5	30 Jun 2005
		b	0.4	0.7	0.8	0.4	0.1	6.8	18.0	15.6	10.6	2.9	0.4	0.3	57.0				
Kathgora	48	a	13.9	13.2	10.5	6.7	11.4	201.5	448.3	429.7	228.1	46.6	10.8	5.6	1426.3	200 (1961)	54 (1979)	433.6	24 Nov 1958
		b	1.0	1.0	0.9	0.7	0.8	8.2	18.0	16.8	11.1	2.3	0.5	0.3	61.6				
Korba	23	a	20.1	12.8	5.6	29.0	7.6	206.1	492.3	472.7	237.4	56.4	12.5	10.6	1563.1	205 (1988)	67 (1993)	358.0	12 Aug 2004
		b	0.6	0.9	0.3	0.1	0.4	8.5	17.2	15.7	10.1	3.1	0.7	0.6	58.2				
Kotaghat	27	a	13.6	19.6	12.2	12.5	6.9	182.3	344.1	396.1	175.1	37.5	6.6	12.5	1219.0	154 (1961)	50 (1965)	224.0	01 Aug 1969
		b	1.2	2.0	1.1	1.1	0.6	8.4	16.4	17.0	9.7	2.5	0.4	0.5	60.9				
Pali	11	a	12.8	6.2	3.0	2.3	5.4	144.1	413.4	347.1	257.0	46.8	1.7	0.0	1239.8	140 (2001)	83 (2009)	195.0	06 Aug 2005
		b	0.5	0.6	0.3	0.3	0.7	7.4	15.4	13.4	9.9	2.1	0.2	0.0	50.8				
Korba (District)		a	13.6	12.0	7.8	10.7	6.5	179.0	429.7	405.9	224.5	50.1	8.1	6.2	1354.1	236 (1988)	56 (1979)		
		b	0.7	1.0	0.7	0.5	0.5	7.9	17.0	15.7	10.3	2.6	0.4	0.3	57.6				

a: Normal rainfall in mm.
b: Average number of rainy days (i.e. days with rainfall of 2.5 mm or more)
* Based on all available data.
** Years of occurrence given in brackets.

Frequency of Annual Rainfall in the District KORBA (Data 1961-2010)

Range in mm	No. of years	Range in mm	No. of years
701 – 800	1	2001 – 2100	0
801 – 900	0	2101 – 2200	1
901 – 1000	2	2201 – 2300	0
1001 -1100	2	2301 – 2400	1
1101-1200	6	2401 – 2500	0
1201-1300	6	2501 – 2600	0
1301-1400	4	2601 – 2700	0
1401–1500	5	2701 – 2800	0
1501-1600	4	2801 – 2900	0
1601-1700	2	2901 – 3000	0
1701-1800	2	3001 - 3100	0
1801-1900	1	3101 – 3200	1
1901-2000	1		

(Data available for 39 years)

Source : IMD CLIMATOLOGICAL SUMMARIES OF STATES series 22

ANNEXURE-A: COMPLIANCE CERTIFICATE OF TECHNICAL SPECIFICATION

The bidder shall confirm compliance to the following by signing and stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.

2. There are no deviation(s) with respect to specification other than those furnished in the schedule of deviations.

3. Only those technical submittals which are specifically asked for in Notice Inviting Tender (NIT) to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of technical offer.

4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

Date: Bidder's Stamp & Signature

ANNEXURE-B: DEVIATION/ CHANGE REQUEST OF TECHNICAL SPECIFICATION

Bidder shall list out all technical potential deviation/ change request (s) along with clause with respect to technical specifications.

Sl. No.	Page No.	Clause No.	Deviation	Reason/ Justification(s)

Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date: Bidder's Stamp & Signature